TWO-YEAR EXPERIENCE IN THE OPERATION OF AN AQUIFER THERMAL ENERGY STORE BASED ON SURPLUS HEAT ARISING FROM A GAS AND STEAM COGENERATION PLANT AT NEUBRANDENBURG / NE GERMANY

F. Kabus, G. Möllmann, F. Hoffmann and J. Bartels
GTN Geothermie Neubrandenburg GmbH, Seestrasse 7A, 17033 Neubrandenburg, Germany
gtn@gtn-online.de
Geothermal heating plant and low-temperature network (12 MW, 80°C/45°C)

Gas and steam cogeneration plant (77 MW electrical, 90 MW thermal) and high-temperature network (200 MW, 130°C / 60°C)

District heat supply by the Neubrandenburg public utilities
Characteristics of the heat demand of Neubrandenburg
ATES at Neubrandenburg

Principle of functioning

- Summer charging
- Winter discharging

Temperature colors:
- 80 °C
- 50 °C
- 40 °C
ATES at Neubrandenburg

Parameters of the geothermal resource

- Geological formation: Upper Postera sandstone
- Depth: 1,228 m – 1,268 m
- Reservoir temperature: 55 °C
- Mineralisation: 135 g/l
- Porosity: 26.6 %
- Permeability: 0.94 μm² – 2.8 μm²
Well construction

- 10" fibre glass
- 5 1/2" fibre glass
- Pump
- 7" liner hanger
- Reducer 10" x 6 5/8"
  with cone 9 5/8"
- 13 3/4"
- 9 5/8"
- Annulus
- Protective fluid
- 6 5/8" fibre glass
- 7" fibre glass
- 7" liner hanger
- Hettangian
- 4 1/2" screen
- Upper Postera
- Gravel pack
- 7" liner
- 1285 m
- 1270 m
Functionchart of the aquifer heat store
winter

high temperature network

low temperature network

cold well

warm well

Functionchart of the aquifer heat store

ATES at Neubrandenburg
ATES at Neubrandenburg

- Number of wells: 2
- Internal distance: 1,300 m
- Production and injection flow rate: 100 m³/h
- Injection temperature: 80 °C
- Discharging temperature (5th year): 78 °C – 72 °C
- Charged heat: 12,000 MWh/year
- Discharged heat: 8,800 MWh/year

Operational parameters of the aquifer heat store (acc. to design)
ATES at Neubrandenburg

Coverage of the heat demand in the course of the year
Percentage demand coverage by the individual heat producers (without the store)

- Heat from cogeneration plant: 49.7%
- Heat from boiler plant: 50%
Percentage demand coverage by the individual heat producers (acc. to design)
ATES at Neubrandenburg

“Cold” well head
ATES at Neubrandenburg

Heat exchanger between district heat supply network and intermediate loop
ATES at Neubrandenburg

March 2004:
Start-up of the first heat charging process (Probebetrieb)

December 2004:
Start-up of the first heat discharging process (Probebetrieb)

March 2005:
Start-up of the first regular heat discharging process

November 2005:
Start-up of the first heat discharging process
Temperatures in the first regular year of charging

ATES at Neubrandenburg

First period

Temperatures in the first regular year of charging
Heating capacity in the first regular year of charging

ATES at Neubrandenburg

Heating capacity out of the aquifer (+), into the aquifer (-) [MW]

First period

Heating capacity in the first regular year of charging
Store behaviour in the first regular cycle of operation (cumulative)

ATES at Neubrandenburg

charging 14.225 MWh

discharging 6.430 MWh
Excess heat and its use on 05. and 06.11.2005

ATES at Neubrandenburg
District heating network and charged heat temperatures on 05. and 06.11.2005

ATES at Neubrandenburg

- T feeding flow
- T return flow
- T injection
- T production

Temperature [°C]

- Cooling down network
- Heating up store

12:00 16:00 20:00 00:00 04:00 08:00 12:00
Heat demand coverage on 23. and 24.01.2006

ATES at Neubrandenburg

heating capacity [kW]

- conventional after-heating
- discharging heat store
- total network heat demand

Heat demand coverage on 23. and 24.01.2006
District heating network and discharged heat temperatures on 23. and 24.01.2006

ATES at Neubrandenburg

- T feeding flow
- T flow - store
- T return flow
- T production
- T injection

Temperature [°C]

Heating up network

Cooling down store
Percentage demand coverage by the individual heat producers (first period)

- Heat from cogeneration plant: 56%
- Heat store: 44%
- Heat from boiler plant: 0.4%
This work was financially supported by the Federal Ministry of Economics and Technology of Germany, project no. 0329838B. The authors gratefully acknowledge this support.