

CASE STUDIES

ENERGY EFFICIENT DATA CENTRES



EcoCooling
EVAPORATIVE COOLING

Testimonials

“We are delighted that our PUE is less than 1.15 during the summer, achieving what we felt was a very ambitious programme of work with a targeted PUE of 1.2”

Peter Esson, Data Centre & Operations Manager - Aberdeen University

“The system works terrifically well for our new London Central data centre. It’s cost effective, very easy to install, and now functions excellently not only as an incredibly effective cooling system, but also as a real-world exercise in the dramatic reduction of operational costs.”

Matthew Butt, Managing Director - Netwise Hosting

“Hydro66 had a very clear vision on how we could bring a new model to colocation - one where the customer wins significantly on both cost and on sustainability. We were fortunate to discover EcoCooling, who were able to exceed our expectations. Not only in terms of pure efficiency of their equipment, but more importantly their desire and capability to enhance their solutions to our specific use case.”

Alex Chiolo, Operations Director - Hydro66



AWARD WINNING EFFICIENCY

'Innovators in Fresh Air and Direct Adiabatic Solutions'

At EcoCooling our mission is to save the country 1% on its total energy bill. That's equivalent to shutting down a power station.

Evaporative cooling is a simple, safe and natural alternative to refrigeration which can result in up to 90% reduction in operational cooling costs.

Our evaporative cooling and ventilation systems are designed to be used across the UK and Europe.

Applications include data centres, UPS, telecoms, retail, warehousing, manufacturing, gyms, leisure centers and commercial cooling.

EcoCooling The Nordics

Hydro66, Boden, Sweden

Free cooling and an abundance of low-carbon hydro power is making the sub-arctic a viable site for data centres. There has been a surge of investment recently in data centres in the remote north of Sweden, including Hydro66 at Boden. The obvious reason for this is the cold climate, which supports 'free' cooling and reduces the considerable cost of taking the heat out of modern data centres.

The key advantages are low-cost cooling and power, and practically unlimited renewable generation capacity and grid infrastructure to support large data centres.

A key objective for Hydro66 was to design the data centre to operate at a power usage effectiveness (PUE) of less than 1.05. This could only be achieved using fresh-air cooling supported by the most efficient uninterruptible power supply (UPS) and power distribution solutions.

Boden lies on the 66th latitude and, consequently, is cold, with a record low

temperature of -40°C and a maximum of 32°C, although it rarely exceeds 25°C. In this climate, a simple ventilation system can maintain compliant temperatures for much of the time, but in the few instances a year when the ambient exceeds 25°C, a supplementary cooling system is required. The options for this are chilled water, direct expansion (DX), and direct or indirect evaporative cooling.

Hydro66 decided to use a direct ventilation system supplemented by evaporative cooling (EcoCooling ECT10800 units). The units are modular, have no external plant and are installed internally, thereby avoiding planning issues.

Ventilation Systems (Free Cooling)

The efficiency of an EC (Electronically Commutated) fan is approximately proportional to the cube of the speed. Data centres require redundancy of N+1, 2N or 2(N+1), so equipment is operated at part capacity. By controlling all of the EC fans as a group – and reducing the air flow rate to that required by the IT equipment – reductions in consumed fan power can be

HYDRO66

achieved, producing remarkable efficiencies. On average, 1MW of IT equipment will require an air-flow of 90m³/s of air at compliant temperatures.

A ventilation system, based on EC axial fans, can support 1MW of cooling for approximately 40kW of fan energy use. This adds 0.04 to the PUE of the data centre.

If – as in the case of Hydro66 – this is used in conjunction with a rotary UPS solution (a flywheel driven by an electric motor) where losses are 1%, **a PUE of 1.05 can be attained.**

Supplementary Evaporative Cooling

On warmer days, the adiabatic cooling is enabled, bringing the supply air temperature down to approach the wet-bulb temperature of the ambient air. In Boden, this means the supply air will never exceed 22°C, which is compliant with all standards without the need to use additional mechanical refrigeration. The use of adiabatic cooling will increase the moisture content, while reducing dry-bulb temperature, so increasing the RH (relative humidity) of the air.

Humidification

A direct fresh-air system operating in arctic conditions at the coldest time of the year can result in very low RH in the data centre.

Low RH, in conjunction with other factors, can cause problems with electrostatic discharge (ESD), which can damage IT equipment. The Hydro66 cooling system incorporates a recirculation loop, where – in low RH conditions – the warm air from the data centre is passed over the adiabatic pads to humidify the air above the ASHRAE 2011 Thermal Guidelines' allowable level of 20%. This novel solution therefore uses the adiabatic pads for two functions – cooling in hot weather and humidification in cold weather conditions.

Hydro66 has constructed a low capital cost, flexible data centre, which has achieved a PUE of less than 1.05. The direct fresh-air cooling system complements the commercial strategy with a modular system that supports this progressive development.

Netwise Hosting achieve a PUE of less than 1.2 in Central London

Netwise Hosting is an innovative and forward thinking company, and one of London's leading data centres. Based in central London, their facilities and systems have been designed and built in-house, allowing for strong working relationships with all the technology suppliers, not least EcoCooling.



Phase 1: Netwise began their journey in South London, with a much smaller facility, and as such, standard industrial cooling systems were not an option. EcoCooling's smaller, external modular units, alongside efficient EC fans were an ideal alternative. EcoCooling units were chosen for the initial installation as they are generally cheaper to install than their refrigerant counterparts. EcoCooling's control systems also

allow for supervision of temperatures and built-in safety measures.



Phase 2: In June 2015 Netwise moved to Central London and opened a bigger facility. The evaporative cooling system at the first Netwise facility was a successful partnership, with the units working as expected and without fault. Three of the external units were moved across to the new site, with only a few minor modifications being made.

"It's cost effective, very easy to install, and now functions excellently not only as an incredibly effective cooling system, but also as a real-world exercise in the dramatic reduction of operational costs."

EcoCooling direct evaporative cooling units alongside their energy optimising control systems can provide 100kW of cooling for Netwise and is

able to significantly reduce their customers CO₂ production, while keeping the levels of energy used much lower than that of other data centres, which have been seen to be running at PUEs of up to 2 with traditional refrigeration.

Evaporative cooling is a very energy efficient way of cooling, and the new project allowed Netwise to develop the design of their system further, stacking multiple units together resulting in a PUE of just 1.12.

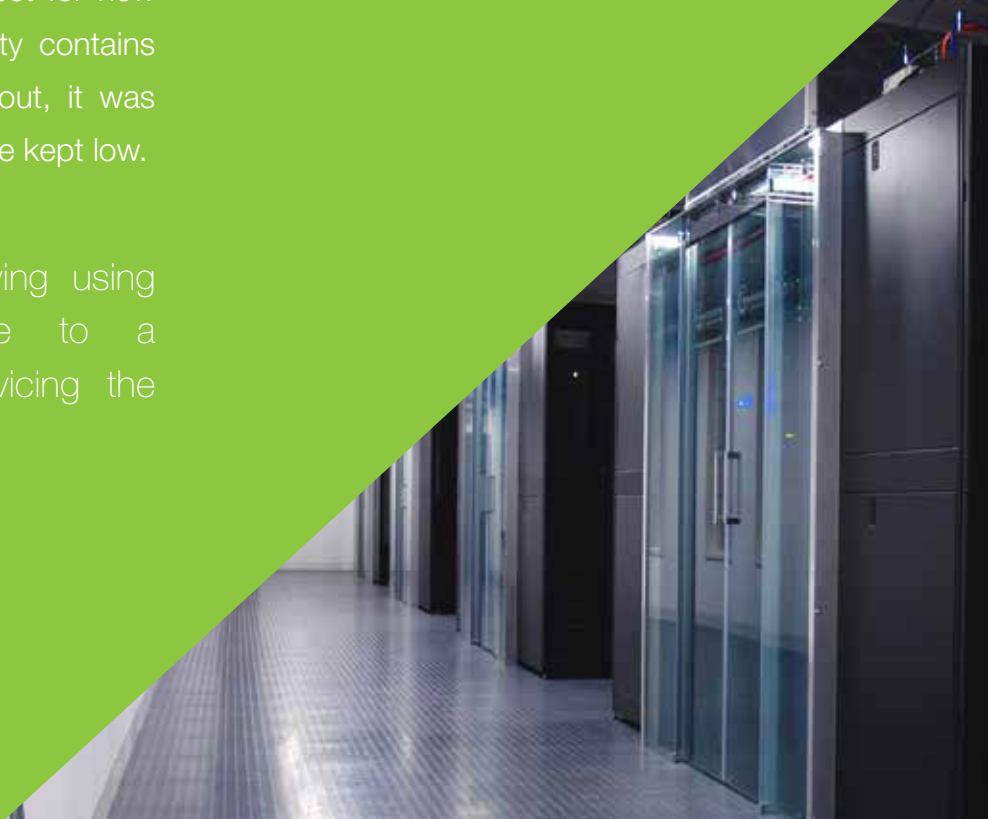
As well as being simple to use, and reliable, the performance to cost ratio with EcoCooling is almost unparalleled, making it perfect for new ventures. Given that the new facility contains 200 operational racks after full fit-out, it was important that operational costs were kept low.

There can be a 90-95% saving using EcoCooling systems relative to a refrigerant based system servicing the same heat load.

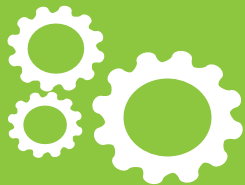
The modular design that was employed within the new facility works to support the future development plans for Netwise Hosting, who plan to expand the facility.

Phase 3: The long term plan for Netwise is to build a host of private, bespoke data centres around the UK which will be highly interconnected offering a truly global hosting platform, and EcoCooling systems are anticipated to be an integral feature throughout this vision.

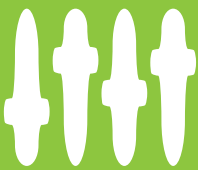
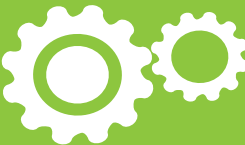
Co-written with Matthew Butt, Managing Director, Netwise Hosting



EcoCooling CREC[®] (Computer Room Evaporative Cooling)



Solutions Overview - EcoCooling's internal and external fresh air, direct evaporative cooling products have been developed alongside an advanced control system to be used in energy efficient IT cooling solutions. With over 500 IT installations worldwide, we have provided the cooling systems for some of the most efficient data centres in the world. Hydro66, Netwise, Leicester City Council and Aberdeen University are just some of the organisations who have capitalised on the energy savings achievable with direct evaporative cooling.



Energy Efficient Cooling to ASHRAE Standards - EcoCooling's control system can maintain a cold aisle temperature of 18°C for the majority of the year without any compromise in energy efficiency. During warmer ambient conditions the system simply allows the temperature to gradually rise, falling back again as external temperatures reduce.



Good Design Principles - Filtration - Filtration is essential to any fresh air data centre installation, we offer filtration options up to Grade F7.



Increasing Efficiency - EC Fans - The fans consume the most energy in an EcoCooling system. The use of new EC fans in all of the data centres featured has allowed for reduced running costs. Operating the EcoCooling system at half speed reduces the fan energy use by over 85%, which means partial population and redundancy can in fact increase efficiency.



Award Winning Public Sector Data Centres

ABERDEEN DC IS SET TO DELIVER 100K OF SAVINGS IN FIRST YEAR

- **Shared Services**
- **Targeted PUE - 1.2**
- **No external space**
- **150kW I.T Load**
- **Redundancy (N+1)**

As part of a joint venture between the University of Aberdeen, Aberdeen College, Robert Gordon University and Banff and Buchan College it was agreed to create a "Shared Services" data centre facility to replace the existing facility.

The previous facility was running at a PUE of 2.6. With a new EcoCooling system, the facility is now reported to be running with a PUE of 1.15 during the summer months.

The whole facility is predicted to deliver energy savings in excess of £100K per annum.

LEICESTER COUNTY COUNCIL ACHIEVE PUE OF 1.1

- **Shared services**
- **Targeted PUE < 1.1**
- **Limited floor space**
- **250kW I.T Load**
- **Redundancy (N+1)**

In 2014 LCC were tasked with moving their legacy data centre to an old training centre identified within the city boundary. Energy efficiency was central to the design requirements of the new facility. Not only was a PUE of below 1.1 demanded, but also the implementation of renewable energy technology and the utilisation of waste heat.

The low power requirements and flexibility of the proposed EcoCooling system meant it could easily be retrofitted to the new building and achieve operational energy savings of up to 90% less than the refrigeration based alternatives. An additional advantage was the units and fans can be powered using a photo voltaic system, further reducing the demand for power from the grid.

EcoCooling's CREC[®] Product Range

How CREC[®] systems work:

Ventilation Mode: Fresh air is brought into the system through EU4 pre-filters and Munters CELdek[®] pads.

Cooling Mode: Evaporative cooling operates during warm periods to cool external air.

Attemperation Mode: During winter periods warm exhaust air is mixed with cold fresh air. EcoCooling describe this mixing process as attemperation.



The ECT10800 is part of EcoCooling's internal product range. It's operated from a touch screen control panel. Functionality includes logging of performance data and faults, altering of system parameters, and a test routine. It is also password protected.

Characteristic/Feature	Value/Detail
Power Supply	3~400V 50 Hz
Cooling Capacity in Adiabatic Mode	35kW (ΔT of 8°C)
Design Flow Rate	10,800m ³ /hr
Dimensions (h x d x w)	2575 x 860 x 1300mm
Design Power Usage (60% fan speed): Cooling Mode Ventilation Mode	0.9kW 0.9kW



The **ECP** is part of EcoCooling's external product range. It is designed to suit diverse installation requirements. The different configurations allow for discharge of supply air through the top, side or base of the unit, meaning the range is suited to roof mounted, wall mounted and floor standing arrangements. A wall mounted controller is supplied with the cooler.

Characteristic/Feature	Value/Detail
Power Supply	1~ 230V 50Hz 0.25A
Design Supply Flow Rate ECP/WB - T & ECP/WB ECP/WB - S	12,600m ³ /hr 9,450m ³ /hr
Dimensions (h x d x w)	950 x 1170 x 1170mm
Cooling Capacity in Adiabatic Mode	60kW

Savings and Performance Calculations

EcoCooling developed a calculator to estimate the possible energy savings for all of their systems, inputs include historical weather data and fan data. Cost analysis can be performed for any size data centre or telecoms room in most locations worldwide. Please contact us for more information.

Example Savings Calculator Report

Cooling Demand (IT): 100kW
Flow Rate Required: 8.3Kg/s or 7m³/s
ΔT 12°C

An IT load of 100kW, with a ΔT of 12°C will require a mass flow rate of 8.3Kg/s or air flow rate of 7m³/s. This equates to 25,000m³/hr or 221 million m³/yr of air.

Running Costs and Performance (ECP standard CREC® system)

Type of System	AC	EcoCooling
Coefficient of Performance	2.0	27.0
Total Electricity Use (kW)	50	3.7
Effect on PUE	0.5	0.04

Annual Usage (IT Environment) = 8760hrs

Operating Costs	AC	EcoCooling	Savings
Electricity Use (kWhr)	438,000	32,412	405,588
Electricity Cost (£)	43,800	3,241	40,599
Water Use (m³)	0	145	- 145
Water Cost (£)	0	145	- 145
Total Cost	£43,800	£3,386	£40,414
CO₂ Impact	235 tonnes	17 tonnes	218 tonnes



EcoCooling
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Industrial and Computer Room Evaporative Cooling

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