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climate control MIDDLE EAST

KEY PERSPECTIVES ON THE REGION'S HVACR INDUSTRY

January 2020

WHY PROPER ENGINEERING REASONING REMAINS AS ELUSIVE AS EVER

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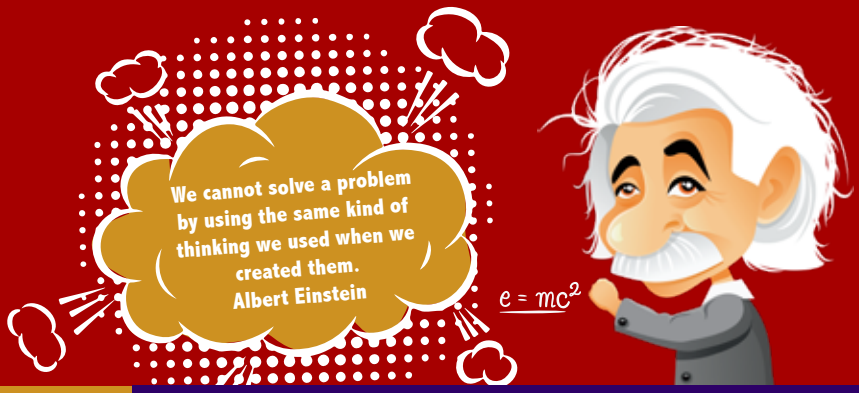

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The Regal Innovation Summit, held on November 28 in Dubai focused on innovative motor and blower technologies, and was a forum for discussion of challenges faced by OEMs, distributors, consultants and end- users in the HVACR sector. *Climate Control Middle East* presents an overview of the company's observations, technical presentations and overarching strategy

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PERSPECTIVE

Aslan Al Barazi is Executive Director at IMEC.
He may be contacted at imec@emirates.net.ae.

COLOUR, COLOUR, WHICH TOWER DO YOU CHOOSE?

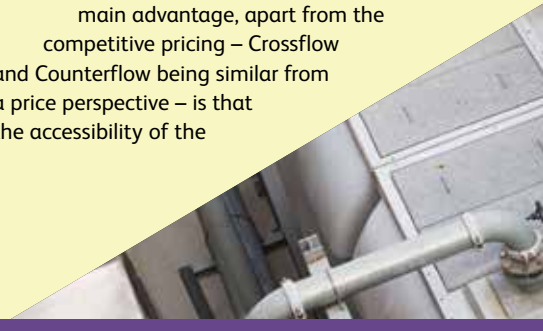
Aslan Al Barazi arrays different types of cooling towers and elaborates on their comparative merits and demerits

INDUCED-DRAUGHT COUNTERFLOW COOLING TOWER

This is the most efficient design, in the sense that it demands minimum energy on the cooling tower fan power. Broadly, it is the most competitive, cost effective and popular design solution for the HVAC industry. It has the maximum force per unit area for the air in contact with the water droplets falling down the cooling tower, thereby deeming it the least in terms of fan energy consumption. It also has the characteristic tendency to be 'Tall & Thin' in dimensions – that is, it has the minimum length and width area with more height, compared to the Induced Draught Crossflow design counterpart, which may be considered 'Short & Fat' – meaning, it has more length and width area but a shorter overall tower height. The reason for this is that the heat transfer in the counterflow design moves vertically, whereas the transfer is happening horizontally in the crossflow design. So, if the client has a space limitation from a 'Length & Width' perspective, they may normally find a counterflow design more apt, whereas if they find that the height is more of a restriction in the design, then a crossflow may be a better choice. The disadvantage in the case of the Counterflow design is that the inner components of the cooling tower are not easily accessible during maintenance, unless you are dealing with bigger industrial cooling towers, with capacities of 6,000 USGPMs per cell and above.

INDUCED-DRAUGHT CROSSFLOW COOLING TOWER

The Induced-Draught Crossflow Cooling Tower is the other popular design for end users and consultants alike. The main advantage, apart from the competitive pricing – Crossflow and Counterflow being similar from a price perspective – is that the accessibility of the



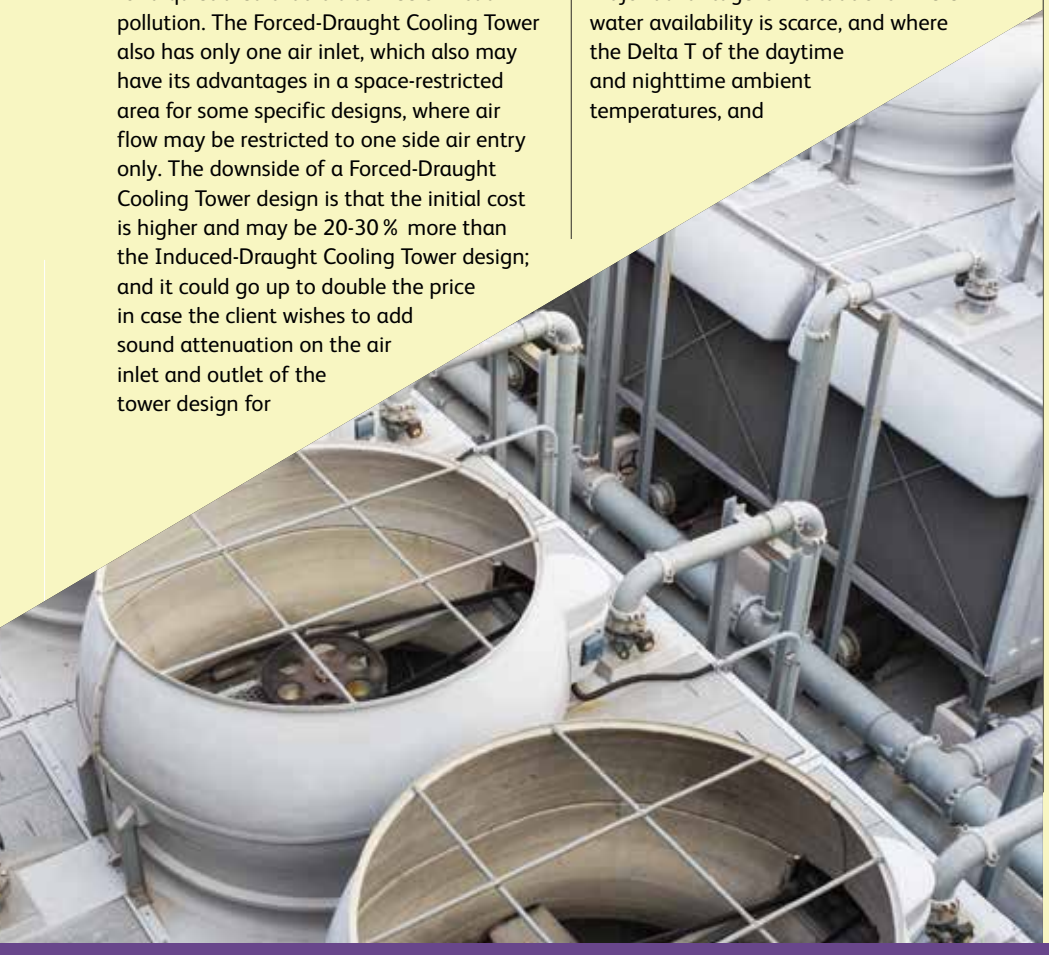
Crossflow type for maintenance is very easy. Even for towers as small as 300 TR (900 GPM per cell), a maintenance worker may enter the cooling tower through the access door to carry out overall tower maintenance. Although the Crossflow is less efficient in energy consumption in terms of the fan power, compared to the Induced-Draught Counterflow design by around 10-20% on average, it consumes less pump energy, as it utilises less design head on the condenser pump. That is the case, because there is no pressure across the water spray nozzles design in a Crossflow system, relying as it does instead on the gravity flow design. The Counterflow, on the other hand, relies on a pressurised water spray nozzles system and so uses more pump head power on the condenser pump design.

FORCED-DRAUGHT COOLING TOWER

This type of tower design is normally preferred when the client has an extremely low-noise requirement or wishes to conceal the cooling tower from view by installing it on the mechanical floor and duct in the air flow to the tower and duct out the effluent discharge air from the tower. It may be that the client wishes to use the roof of the building for other purposes than an HVAC installation, such as having a swimming pool or a penthouse, which means the need for a quiet area that is also free of visual pollution. The Forced-Draught Cooling Tower also has only one air inlet, which also may have its advantages in a space-restricted area for some specific designs, where air flow may be restricted to one side air entry only. The downside of a Forced-Draught Cooling Tower design is that the initial cost is higher and may be 20-30% more than the Induced-Draught Cooling Tower design; and it could go up to double the price in case the client wishes to add sound attenuation on the air inlet and outlet of the tower design for lower noise. Also, a Forced-Draught Cooling Tower is more prone to 'recirculation' issues of used saturated air, which would negatively affect the performance of the cooling tower due to the lower-speed discharge of the air flow compared to the higher-speed discharge for the air inlet flow (which is the opposite effect in the Induced-Draught Cooling Tower design, where the discharge speed of the airflow is typically double that of the Forced-Draught design). Air flow restrictions – if any – in the proposed cooling tower area being considered need to be, therefore, properly studied in all cooling tower designs, particularly in the Forced-Draught Cooling Tower. The other disadvantage in the case of the Forced-Draught system is that energy consumption may be 20-30% more than the Induced-Draught Tower design.

CLOSED-CIRCUIT FLUID COOLERS

The Closed-Circuit Fluid Cooler design has been drafted into the initial project designs for its water-savings advantage but has normally been rejected once the pricing has been declared. Indeed, the pricing normally is at 2-3 times the total cost of a normal Open-Circuit Cooling Tower design, persuading most clients to move away from it. It still has its market, though, in the industrial sector, where the process fluid is required to be clean and free of any contaminants. Its other major advantage is in situations where water availability is scarce, and where the Delta T of the daytime and nighttime ambient temperatures, and summer and winter variance temperatures are large enough. This cooling tower type is not the optimum design for the GCC region; it would be better suited for cold countries with fewer water resources, whereby clients may rely on 'free cooling' in the wintertime by switching off the water flow in the fluid cooler and rely on sensible cooling heat transfer, instead.



HYBRID COOLING TOWERS

The advantage of this cooling tower would again manifest most in colder climes, where the warm plume discharge from the cooling tower condenses and would look like thick smoke, giving the impression of visual pollution or, worse, as a signal to summon the fire brigade. In the GCC region, however, the plume discharge of the cooling tower would be hardly visible, so that's the least of the concerns. However, the cost of the cooling tower is forbiddingly high, much like the Closed-Circuit Cooling Towers and, therefore, does not usually warrant serious consideration, based on the cost of most projects in the region.

SO, WHAT DOES THE INDUSTRY PREFER?

Around the year 2000, which represented the early days of the rise in demand for cooling towers in the GCC region, the industry preferred the use of the Induced-Draught Crossflow design. However, in the past 5-10 years, there has been a noticeable shift in trend towards Induced-Draught Counterflow design. The reason for this is that though Crossflow systems are easier to maintain, Counterflow systems offer much by way of design and practical operation perspectives. Crossflow systems have the complete PVC Fill Air inlet/ PVC Fill exposed to the ambient air on both sides of the tower, with all the sand and sediments from the air thereby entering into the cooling tower. Over time, the sediments would typically scale the cooling tower inlet and PVC Fill, thus necessitating much more regular cleaning of the tower; and if not properly cleaned, the scaling would reduce the heat transfer efficiency of the cooling tower and require expensive replacement in a shorter duration of time. The Counterflow system, on the other hand, has the PVC Fill situated inside the cooling tower body. And through the inherent design of the Counterflow system, the PVC Fill is continuously being self-washed while the cooling tower is in operation. Therefore, it is viewed as being more protected from scaling in comparison to the Crossflow

system. This is not to suggest that the Counterflow cooling tower PVC Fill does not need to be periodically washed, but the intervals of cleaning are less often, and so the tower would need less shut down time for cleaning; and the PVC Fill, therefore, may last longer than in the case of the Crossflow systen by a few years, on an average.

INDUSTRIAL OR PACKAGE-RANGE COOLING TOWERS?

Consultants and designers need to be aware that cooling tower specifications and details differ between Industrial and Package-Range types. Normally, Industrial Cooling Tower specifications, which are normally based on Induced-Draught Counterflow Towers are more quantified and detailed than the Package Range Cooling Tower specifications. Industrial Cooling Tower specifications are normally applied only for plant room or District Cooling Tower applications, and normally start being competitive from around 5,000 USGPM per cell and above. Package-Range Cooling Towers, on the other hand, are normally used for chillers up to a capacity of 1,200 RT in single-, double- or even triple-cell configurations. Package-Range Cooling Towers normally come in factory-assembled configuration, whereas Industrial Cooling Towers always come in a field-erected materials supply regimen, where the towers are always erected at site due to their bigger sizes.