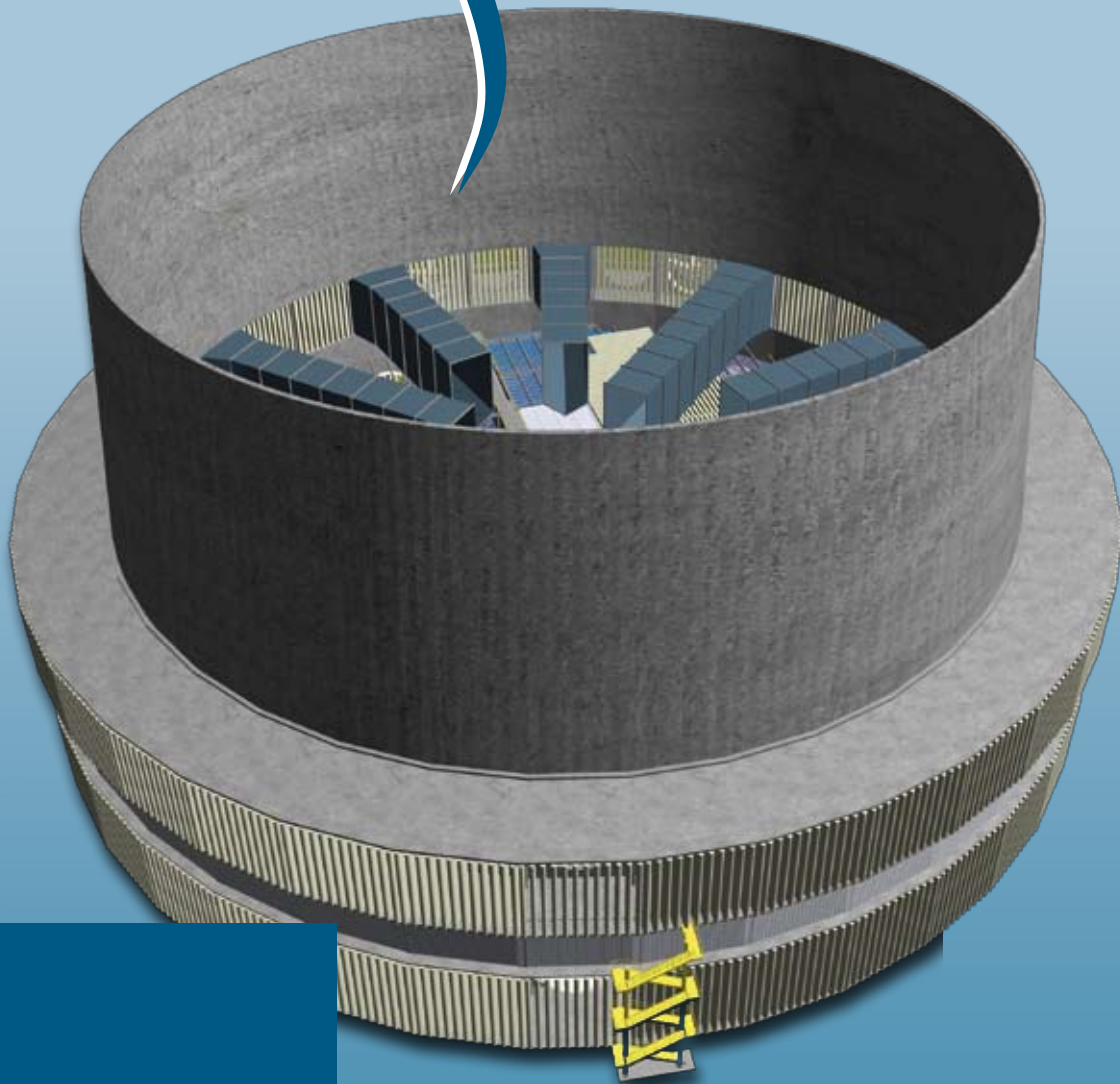


**Hamon**

# Wet Cooling Systems



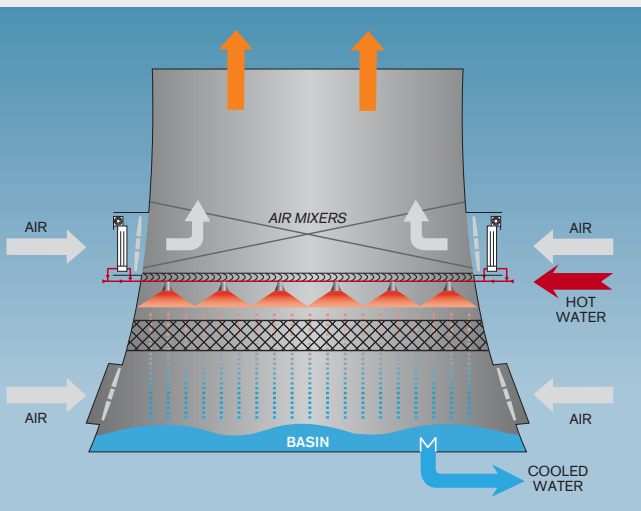
**Circular Hybrid  
Cooling Tower**



# Circular Hybrid Cooling Tower

Hybrid cooling towers combine the wet and dry cooling with the intention of avoiding the visible plume formation. Circular hybrid cooling towers are the best technical solutions for large heat loads and stringent plume abatement requirements.

Due to environmental protection requirements the circular hybrid cooling tower leads to improved public acceptance of the total plant and facilitates the governmental permission process. In some cases this tower is the ultimate requirement in Central Europe for new plants.



## Process description and construction features of circular hybrid cooling towers

Hybrid cooling towers can be built as cells with induced draft fans on the roof or as circular hybrid cooling towers with forced draft fans arranged at the perimeter of the cooling tower.

Circular hybrid cooling towers are ideal for large heat loads and stringent plume abatement requirements in one structure. A cell type configuration would require more space for several banks, proper wind direction alignment and additional design margins for recirculation and interference and the plume could still affect the neighbourhood. Contrary to this the air leaves the round hybrid cooling tower at higher elevation and this air has a further strong upwards movement.

The dry part of the hybrid cooling tower is arranged above the wet part and dissipates only a small heat load. The hot water for the dry section is being taken as partial flow from the main hot water flow entering the wet section by means of booster pumps. This flow is pre-cooled in the bundles and is then fed back into the wet section.

Both the dry and the wet sections are being divided into 4 or 8 sectors by means of valves to control the water flows and by separation walls which serve to separate the air and water flows between the sectors. The basin can as well be divided into 2 or 4 compartments. This concept provides flexibility in operation and the required operational safety.

We recommend the use of two speed fan motors for adjusting the performance and for the saving of energy. Especially the fans of the dry part can be operated most of time at low speed. During nights it could be acceptable to stop these fans and to allow the plume formation.

The height of this cooling tower is typically between 40 to 80 m. The natural draft effect saves fan power. Stringent noise requirements can be met.

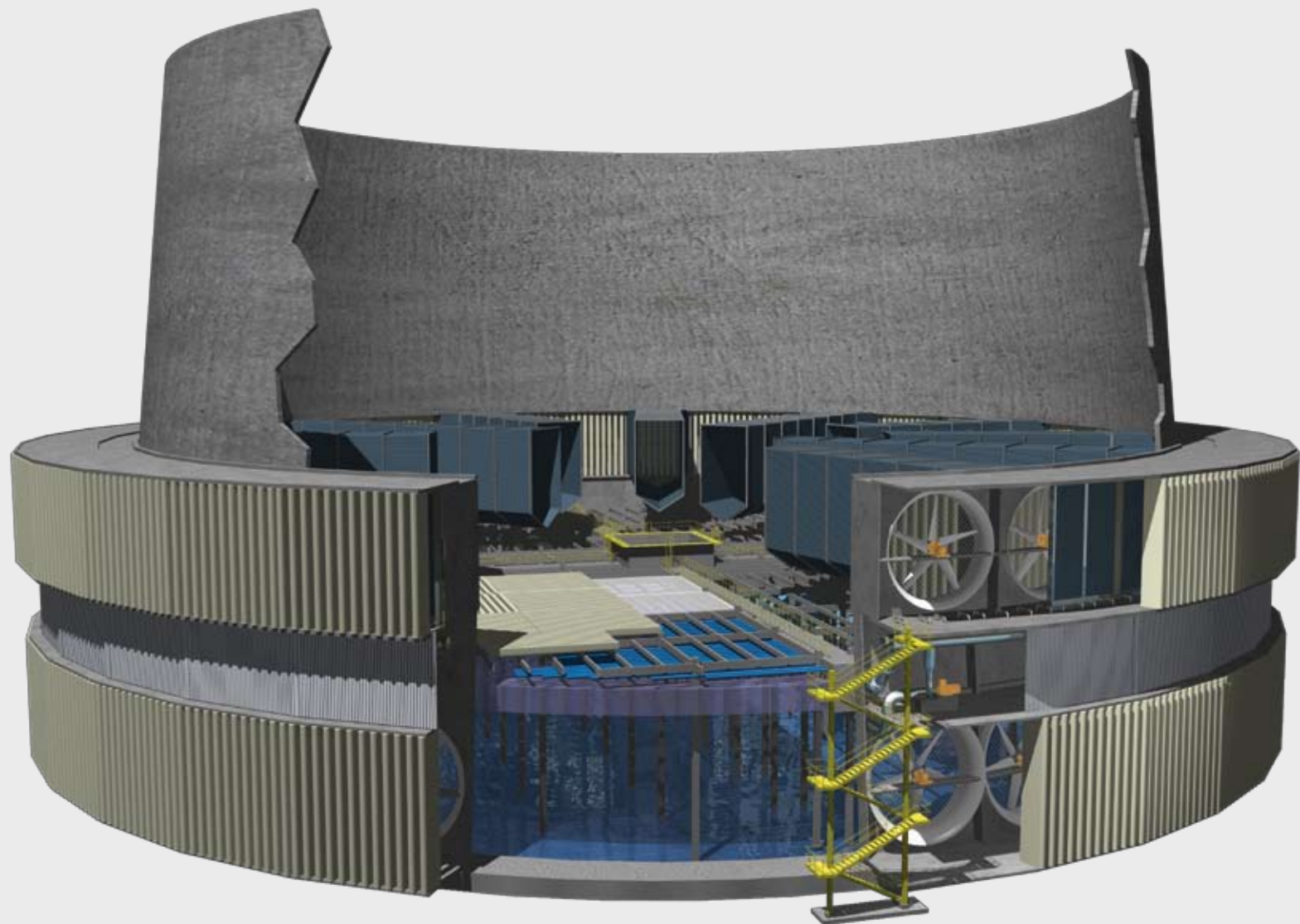


### Typical Applications

- Seawater application
- For winter and normal climate conditions
- If overall height is limited
- To keep countryside free from visible plume formations and shadow
- For locations close to residential areas
- To facilitate permission processes
- The circular hybrid cooling tower cannot be combined with flue gas discharge.

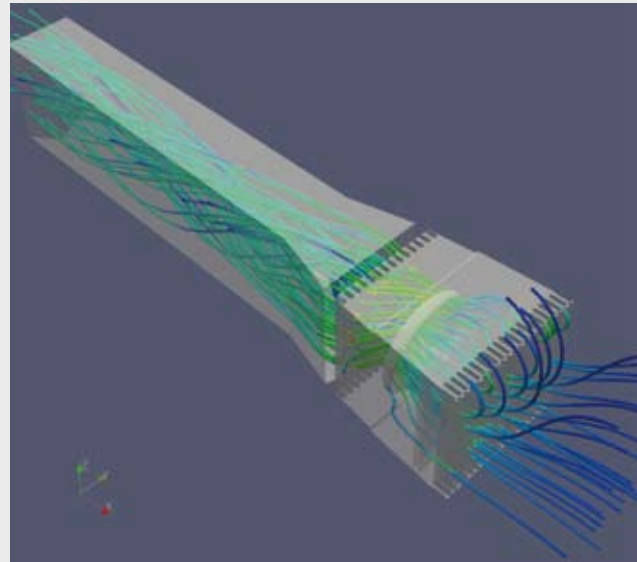
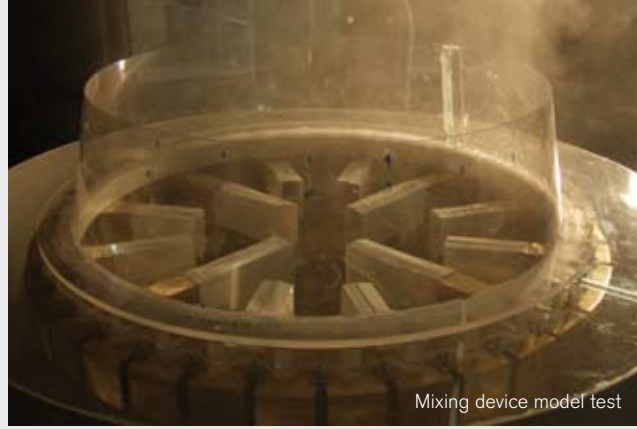
### Advantages versus cell type hybrid cooling tower

- Compact arrangement/space saving
- No recirculation and interference effects
- Exhaust air is leaving the tower at higher elevation and with strong upwards draft
- No wash down (grounding) effects of plume
- Use of natural draft
- No corrosion due to humidity and salinity in the neighbourhood
- Visually an interesting architectural structure.



## Research and development

The circular hybrid cooling tower is a highly sophisticated plant and requires specifically developed solutions for an optimised process and the civil structure. Extended models and mathematical calculations are made by Hamon Engineers to prove that the selected solutions are the most suitable. The equipment is Hamon original supply with tested and proven equipment from reliable component suppliers.

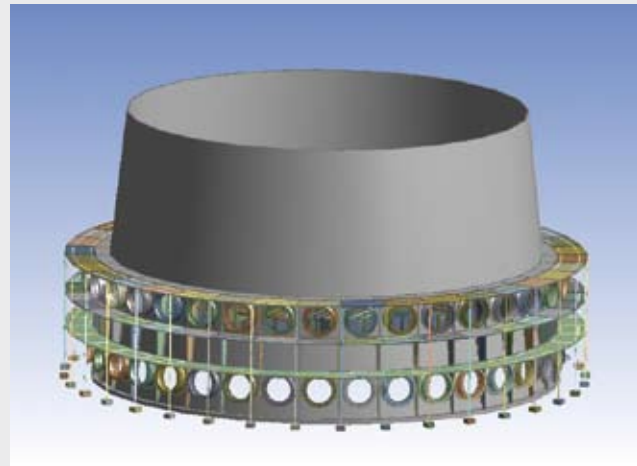


## Reference Moorburg

Vattenfall Europe awarded the turnkey supply contract of the Moorburg circular hybrid cooling tower to the consortium of Alpine Bau Deutschland AG for the civil works and Hamon Thermal Germany GmbH for the process design and cooling equipment. This cooling tower is unique in its design because it serves the two 800 MWe blocks of the Moorburg power station independently from each other. For most of the year the Moorburg power station can be cooled with fresh water from the river Elbe. Only for a few months especially during the summer, the heat discharge into the river Elbe is limited due to environmental reasons and circuit cooling via the cooling tower is required either for one or two blocks. This type of cooling tower made the plant approval possible because it reduces the visual impact of the power plant in the city of Hamburg.

### Technical Data required:

- Heat load: 1537 MW
- Water load: 152 136 m<sup>3</sup>/h
- Hot water temperature: 31.6°C
- Cold water temperature: 22.9°C
- Wet bulb temperature: 13.5°C
- Plume abatement: 5°C / 85%
- Max. diameter: 130 m
- Max. height: 60.5 m



### Other recent references for hybrid cooling towers:

- Cas Tresorer II – Endesa – Spain - 5 cells
- Staythorpe – RWE – United Kingdom – 28 cells
- Tasmania – Alinta Power – Australia – 6 cells
- As Pontes – Endesa – Spain – 16 cells
- Huntly – Genesis Power – New Zealand – 7 cells

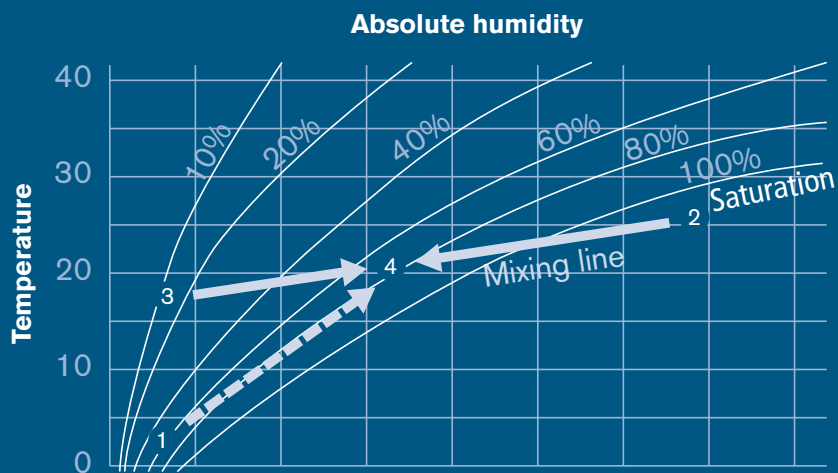


### Plume abatement

The plume abatement process can be best explained by using the h-x diagram:

After passing through the wet section the ambient air (1) is heated up and oversaturated (2) due to the direct contact with the hot cooling water whereas the ambient air in the dry section is heated up (3) without changing its absolute water content. Both airflows are almost perfectly mixed within the shell (plenum) and leave the cooling tower undersaturated (4). This exhaust air status can be balanced with the air volume quantities passing through the wet and dry section.

After leaving the cooling tower the exhaust air is merging with the ambient air. The status of the air outside the cooling tower moves along the connection line from status 4 to status 1 the more it dissipates. A hybrid cooling tower is being considered plume free if this mixing line stays in the area of under-saturation and not crossing the 100% humidity line.



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