Wednesday, 29 October 2025

Newsletter: Energy Saving in Refrigeration and HVAC Systems

Chillers and HVAC systems consume up to 60% of the total energy consumption in commercial and Industrial facilities in Singapore and around the world. Therefore, optimising these systems for saving maximum energy as possible will be a huge boost in reducing the operating costs of these facilities.

The HVAC industry powers comfort, but we can't deny that it also drives a big share of building emissions. We can, however, show the world that comfort and climate action can work together effectively by taking note of the following points and looking for ways to implement strategies based on these points.

1. Upgradation of older systems which are not suitable for evolving cooling demand

Rising temperatures and heatwaves puts HVAC equipment under stress as the demand for cooling intensifies. Equipment is forced to work harder to maintain comfortable indoor temperatures. The higher temperatures also put a strain on components, motors, fans and compressors, reducing their lifespan and can increase energy consumption.

The current high temperatures overall are a stark reminder that older HVAC equipment is particularly at risk of failing. Investing in the latest energy efficient equipment can enhance resilience and improve energy savings.

Air source heat pumps can provide both cooling and heating, can help ease pressure on the grid and are good for business and the environment too.

An illustrative example for the above shall be seen below. Older chillers from the early 2000s efficiency is typically in the range of 0.7 to 0.85 kW/RT. These chillers can be replaced with latest chillers with efficiency as high as 0.5kW/RT with the turbocor chillers.

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Therefore, for a 300RT chiller

Power savings = 300 x (0.8 – 0.5) = 90kW

Annual running hours = 365 x 24 = 8760 hours

Annual power savings for a 300RT chiller = 90 x 8760 = 788,400 kW

This is a substantial power saving as we can see.

2. Usage of Free cooling chillers when the ambient temperature is low

Usage of closed-loop systems, particularly for chillers and air conditioning units recycle water or air and allow for efficient and environmentally friendly cooling.

Free cooling chillers use ambient air to cool water in the closed-loop circuit and provide a more sustainable cooling method when the ambient temperature is lower than the return water temperature.

3. Replace gas systems with electrical driven systems

Go electric by swapping gas systems for heat pumps powered by renewables.

Heat pumps are almost 3 to 4 times more efficient than gas systems or boilers, providing 3 to 4 times more energy savings.

4. Usage of smart systems to optimise the overall operation of a HVAC system

Smart systems use zoned cooling and ventilation which cuts energy costs and environmental impact.

Traditional chiller systems often operate inefficiently, consuming excess energy. Smart chillers analyse real-time cooling demand and adjust operations, accordingly, helping businesses save electricity costs while maintaining optimal performance.

Precise Temperature Control**:** With AI and IoT integration, smart chillers maintain consistent indoor temperatures, preventing overcooling or heat accumulation. This ensures a comfortable and stable environment throughout the day.

Algorithms manage the chiller units' unique real-time data, weather forecasts and active learning.

5. Use of AI in optimising modern systems

Harnessing the use of AI in making HVAC more efficient is a key focus for our team as we look to 2025 and beyond.

AI can analyse all environmental conditions such as temperature, humidity and air flow in real time to make HVAC more efficient.

The power of AI's predictive capabilities means the maintenance of chillers and other HVAC equipment can maximise operational productivity but will also reduce energy costs, inefficiencies and downtime events.

Optimizing the chilled water flow rate using a control method combining artificial neural networks and genetic algorithms can reduce the energy consumption of the chilled water pump by 51.11 %

We are working hard to leverage AI and enhance its offerings that will give informed control to building and facilities managers. We are excited by its influence - significantly reducing energy usage in cooling systems and providing more accurate and efficient cooling.

6. Transition to cold plates or immersion cooling instead of air cooling

Microsoft has conducted a comprehensive two-year life cycle assessment (LCA) comparing 4 data centre cooling technologies, traditional air cooling, cold plates, and both one-phase and two-phase immersion cooling.

A life-cycle assessment evaluates the full environmental impact of these systems - from raw material extraction and manufacturing to operation and end-of-life disposal.

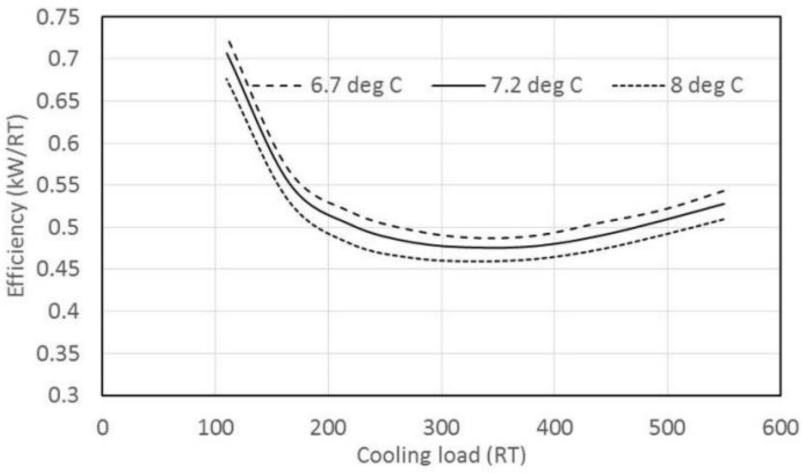
Findings indicate that transitioning from air cooling to cold plates or immersion cooling can reduce greenhouse gas emissions by 15-21%, energy demand by 15-20%, and water consumption by 31-52% over the systems' entire life cycles.

7. Raising the temperature set point

Some data centres are now experimenting with raising the temperature in their server halls to reduce energy consumption and lower costs.

Traditionally, data centres are kept at relatively low temperatures to prevent servers from overheating. However, modern hardware is often designed to operate efficiently at slightly higher temperatures. By increasing the ambient temperature, businesses can save on cooling costs and improve energy efficiency.

Below figure shows the efficiency improvement with the increase in the supply water temperature.



An illustrative example for a 300RT chiller, an increase in supply water temperature of 1.3C increases the efficiency from 0.49kW/Rt to 0.46kW/RT.

Therefore,

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Power savings = 300 x (0.49 – 0.46) = 9kW

Annual running hours = 365 x 24 = 8760 hours

Annual power savings for a 300RT chiller = 9 x 8760 = 78,840 kW

8. Using centralised chiller systems instead of individual cooling systems

Centralised chiller systems typically supply the cooling needs of several applications doing away with the need for each application in the facility to build and operate its own plants.

This can provide significant energy-saving, space saving and improving overall refrigeration efficiency.

Conclusion

The cooling demands of modern-day facilities have constantly been increasing given the changing environmental conditions and expanding needs for industrial cooling. It is critical for businesses to look at the cooling plants design holistically and embrace latest technologies and strategies to optimise the energy consumption, thereby saving cost and environment at the same time. Please feel free to approach us, we can provide you with advice on how to manage temperature and cooling systems.

Our Products and Services

Industrial process chillers, Low temperature refrigeration for cold storage, Heat pumps, Customised and standard chillers,
Natural refrigerant chillers, HFO chillers, Crane cabin Air conditioners, Dehumidifiers, Compressed Air Dryers (Refrigerant and Desiccant type), Compressed air filtration, Aftercoolers/Moisture Separators/Pressure vessels, OEM Spare parts,
Service and maintenance of refrigeration products.

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