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16-17 March 2015 in Brussels

HOTREC CO2 REFRIGERATION

Canary Wharf London
by Green Cooling

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Green Cooling
Background

Green Cooling actively promote the application of low GWP based refrigeration systems within the UK...

- *Experienced with regard to both **system design and installation***
- *UK partner of CO2 pioneers enEX srl*
- *Developing a strong reputation for designing and installing high efficiency sustainable systems*
- *Green Cooling is a specialist within the **HOTREC and food production/processing sectors***

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Canary Wharf case study
Project requirement

***HOTREC Case Study**: A high rise tower in Canary Wharf London with a 1,500 office worker catering facility…*

- *Complete refurbishment of the top 7 x floors of the tower*
- *Project had to **satisfy BREEAM sustainability standards** throughout*
- *Restaurant refrigeration and hot water production is a critical energy consuming requirement*
- *Consultant **approached Green Cooling to provide a refrigeration system design** for the food service element of the project*
- *Green Cooling **created the application** by introducing the benefits of CO2 to the specifier & client…*

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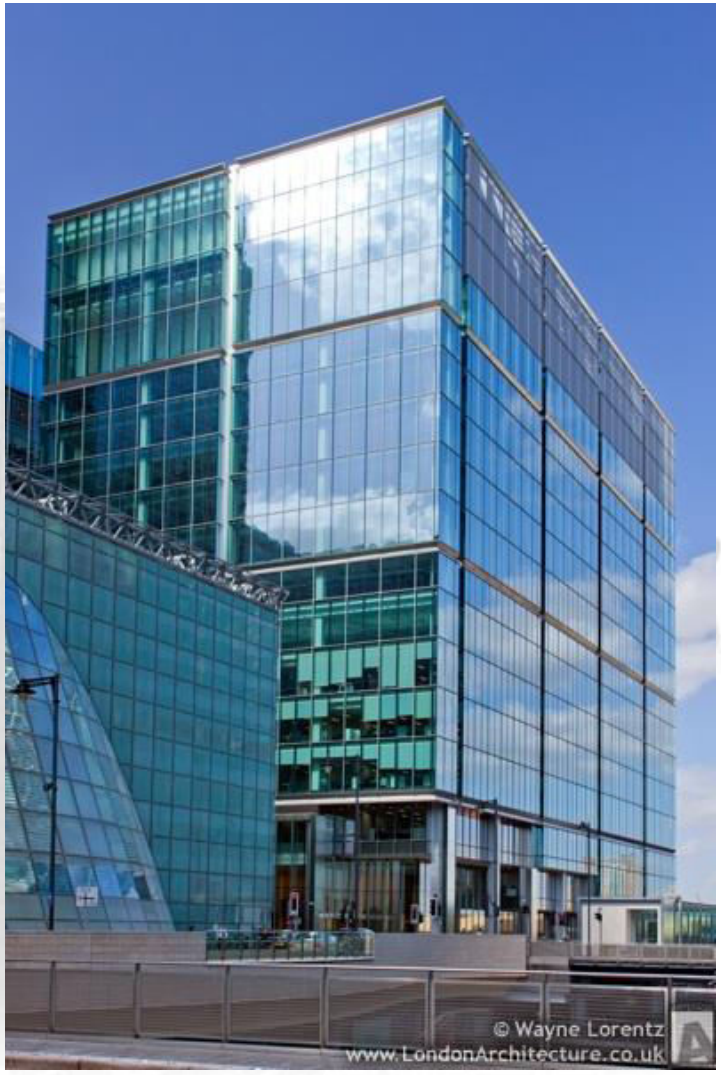
15 Canada Square



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Design considerations

Multiple areas required cooling throughout several floors of the building…

- ***45 points of cooling**, to cold rooms and kitchen refrigeration units*

Contingency and high efficiency were design priorities…

- *2 x 30kW systems with multiple inverter driven compressors were utilised*
- *Medium temperature **and low temperature outputs** were required…*

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Plant selection

2 x 30kW enEX packaged CO2 refrigeration units were specified & installed

Supplying both medium temperature ***chillers at 4°C*** *& low temperature* ***freezers at -18° C,*** *along with* ***providing a simultaneous 50° C or 65° C hot water feeds***

An alternate system installation method was utilised which provides….

- *Increased contingency*
- *Efficient load management*
- *High efficiency*

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Installation challenges

The installation took place within an operational facility alongside multiple other contractors…

- *Site had restricted access with one elevator for all contractors to use*
- *Also restricted space for pipe runs, **520m of interconnecting pipe**work was installed*
- *Access was limited due to the nature of the building*

*A normal situation within the **HOTREC sector, applications are challenging**!*

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Increasing the benefits

As the project design developed it was clear that CO2 hot water production could be attractive…

- *High daily hot water demand within the catering facility*
- *Highlighted to the customer that **free & zero carbon thermal energy** was available*
- *A thermal accumulation system was designed by Green Cooling to **integrate the refrigeration & hot water services***
- *3 x 1,500 litre tanks were installed with a hot water delivery heat exchanger*

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Projected savings

Scenario presumes daytime 50C hot water from 2 x Packs
Choice of higher temp dependent on application demands

Projected savings comparison R404	CO2 pack input kWh/anum	Equivalent R404 pack input kWh/anum	Saving KWh per anum	Cost saving £ per anum	Carbon saving Tonnes per anum
	60,700	84,774	24,074 or 28% x 13p/kWH	£3,130	12 (0.489kg/ kWH)
Projected Savings by displacing mains gas	Cooling energy delivered per 24hrs KWH	Energy delivered as 50C Hot Water per 24hrs kWh	Saving KWh per 24hrs (92% boiler efficiency)	Cost saving per anum £	Carbon saving Tonnes
	720 Nominal duty = 15kW/pack	830 = 100% of capacity used	902 x 365 = 302,950 x 3p/kWH	£9,088 ROI GC-ITH/3 yrs	56 (0.185kg/ KWH)

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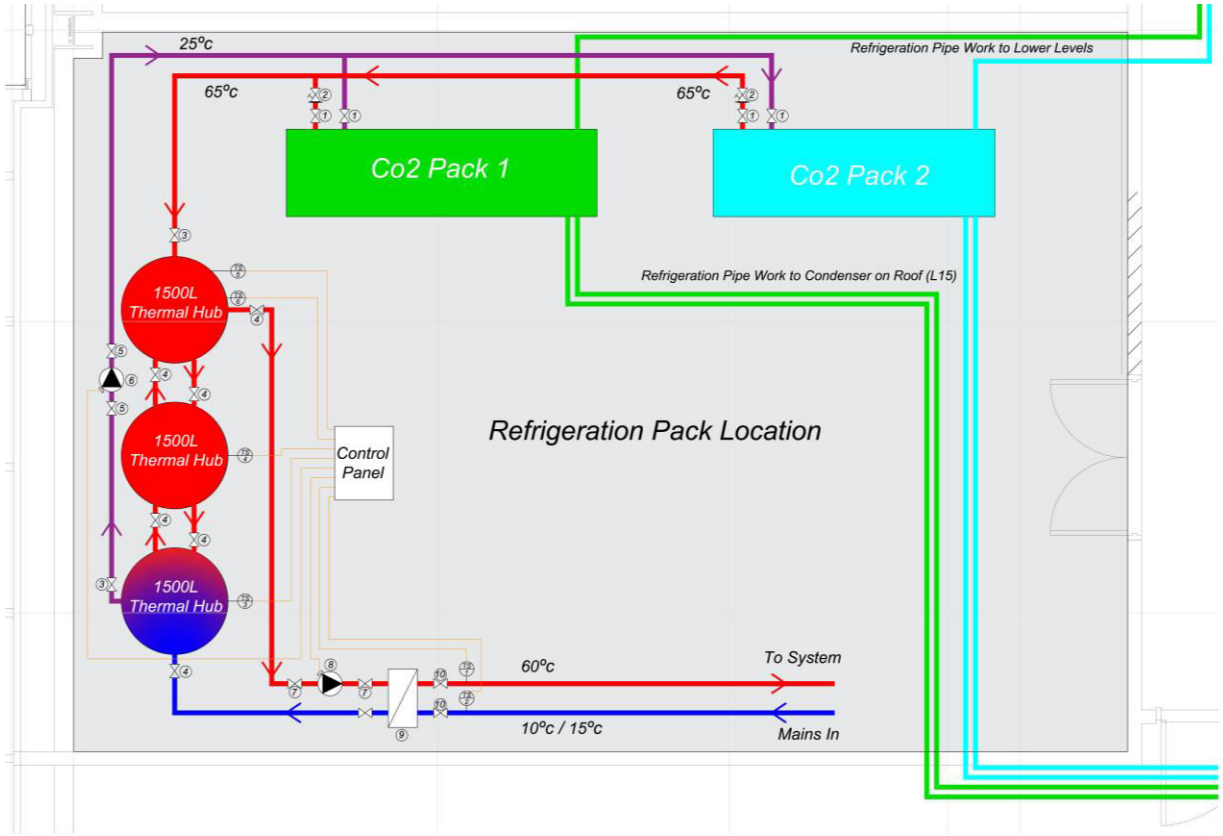
Plant schematic

Overnight illustration at 65C output flow temperature



Component List	
1	Heat Exchanger Isolating Valves
2	Commissioning Valves c/w Fixed Orifice Plates
3	Vessel Isolating Valve
4	Vessel Isolating Valve
5	Secondary Pump Isolating Valves
6	Secondary Pump
7	Primary Pump Isolating Valves
8	Primary Pump
9	Plate Heat Exchanger
10	Secondary Isolating Valves

Sensor List	
TS1	Cold Potable Water Inlet Temperature
TS2	Hot Potable Water Outlet Temperature
TS3	Return Vessel Temperature
TS4	Intermediate Vessel Temperature
TS5	Flow Vessel Temperature
TS6	Flow Vessel Temperature For Pump

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Equipment summary

- 2 x enEX 30kW CO2 refrigeration systems
- Variable speed compressor controls
- Auxiliary air-cooled remote condenser
- Dual output heat exchanger system
- 3 x 1,500L hot water accumulation tank, including circulation pumps, valves and control system
- Delivery plate heat exchanger
- 520m of refrigeration pipework
- Green Optimisation and maintenance and control systems with web-based access
- Cold room control and alarm systems

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Why HOTREC CO2?

HOTREC applications are an attractive application area for CO2…

- *CO2 efficiency provides real benefits, **HOTREC facilities are high energy users***
- *Refrigeration is a critical requirement, reliability and load management have to be 100% correct*
- *Hot water is a critical requirement and is a high operational cost on a 365 day basis*
- *A design to completion approach is required to overcome **lack of natural refrigeration knowledge***

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Summary

This case study demonstrates the practical application of CO2 delivering a positive result…

- *This project became CO2 because of **the consultant having confidence** in the equipment and the system designer*
- *A HOTREC project with a high number of evaporators **challenges the specifier to do something different***
- *CO2 can become mainstream in these applications but must be **designed by a competent sector specialist, …..delivering CO2 confidence***

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Canary Wharf case study

The future…

This application has significantly increased the awareness of CO2 within the HOTREC sector within the UK

- ***Increased enquiry levels***
- *Currently have 12 proposals live with HOTREC projects throughout the UK and Dubai*
- *Heating hotel spa's and swimming pools with **FREE and ZERO CARBON** waste heat*
- *Complete **HOTREC refrigeration systems providing chilled and frozen storage***
- *Case study is now being published within leading UK journals*

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Thank you very much!

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