REICHSTAG, GERMANY

NAME, LOCATION:

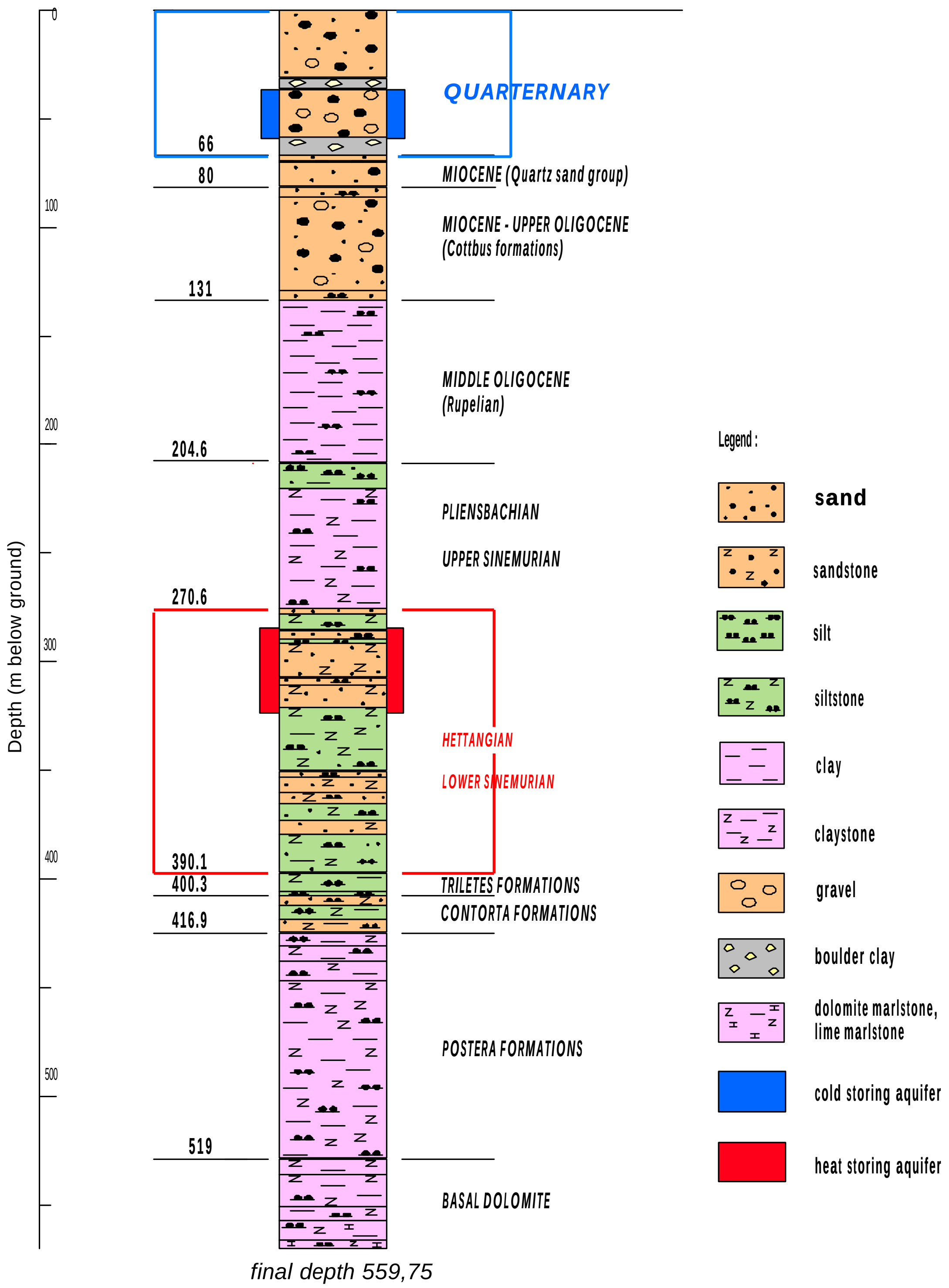
Aquifer - Cold and Heat Storage, Reichstag
Berlin, Germany

PURPOSE:

Heating and cooling of a government buildings
The system is designed for heating and cooling of the new buildings of the German Federal Parliament (Bundestag) around the old pre-1945 parliament building and along the river Spree. The energy system uses two aquifers, separated vertically. The upper ATES is the cold storage for space cooling, the lower one for heat storage at higher temperature levels (70 °C). The main heat source are three heat and power cogeneration plants (HPC). Heat and cold are supplied to the buildings via three absorption heat pumps, which can be assisted by an additional peak boiler in heating mode.

PHOTOGRAPH OF SITE

GEOLOGY:


Depth (m below ground)
0
100
200
300
400
500
66
80
131
204.6
270.6
390.1
400.3
416.9
519
QUARTERNARY
MIOCENE (Quartz sand group)
MIOCENE - UPPER OLIGOCENE
(Cottbus formations)
MIDDLE OLIGOCENE
(Rupelian)
PLIENSBACHIAN
UPPER SINEMURIAN
HETTANGIAN
LOWER SINEMURIAN
TRILETES FORMATIONS
CONTORTA FORMATIONS
POSTERA FORMATIONS
BASAL DOLOMITE
final depth 559,75
Legend :
sand
sandstone
silt
siltstone
clay
claystone
gravel
boulder clay
dolomite marlstone,
lime marlstone
cold storing aquifer
heat storing aquifer

ENERGY SYSTEM:

The energy system contains several components and is quite complex: In summer the lower ATES for heat storage is charged by excess heat (110 °C) of the three HPCs. The upper ATES for cold storage is charged with low temperature heat from a direct cooling system (16/19 °C) as well as by waste heat from a (6/12 °C) chilling system. The maximum temperatures in the heat store is approximately 70 °C and about 30 °C in the cold storage.

During winter the heat from the heat store is extracted and supplied to the low temperature heating net (45/30 °C) either directly or via the absorption heat pumps. Additionally also the low temperature heat from the so called cold storage is used as supply for the heat pumps. If the ambient temperature is low, the cold storage is chilled by ambient cold. During the heating season the average temperature in the heat storage drops to approximately 25 °C and to about 10 °C in the cold storage.

The lower ATES (heat store) uses one production and injection well each, the upper one (cold store) uses three wells each. The absorption heat pumps are driven by excess heat from the HPCs (110 °C) which is supplied to a heat intra system. This intra system is used also to supply heat to a high temperature (90/60 °C) heating net.

Operating temperatures	**Design values**
Cold storage	10 - 30 °C
Heat storage	25 - 70 °C
Heating/ cooling demands	**Design values**
Heating demand	12.5 MW
Annual heating demand (average)	19.5 GWh
Cooling demand	6.2 MW
Annual cooling demand (average)	2.8 GWh

STORAGE TECHNOLOGY:

Type of storage	Aquifer
Number of wells	2 (1+1) heat store/ 6 (3+3) cold store
Depth of wells	approx. 300 m (heat store)/ 50 m (cold st.)
Distance of wells	300 m (between warm and cold wells)

Flow rate	100 m³/h (heating), 300 m³/h (cooling)

Performance:

Mean storage temperatures	50 °C (heat store)/ 25 °C (cold store)
Main energy source	waste heat/ cold

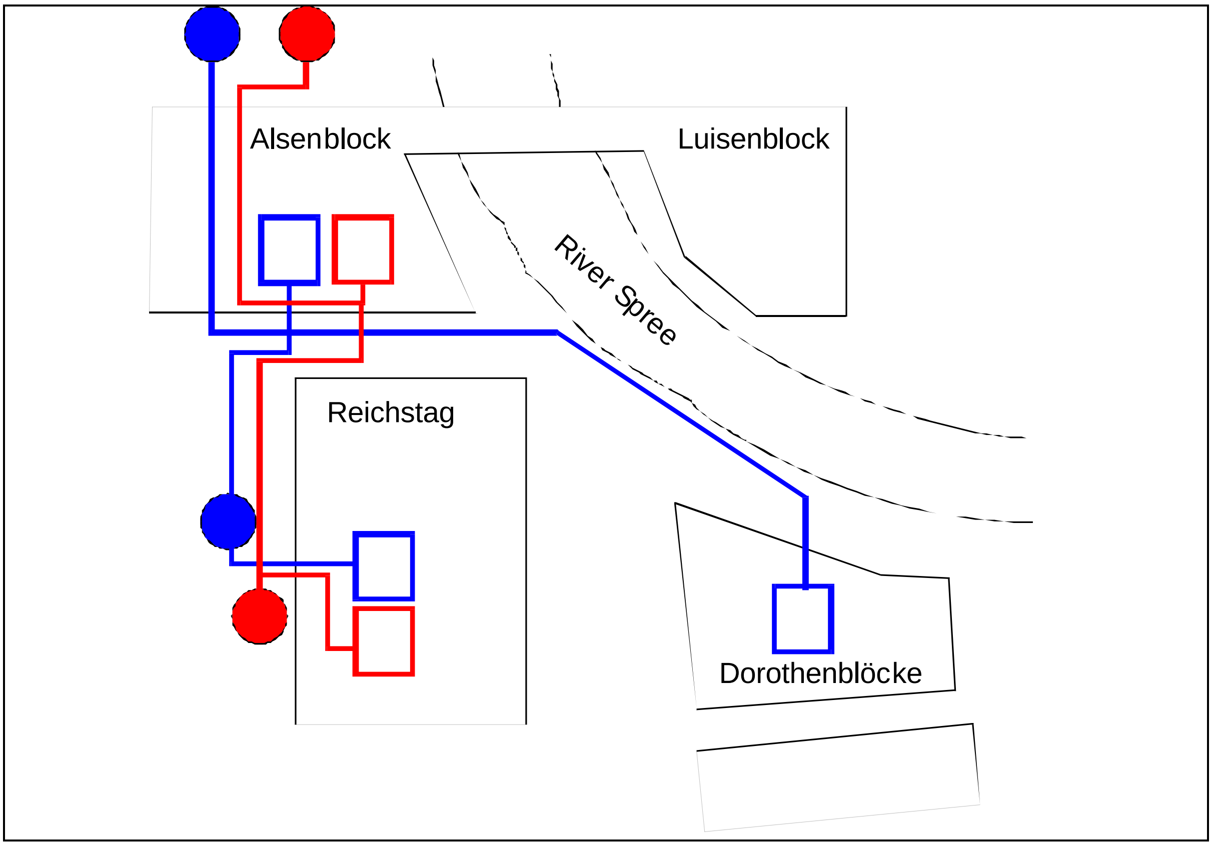
ECONOMICS:

Not yet investigated – system still in test phase.

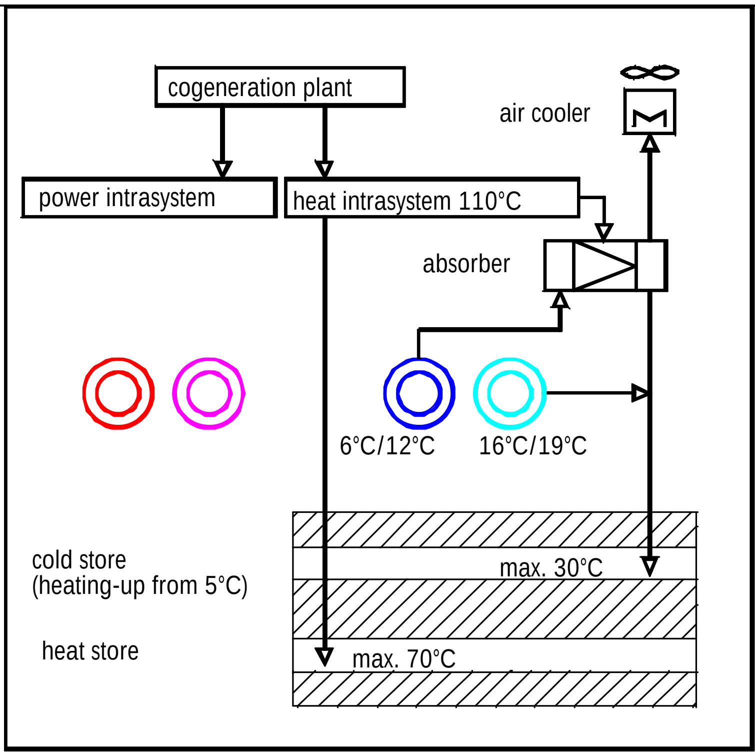
MONITORING:

It is intended to launch an extensive monitoring programme in 2000.

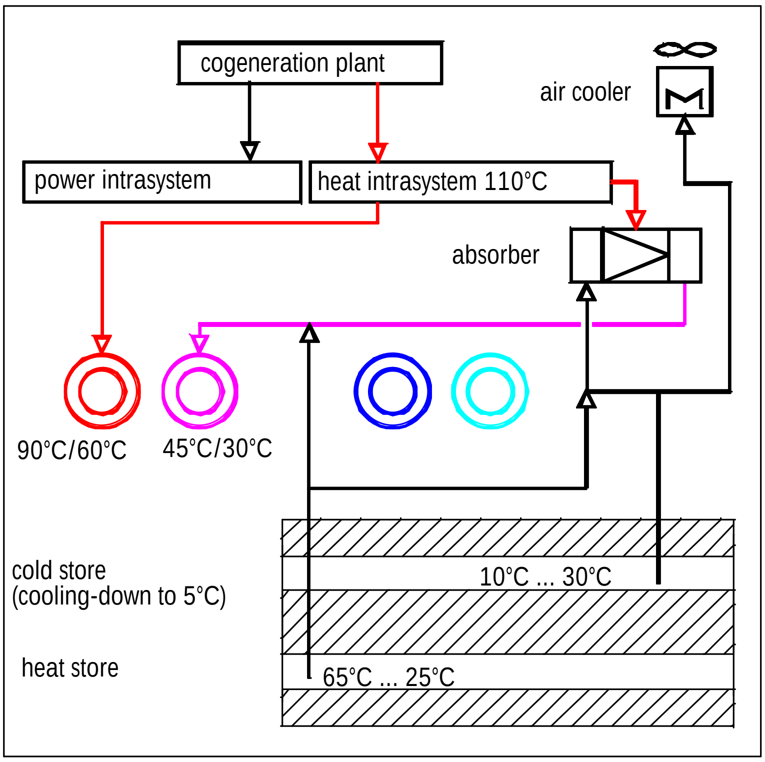
PLAN OF SITE



SYSTEM BLOCK DIAGRAM



system operation in summer



system operation in winter

OPERATING EXPERIENCES:

After the end of construction in autumn 1998 the system was first tested hydraulically, without temperature rise. The following tests with injection were successful. Since routine operation has not yet begun, there is no operational experience with the system.

The lifetime expectancy of the total system or of its components respectively is estimated to be at least 15 - 20 years.

ESTIMATED POTENTIAL OF TECHNOLOGY:

In general service and office buildings require heating and in many cases also cooling. Depending on the local hydro-geological conditions, the heating and cooling load and especially the full-load operation period the potential of this type of systems is significantly high. Currently, only a small part of new and renovation projects in this area is cooled by means of cold storage, but the percentage is expected to increase. The expectation is especially based on the current cost-effectiveness of heat and cold storage.

With this plant the first high temperature ATES is realised in Germany. High temperature heat storage combined with heat and power cogeneration is favourable, since the operation of the HPC can be dictated by the electrical power demand.

PROJECT WORK:

DESIGN BY	GTN GmbH Lindenstraße 39 17033 Neubrandenburg
FINANCIAL SUPPORT	-
CONTACT PERSON	F. Kabus GTN GmbH Lindenstraße 39 17033 Neubrandenburg Tel.: ++49-395-36774-19 Fax: ++49-395-36774-11 E-mail: gtn@nbnet.de

ADDITIONAL REMARKS:

Initially no water treatment is planned, the system is airtight and under pressure (with nitrogen) to avoid problems with oxygene. Upgrading with water treatment (CO_2) possible, if the need should arise.

REFERENCES:

Sanner, B. (ed.): High Temperature Underground Thermal Energy Storage; State-of-the-art and Prospects. IEA ECES Annex 12 - report, 1999.