

# Chilled Beam Systems: Alternative Cooling Technology



## Introduction

In May 2017, the EmiratesGBC Technical Workshop covered the chilled beam technology which operates on induction and convective cooling. Participants were invited to discuss based on their experience the application of chilled beam technology, pro and cons, occupant thermal comfort and energy costs.

## Overview of Chilled Beam Technologies

A chilled beam system is an air-water cooling system which consists of an air diffuser and localized water based heat exchangers. The application of the chilled beam technology is mostly favourable for low to moderately occupied areas such as offices, airports, education, hospitals, hotels, laboratories.



Figure 1 : Chilled Beam Systems

The different types of chilled beam systems are as follows:

### Chilled Ceilings

- Comprise of both radiant and convective cooling with dew point temperatures of 2 K
- Best applicable with ceiling voids of greater than 120 mm.

### Radiant chilled ceilings



Figure 2 : Radiant Chilled Beams

### Passive Chilled Beams

- Convection driven technology where the warm air at higher levels cools in contact with the cooling coil and then naturally drops

## Floor Induction Systems

- Convection driven technology
- Best applicable for underfloor induction typically around the perimeter façade or internal walls.

## Active Chilled Beam

- Induction driven technology
- Use of nozzles to percolate surrounding air from the chilled beam at high velocities (no need of an air displacement system)

## Challenges & Opportunities

### Challenges

- **Compatibility** – To ensure that chilled beam systems operate effectively, the occupancy densities should remain low. Furthermore, these technologies are better compatible with new buildings with green building features rather than old inefficient ones.
- **High Initial Costs** compared to air cooled systems.

### Opportunities

- **Reduced Energy Consumption** – Water-cooled systems reduce the cooling energy needs by 75% to 85% compared to air-cooled systems. Furthermore, in chilled beam systems the chiller plant operates at a higher temperature which increase the COP and reduces the energy consumption.
- **Design Flexibility** – Optimized space heights provide design flexibility for architects.
- **Improved Thermal Comfort** – Chilled beams operate on convection cooling principle which reduces the noise levels (reduced air velocities).

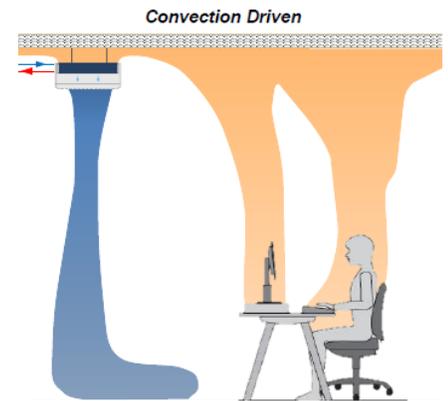


Figure 3 : Passive Chilled Beams

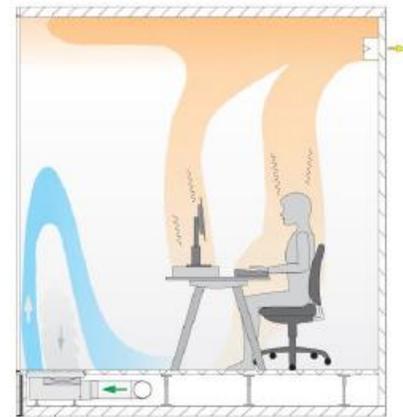


Figure 4 : Floor Induction Cooling

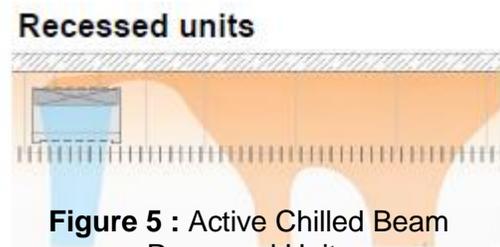


Figure 5 : Active Chilled Beam Recessed Units

- **Lowered Operational Costs** – Lowered fan speed and higher Chiller COP contribute to reducing the operational costs.

## Conclusion

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The chilled beam technology is a new promising technology in the HVAC industry with several benefits including the reduction of energy demand and consumption as well as improving the thermal and overall comfort of the building occupants. However, there are some challenges in the uptake of the chilled beam technology specifically when operated in dense spaces. The chilled beam technology might also have higher initial costs and some retrofitting limitations compared to conventional cooling technologies. Hence, further research and analysis are required to evaluate the feasibility of replacing a conventional air-cooled system with a chilled beam system for each individual project.

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*Workshop facilitated by Eoin Crowley and Dr. Jason Shilliday, TROX*