CASE HISTORY

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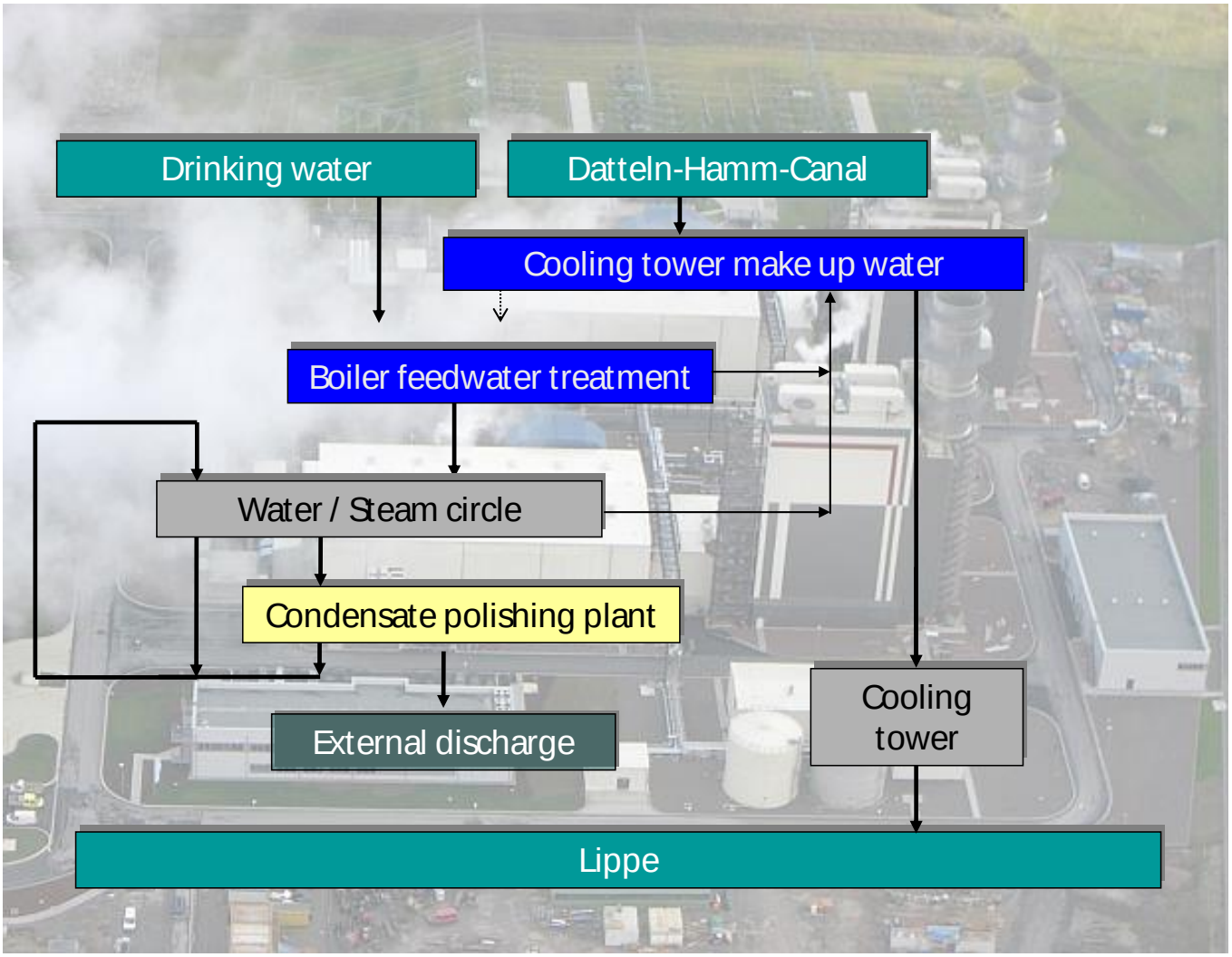
HAGER+ELSÄSSER

An aquarion Group Company

Hamm-Uentrop - Germany

Water Supply for the Trianel Combined Cycle Gas Turbine Power Plant



1. Project outline

The 820 Megawatt combined cycle gas turbine (CCGT) power plant in Uentrop has been in operation since 2007, in a partnership structure comprising Trianel European Energy Trading GmbH, 28 municipal works and regional utility companies from the Netherlands, Austria and Germany.

Power station data:

Total power station output: 2 x 410 MW
No. of power units: 2
Electrical efficiency: > 57.5 percent
Operating period: up to 8,000 hours/year
Annual power generation 4.8 bn kilowatt-hours
Annual natural gas input: 8.3 bn kilowatt-hours

The power station was constructed under a general contractor contract awarded to Siemens AG, Energy Sector.

In 2005, H+E was awarded the contract for the supply of **all water treatment plants** required for operation of the overall power plant:

- Cooling tower make-up water treatment plant
- Deionisation plant
- Condensate polisher

2. Cooling tower make-up treatment

Surface water was taken from the Datteln-Hamm Canal and treated in the make-up water treatment plant (CMW) by lime dealkalisation and flocculation using $FeCl_3$. The design of this plant was based on the following outline parameters:

Throughput		2x 500 m³/h
Feed values		
Temperature		5 – 35 °C
Total hardness		9.3°dH
Carbonate hardness		6.1°dH
Calcium	Ca	56 mg/l
Magnesium	Mg	7 mg/l
Chloride	Cl	48 mg/l
Sulphate	SO_4	59 mg/l
Org. substances	COD	15 mg/l
Solids	TS	40 mg/l

Some service effluents produced in the power plant, e.g. filter backwash waters, are also treated.

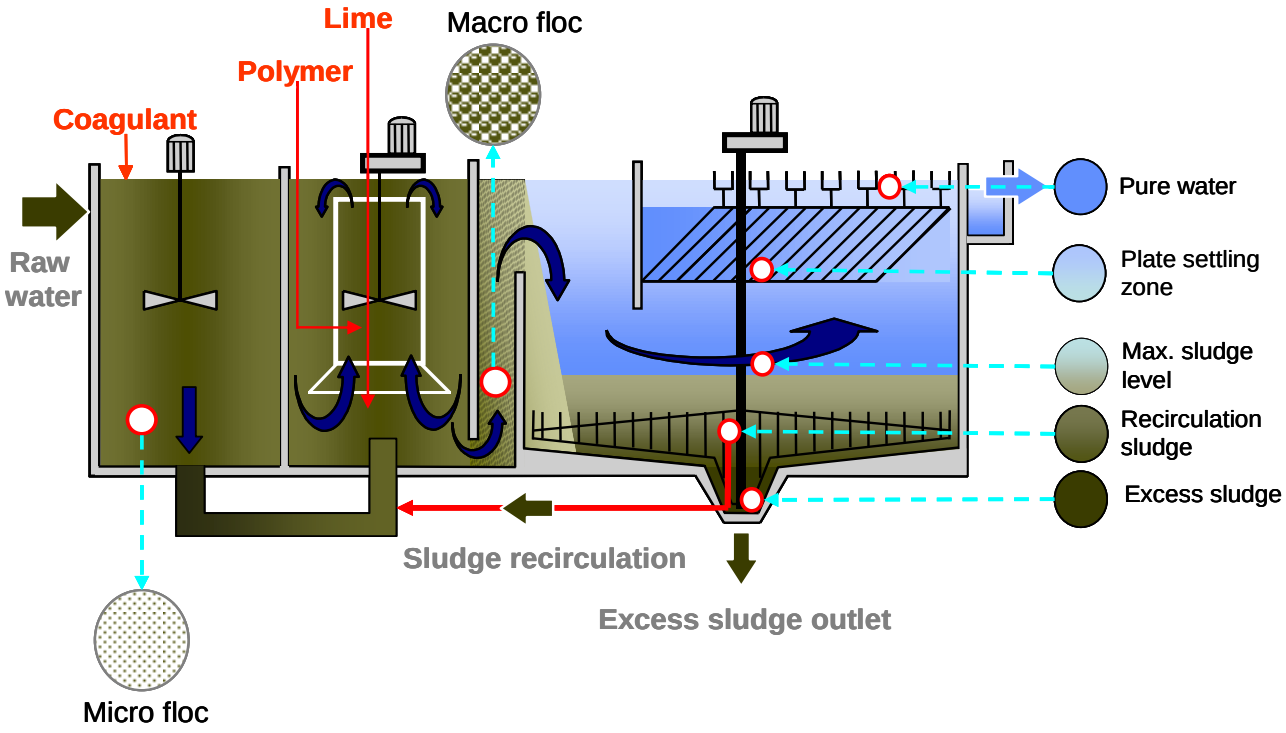
Required effluent values after treatment:

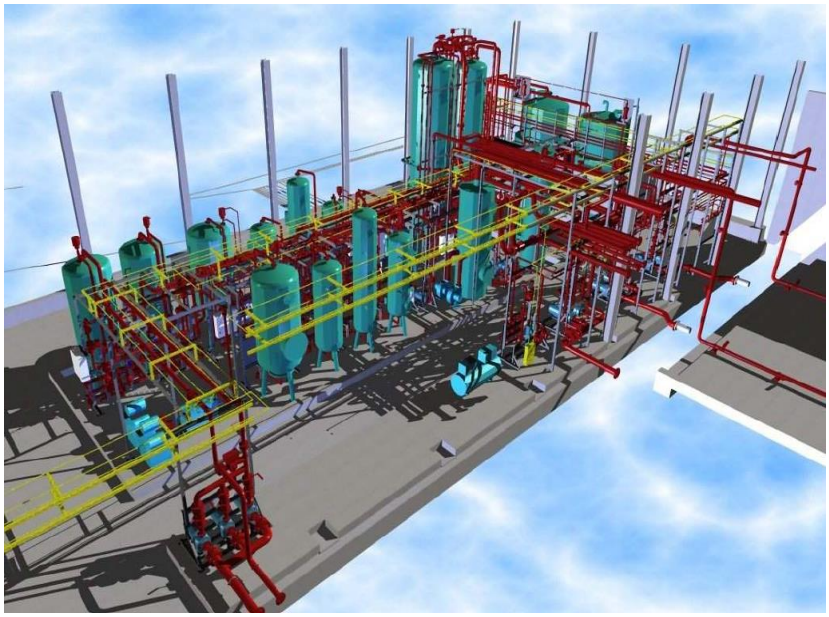
Solids	TS	≤ 5 mg/l
Carbonate hardness	KH	≤ 0.7 mval/l

Filter cake:

Dry matter content	TS	≥ 50%

The **FLOCOPAC** system was selected for the numerous advantages it offers, such as high throughput, high operational dependability, high filtration and thickening efficiency. This decision resulted not least from its small space requirements.





2a. Treatment train

1st step: Destabilisation (coagulation) by $FeCl_3$
2nd step: Water de-alkalisation and flocculation by adding lime and polymer
3rd step: Solids separation by means of a high-performance sedimentation stage with integrated plate clarification zone
4th step: Sludge treatment by means of a chamber filter press

2b. Results

The **FLOCOPAC** accomplishes the specified task safely and reliably; the quality is regularly better than that agreed in the contract.

Treated water

Solids	TS	<	2 mg/l
Carb. hardness	KH	<	0.5 mval/l
Filter cake	TS	>	50%

3. Demineralisation plant

The demineralisation plant is used to produce deionised water; it mainly removes filterable and dissolved substances by filtration and ion exchange. The DI water produced is used as feed water for the high-pressure boilers of the power plant. The following is the basic design data:

Throughput: 2x 16 m³/h

Feed water quality:

Temperature		10 – 30 °C
Calcium	Ca	47 mg/l
Magnesium	Mg	5.6 mg/l
Sodium	Na	26 mg/l
Potassium	K	3 mg/l
Chloride	Cl	33 mg/l
Sulphate	SO_4	39 mg/l
Nitrate	NO_3	13.6 mg/l
Silicic acid	SiO_2	6 mg/l

Required treated water quality:

Conductivity			≤0.1 µS/cm
Silicic acid	SiO_2	≤	10 µg/l
Sodium	Na	≤	5 µg/l
TOC		≤	100 µg/l

3a. Treatment train

The treatment train is divided into the following steps:
Gravel filter: to remove the particles contained in the water. **Activated carbon filter:** to remove free chlorine and organic loads. **Cation exchanger:** to remove cations, operated using the moving-bed process. **De-carbonator:** to remove carbon dioxide (jointly for both trains). **Anion exchanger:** to remove anions, operated using the composite moving-bed process. **Mixed bed exchanger:** to remove salt residues from the water.

3b. Results

All values were below those guaranteed with the system selected:

Treated water:

Conductivity		≤	0.1 µS/cm
Silicic acid	SiO_2	≤	5 µg/l
Sodium	Na	≤	1 µg/l
TOC		≤	50 µg/l

4. CPP condensate polisher

Condensate polishing is used to remove dissolved salts and corrosion products from the condensate of the two power units by filtration and ion exchange. Two trains of 50% each of the condensate volume flow are available for each unit.

Throughput: 4x 195 t/h

Feed water quality:

Direct conductivity		1.2 µS/cm
Ammonium	NH4	0.24 mg/kg
Iron	Fe	0.02 mg/kg
Sodium	Na	0.01 mg/kg
Silicic acid	SiO_2	0.02 mg/kg

Required treated water quality:

Conductivity		≤ 0.1 µS/cm
Silicic acid	SiO2	≤0.005 mg/kg
Sodium	Na	≤0.001 mg/kg

4a. Treatment train

The condensate is treated in the following steps:
A backwashing-type **cartridge filter** to remove the particles contained in the condensate. Then a **mixed-bed exchanger**, containing a mixture of cation and anion exchange resins, to remove salt residues from the condensate. Backwashing and regeneration of all four mixed-bed exchangers is carried out in a common regeneration unit located in the water treatment building.

The resins are fed into the regeneration unit via pipelines, regenerated there and then pumped back into the mixed-bed exchangers.

4b. Results

All values were permanently below those guaranteed with the system selected:

Conductivity		≤0.06 µS/cm
Silicic acid	SiO2	≤0.003 mg/kg
Sodium	Na	≤0.001 mg/kg

H+E ranks among the world's leading suppliers in the fields of: water & wastewater treatment, and energy efficiency. Based on its global presence, the **H+E** **GROUP** has completed projects in over 50 countries.

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