

## Air Cooled Condensers (ACC)



## Member of an excellent group

The Business Unit ACC/Heller of the segment GEA Heat Exchangers is part of the global GEA Group, which operates in more than 50 countries worldwide.

By focusing all activities in one single Heat Exchangers segment, GEA now highlights its position as one of the world leaders on the market of heat exchangers. Concentration of business in this new segment will further improve the proximity to our customers and, at the same time, the access to the product portfolio of GEA. It will likewise vigorously promote high GEA quality standards, in conjunction with the customized solutions of GEA as a leading technology group.

The segment GEA Heat Exchangers covers numerous application areas, from air conditioning systems to cooling towers, and therefore probably provides the widest portfolio of heat exchangers worldwide. Finned-tube heat exchangers, single-tube heat exchangers, Heller systems, air-cooled condensers, wet cooling towers, plate heat exchangers, HVAC systems, and all kinds of shell-and-tube heat exchangers: for all feasible applications, the new GEA segment Heat Exchangers offers from one source the best possible solutions. And it powerfully supports planning efforts in all areas of heat transfer.

### The benefits of GEA:

- You profit from the dynamic innovation of a strong group
- You utilise the synergies from all GEA segments

## Decision between Wet and Dry Cooling

The Business Unit ACC/Heller is known for its comprehensive expertise in the field of cooling technology and, as a business unit within the GEA Heat Exchangers segment, it offers the whole range of services for dry cooling systems.

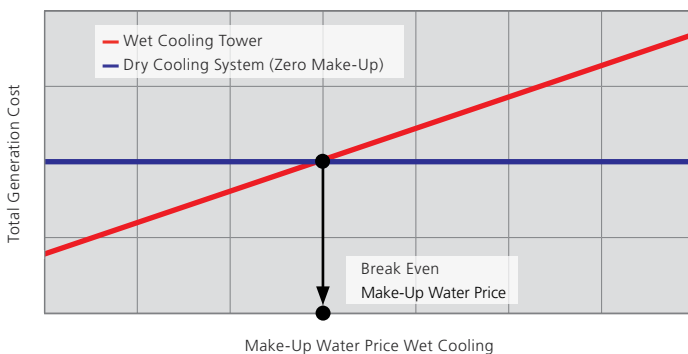
GEA's leading market position in the field of industrial cooling is partly due to its thorough command of both cooling processes. It is a well-known fact that experience pays off. For decades, GEA has been building cooling systems all over the world, covering everything from the construction of new systems to the enhancement, maintenance and optimisation of existing systems, always to the highest quality standards and incorporating the latest findings from its own research and development programmes.

Cooling your plant with a wet cooling tower is the common solution. But what if there is little or no water available? Or the available water is too costly? What if it gets so cold in the winter that the plume ices up roads, runways or neighboring facilities? What if there's no suitable place to discharge waste water? What if you are being challenged on issues of water conservation, pollution or aesthetics?

If you are facing one or more of these problems, GEA has the perfect answer: a reliable, efficient air cooled condenser (ACC). A GEA air cooled condenser does not rely on water for cooling and hence there are no waste water disposal problems. This makes it ideal for water scarce areas, zero discharge plants, or situations that mandate plume elimination.



At GEA Heat Exchangers, sustainable systems form the basis for the preservation of natural resources.

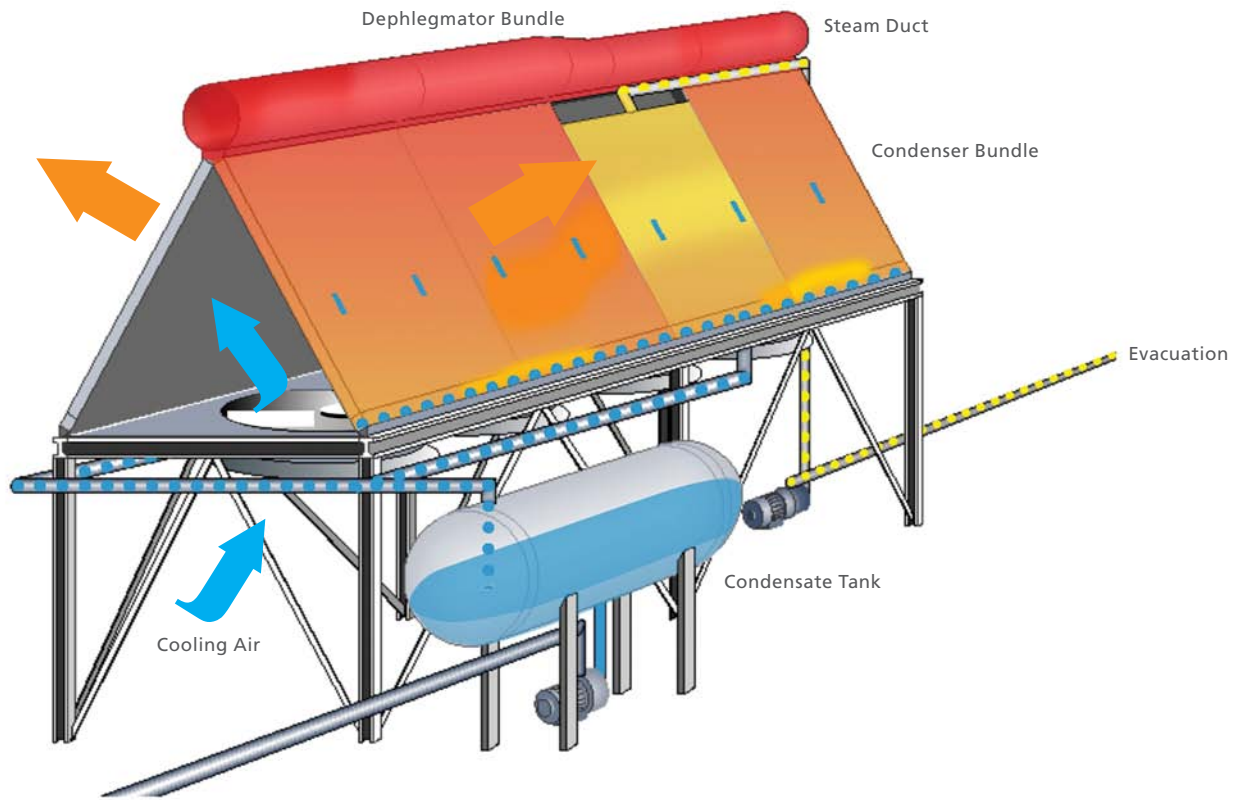


### Application of the optimal cooling systems depends on:

- Availability of water
- Price of make-up water
- Environmental restrictions (plume, sound, height)
- Area restriction

Optimization studies evaluate the system with the greatest economical benefit.

# Principle and design of GEA Air Cooled Condensers



An ACC consists of cells arranged in parallel rows. The fin tube bundles are arranged on the fan deck. The airflow through the heat exchanger bundles is achieved by forced-draught fans.

The ACC normally comprises the supporting steel structure, steam ducting from the turbine exhaust to the heat exchanger bundles, the fin tube bundles, fan units, condensate tank, condensate and drain pumps, evacuation system, interconnecting piping and instrumentation.

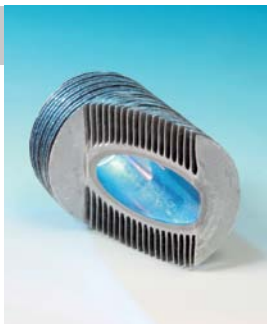
## Alex - Tube

- Flat shape steel with aluminium coating
- Meandering form of aluminium fins
- Connection by brazing



## Mash (extruded) - Tube

- round core tube made of steel or alloys
- thick-walled sleeve of soft aluminium threaded on core tube
- helical fins progressively extruded from aluminium sleeve



## A - Tube

- Elliptical core steel tube
- Rectangular steel fin
- Connection by hot dip galvanizing



## Engineering Development

In order to further enhance GEA's leading position in today's hotly contested market the engineers of GEA Energietechnik GmbH developed two improvements which can be used for larger Air Cooled Condensers.

These two improvements are:

(a) The inclined exhaust duct routing reduces the steam side pressure drop between turbine and condenser and saves duct material as well as man power for manufacturing and erection.

Power stations with turbine capacities up to 750 MW<sub>e</sub> have been designed and installed with the inclined duct routing. The maximum diameter of the inclined exhaust steam duct is presently 8000 mm.

(b) The supporting structure of the Air Cooled Condenser platform was derived from nature and therefore called "bionic design". This design reduces the number of foundations and saves structure material as well. Waste to energy plants with turbine capacity of 30 MW as well as combined cycle power stations with turbine capacity of 200 MW have already been built with GEA's "bionic design".

Both new designs of GEA Energietechnik GmbH are patent-registered.



Inclined exhaust steam duct  
Waste To Energy Power Plant (Bielefeld, Germany)



Bionic design  
Waste to energy power plant (Herten, Germany)

## The current status of booked and delivered GEA Air Cooled Condensers (December 2011)

Mode of Operation	Number	Cond. Capacity t/h	Turb. Capacity MW <sub>e</sub>
Public utility	257	142,637	63,168
Industrial power generation	265	12,533	3,869
Compressor driven turbines	138	4,726	1,013
Refuse incinerators / biomass	187	6,980	5,389
Mash Condensers	202	9,820	4,805
<b>Total</b>	<b>1049</b>	<b>176,696</b>	<b>78,244</b>



Air Cooled Condenser  
for a 800 MW Combined Cycle Power Plant  
Amorebieta, Spain



Air Cooled Condenser  
for a 2 x 600 MW Coal Fired Power Plant  
SP Power Plant Datong Generation Co. Ltd., China



Air Cooled Condenser  
for a 500 MW Combined Cycle Power Plant  
Durango, Mexico



Air Cooled Condenser  
for a 805 MW Combined Cycle Power Plant  
E.on Produzione Centrale Livorno Ferraris, Italy

Air Cooled Condenser  
for a 4 x 600 MW Coal Fired Power Plant  
Jinjie, China



Air Cooled Condenser  
for a 20 MW Biomass Plant  
Siegerland, Germany

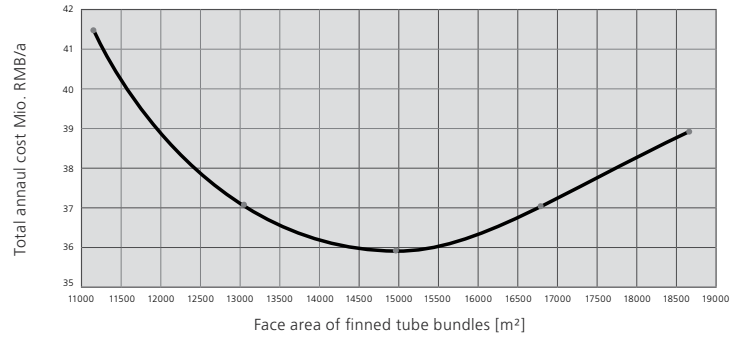


## Designed in Germany – made by GEA

### Optimization

Most of the time the cooling process in the power station is not operating at its design parameters but with higher or lower temperatures following the daily and seasonal swings of the ambient air temperature. For each cooling system the economic optimum is different. Therefore, a multitude of variable parameters has to be considered in order to find the optimum economic solution. Within this complex planning field, GEA completes the long experience with a proprietary developed optimization calculation program.

Optimization Results for PS Jinjie 4 x 600 MW



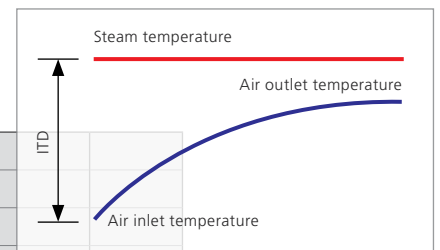
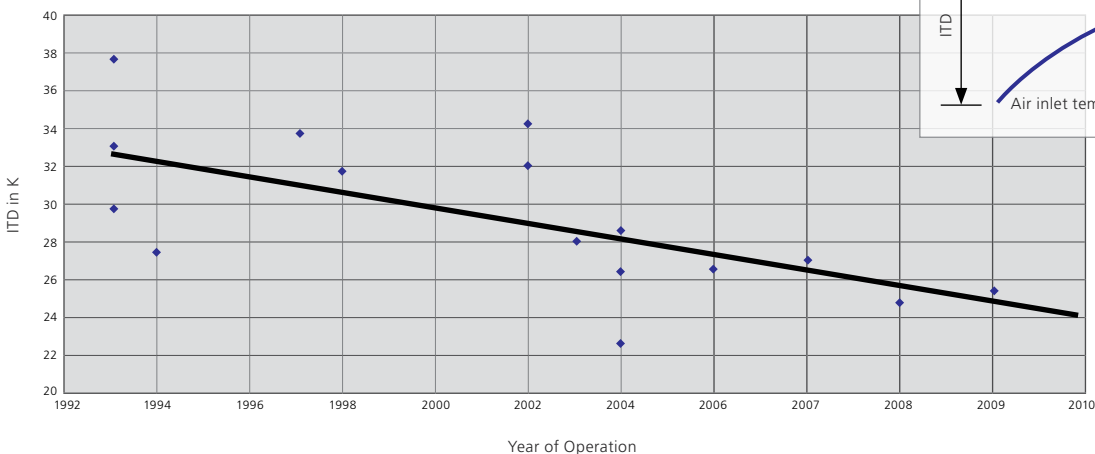
### Wind Channel Test & CFD

- For stable quality of manufactured Alex bundles and new developed heat exchangers the thermal and aerodynamic performance are periodically measured in our wind channel.
- The performance and the operational behavior of ACCs are influenced by wind in general.
- For structural and thermal design reasons the effect of wind has to be calculated under different wind conditions.
- The CFD analysis shows the influence of warm air recirculation, air side pressure distribution and velocity and temperature characteristic on the performance of an ACC. The influence of buildings and topographic conditions in the neighborhood can be also calculated.



### Development of the Initial Temperature Difference (ITD)

The condenser heat rejection and the ITD determine the size of the ACC. Economic aspects show a decreasing trend of ITD. The reason is the increasing energy cost which leads to a growing of demand on the efficiency of power cycle.





Excellence

Passion

Integrity

Responsibility

GEA-versity

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