Munters
Your Perfect Climate

Munters Data Center Cooling Solutions

Simon Young & Craig MacFadyen – Munters Data Centers

Introduction

Vision

- Your Perfect Climate

Mission

- Munters' mission is to be a globally leading supplier of energy efficient solutions for air treatment and climate control technologies.

Facts and Figures

- Global presence with sales and manufacturing in over 30 markets
- In excess of SEK 6 billion in annual net sales (600m Euros)
- Approx 3,600 employees
- 17 manufacturing plants, 7 smaller assembly hubs, and 55 sales and service Centres
- Installed base of more than 300,000 air treatment systems
- Install base in excess of 200MW of Data Centre Facilities
- Owned by private equity partner Nordic Capital Fund VII

Over 60 years of experience in Evaporative Cooling technology

A Corporate Culture of **Technical Innovation** and a History of **Customer Service**

1946 Munters CargoCaire manufacture under licence

1955 Munters Sweden bought UK/US CargoCaire

1960 Munters Worldwide

1997 on Swedish stock exchange

2007 Acquire Des Champs USA

2008 Acquire TN Belgium

2010 MCS divestment

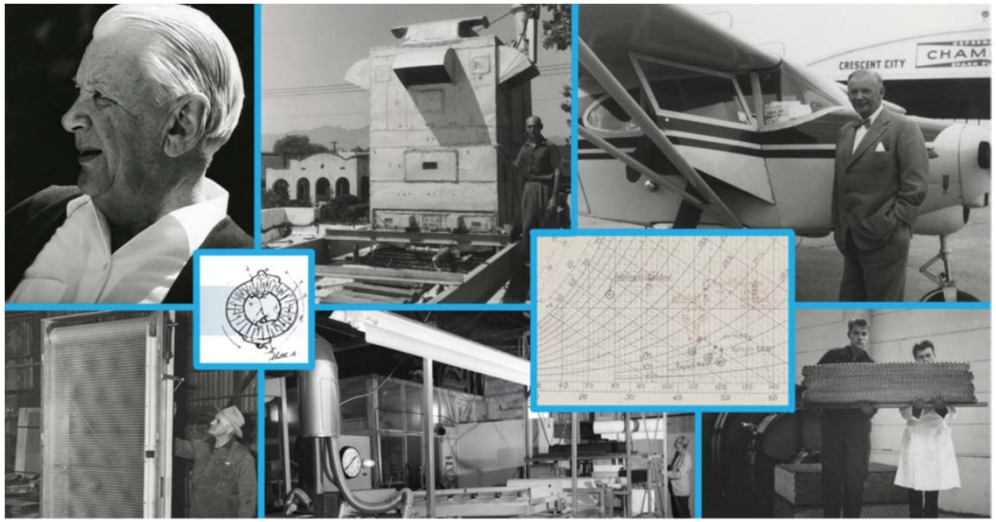
2010 Acquired by Nordic Capital

2011 Acquire Keruilai China

Carl Munters (1897-1989)

- Swedish inventor and entrepreneur
- A pioneer in desiccant rotor & evaporative cooling/humidification
- Applied for close to 1,000 patents
- Invented Desiccant rotor technology over 30 years ago

Worldwide Award Winning Organisation



Carl George Munters – 1897- 1989
ASHRAE PIONEER OF THE INDUSTRY
Contributions to Air Conditioning, Heating and Ventilation

DATACLOUD ASIA 2017
GLOBAL CONGRESS & EXHIBITION
SINGAPORE

INNOVATIVE SOLUTION AWARD
Munters

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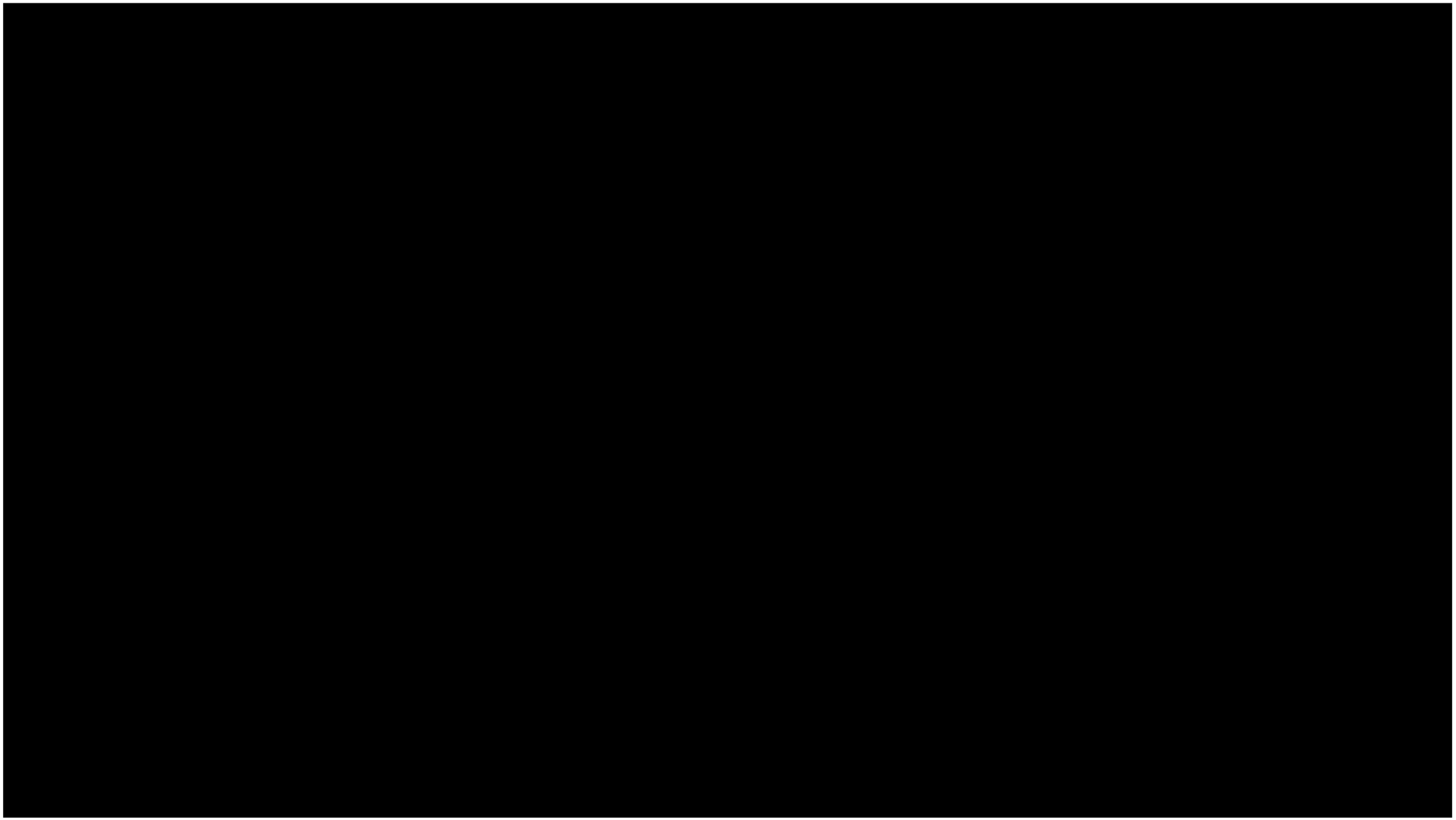
World of data



The Facts:

connected things....some predict that by 2020, the number of Internet-connected things will reach or even exceed 50 billion.

In 2015, over 1.4 billion smart phones will be shipped and by 2020 we will have a staggering 6.1 billion smartphone users.

By 2020, a quarter of a billion vehicles will be connected to the Internet, giving us completely new possibilities for in-vehicle services and automated driving.

Today, the market for Radio Frequency Identification (RFID) tags, used for transmitting data to identify and track objects, is worth $11.1 billion. This is predicted to rise to $21.9 billion in 2020.

Machine-to-machine (M2M) connections will grow from 5 billion at the beginning of this year to 27 billion by 2024, with China taking a 21% share and the U.S. 20%.

CISCO believes the IoT could generate $4.6 trillion over the next ten years for the public sector, and $14.4 trillion for the private sector.

Source: Forbes "2017 Internet of Things Facts"

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World of data centres

World Wide Energy Consumption by Country

Rank	Country	Uesage
1	China	4.69 Trillion kWh
2	Unites States	3.89 Trillion kWh
3	Russia	1.04 Trillion kWh
4	Japan	859.7 Billion kWh
5	India	698.9 Billion kWh
6	Germany	549.1 Billion kWh
7	Canada	499.9 Billion kWh
8	France	471 Billion kWh
9	Brazil	455.8 Billion kWh
10	South Korea	455.1 Billion kWh
11	**DATA CENTRES**	**416.2 Billion kWh as of 2016**
12	United Kingdom	329.3 Billion kWh
13	Italy	313.8 Billion kWh
14	Spain	249.7 Billion kWh
15	Taiwan	242.2 Billion kWh

http://www.independent.co.uk/environment/global-warming-data-centres-to-consume-three-times-as-much-energy-in-next-decade-experts-warn-a6830086.html

INDEPENDENT

From Modular to Hyperscale

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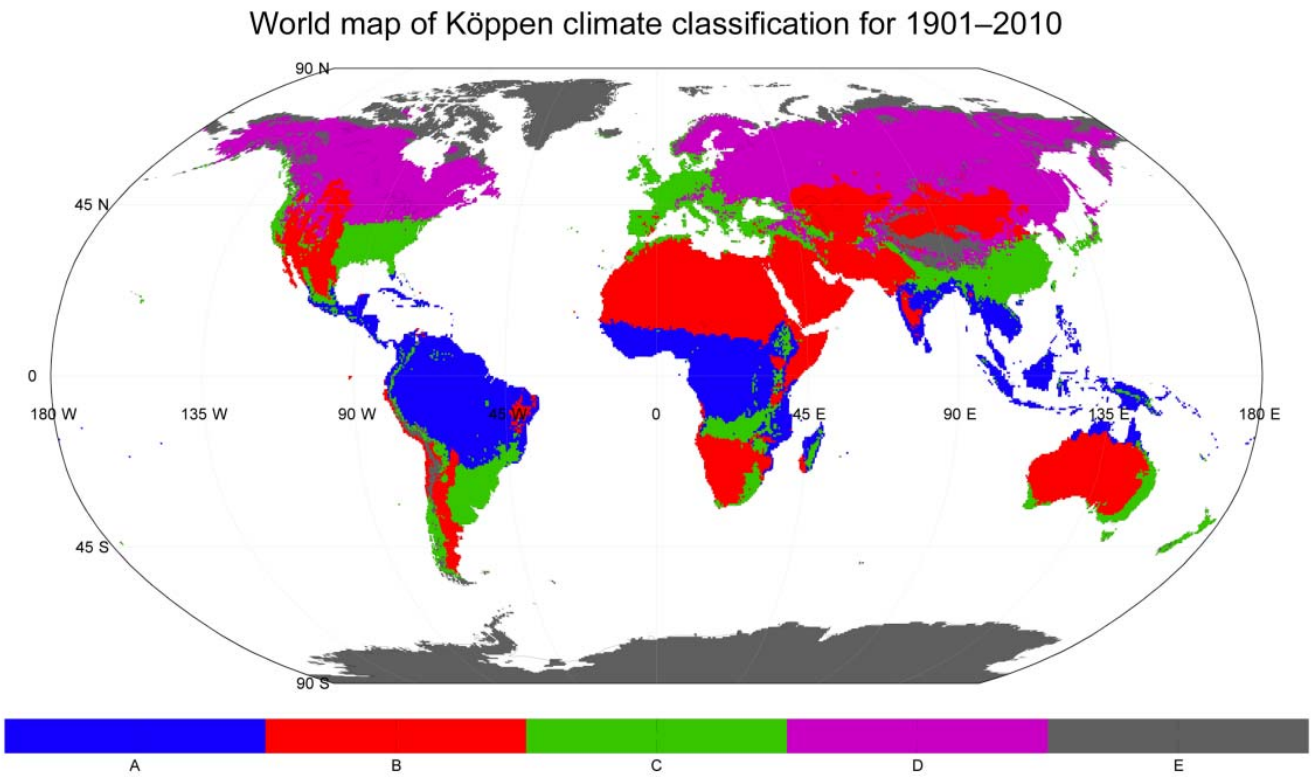
Climate Conditions



Letter

A: Tropical
B: Dry
C: Mild temperate
D: Snow
E: Polar

Data source: Terrestrial Air Temperature/Precipitation: 1900-2010 Gridded Monthly Time Series (V 3.01)

Resolution: 0.5 degree latitude/longitude

Website: http://hanschen.org/koppen

Ref: Chen, D. and H. W. Chen, 2013: Using the Köppen classification to quantify climate variation and change: An example for 1901–2010. Environmental Development, 6, 69-79, 10.1016/j.envdev.2013.03.007.

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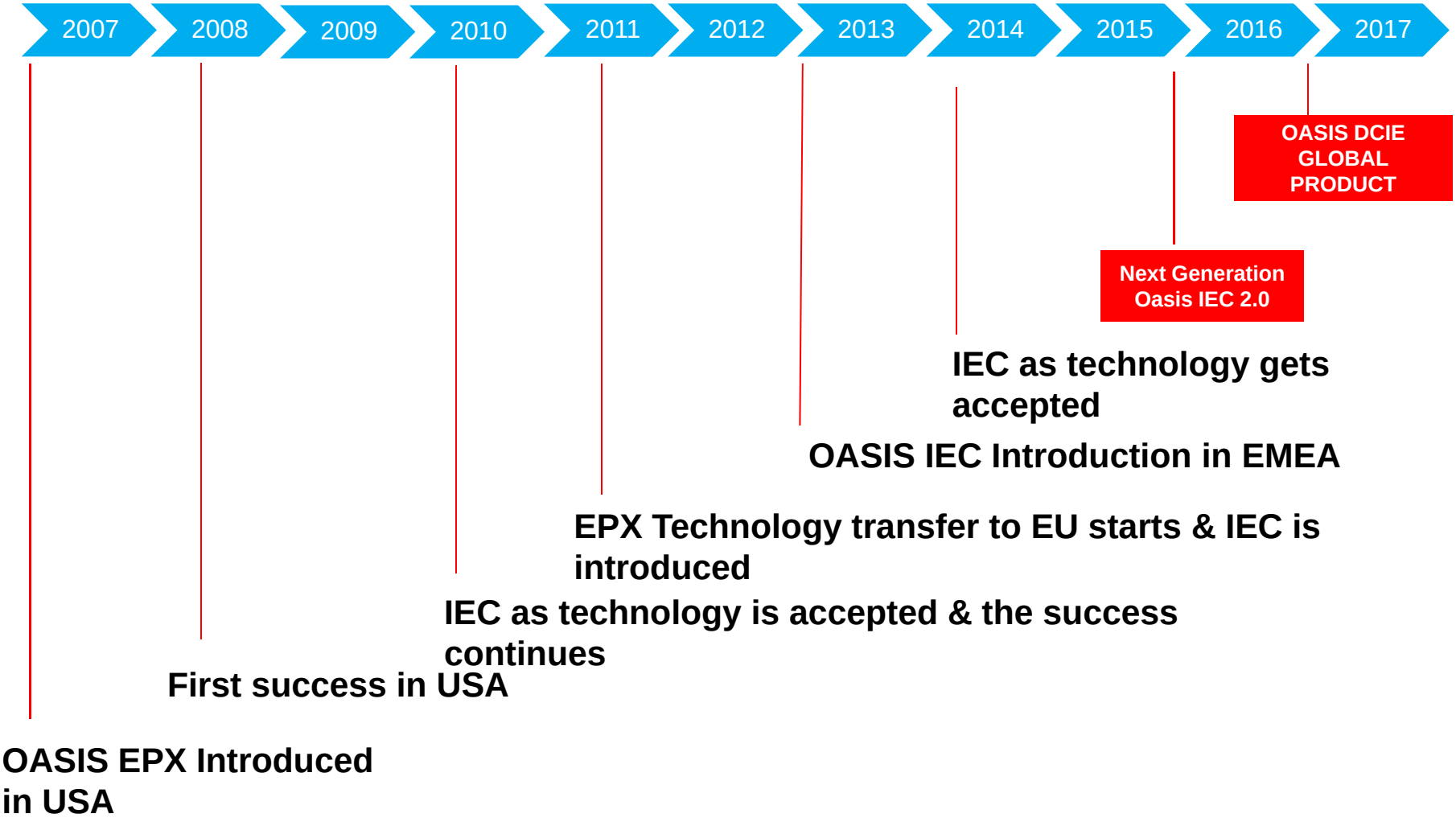
Oasis IEC Family Product Evolution



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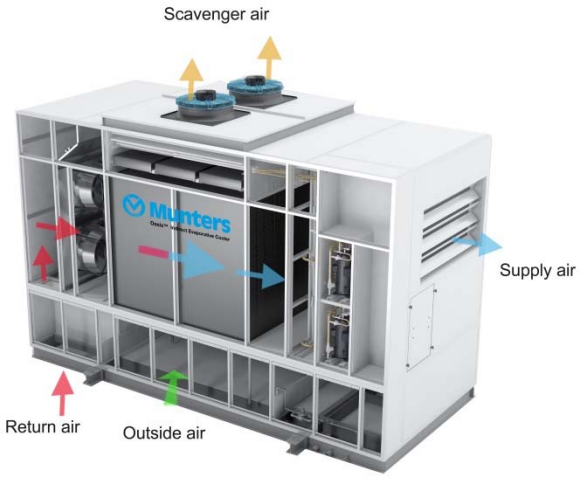
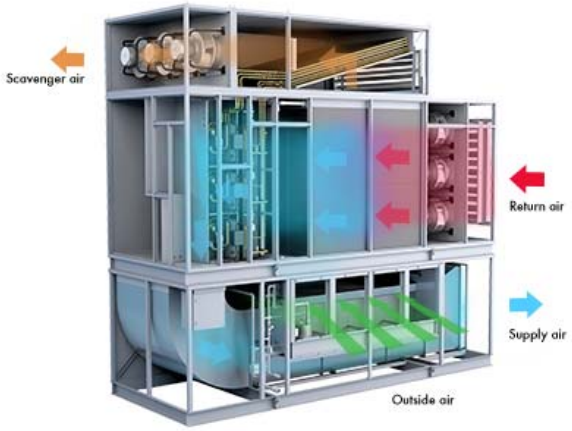
An effective Data Center cooling solution must be…..

- Flexible
- Efficient
- Suitable for all climates
- Resilient
- Global product / Global reach
- Configurable

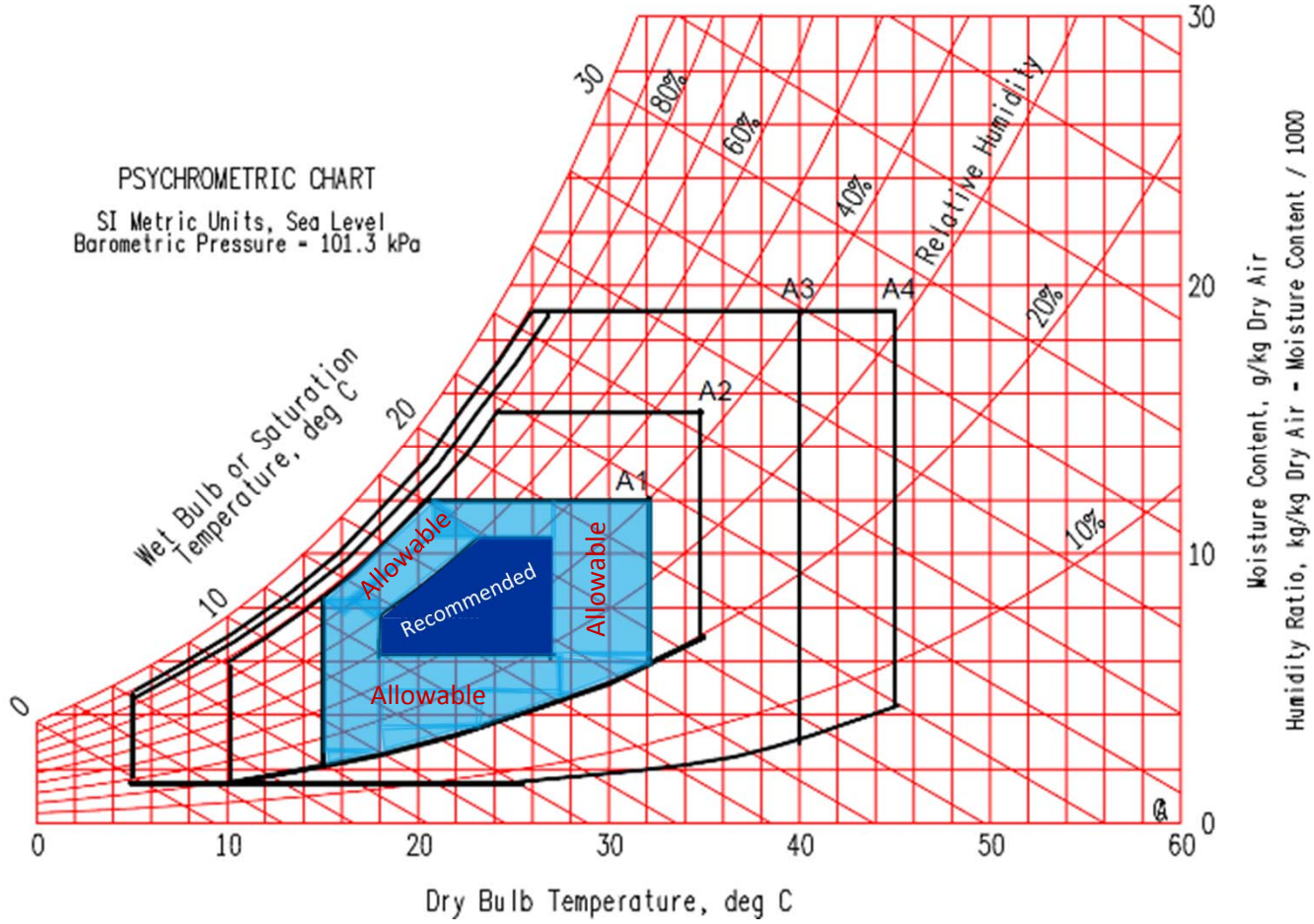
- Scalable





ASHRAE

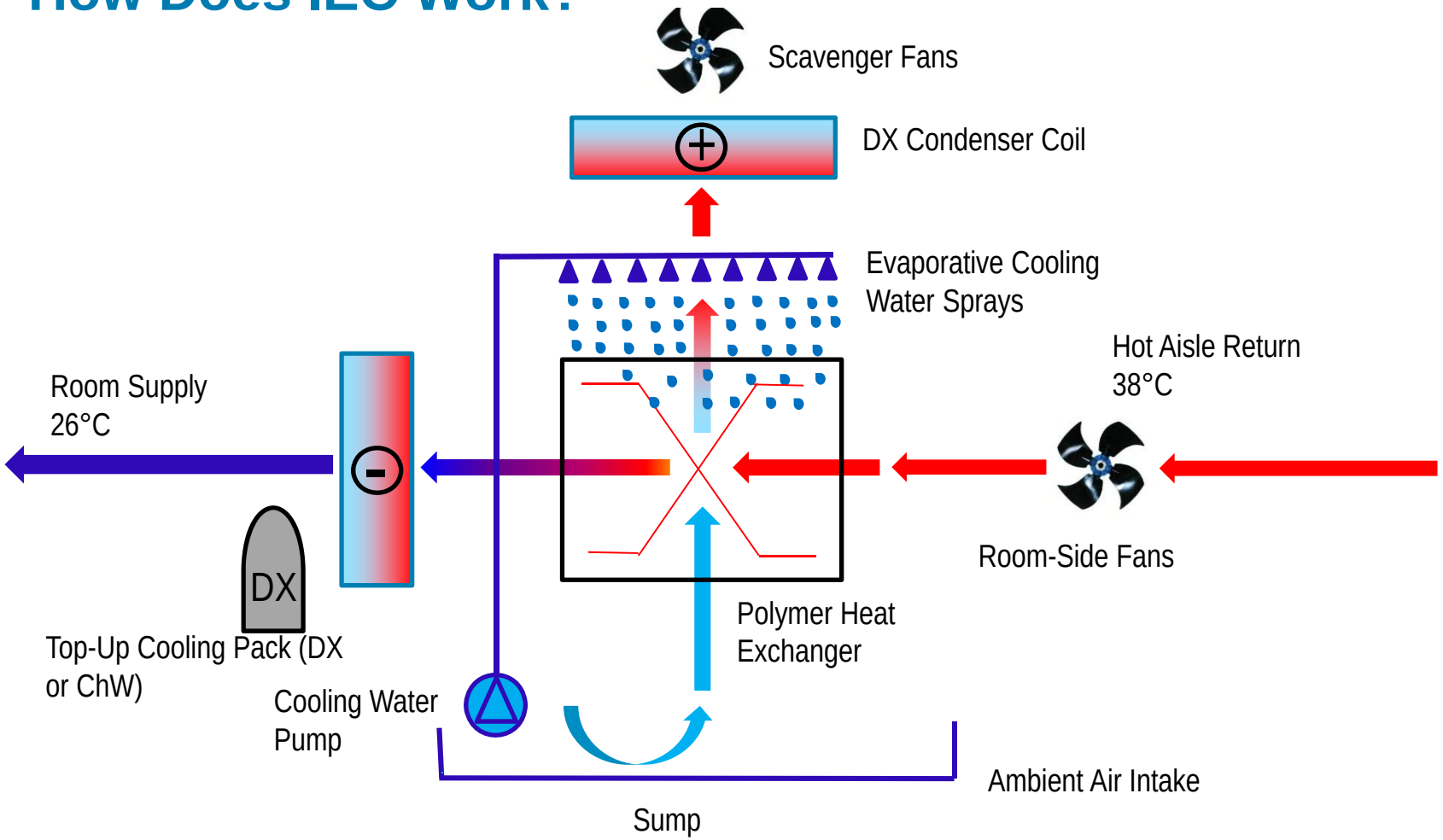
(Guidelines for Data Processing Environments)



Recommended **18-27°C at server inlet (5.5dew point - 60% rh)**
Allowable **15-32°C at server inlet (20-80% rh)**

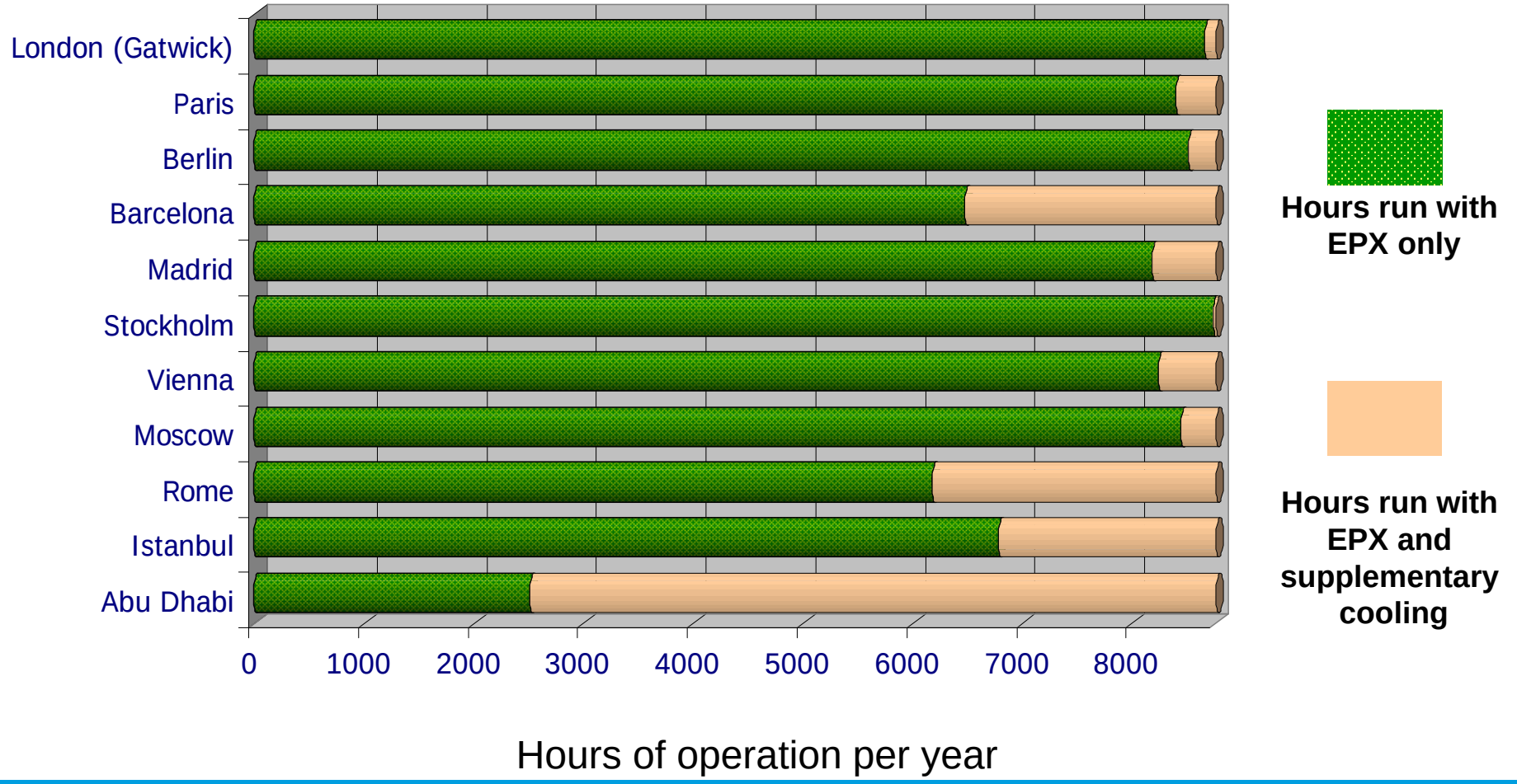
Indirect Evaporative Cooling

How Does IEC Work?



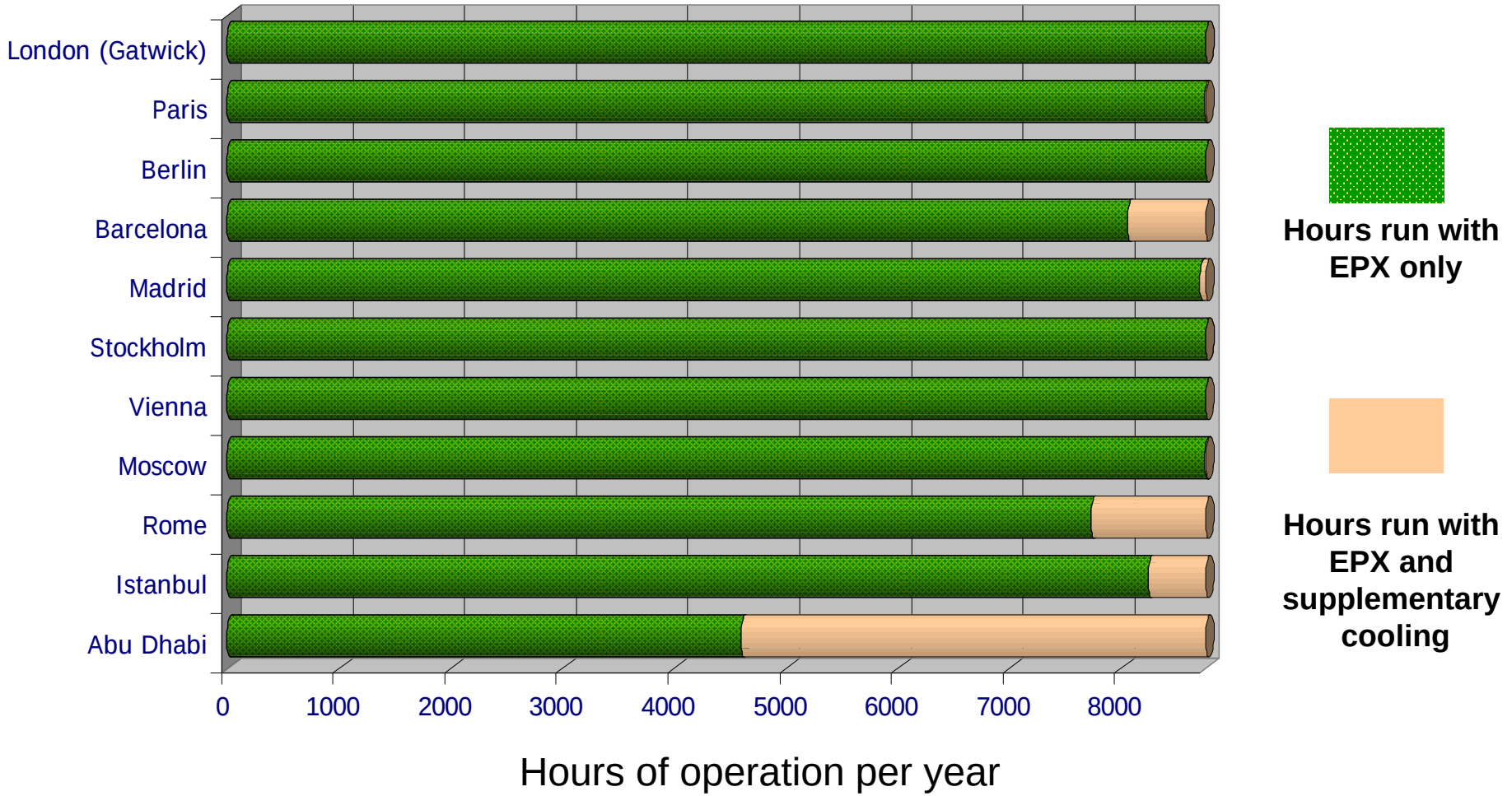
Hours per year that Oasis™ IEAC can provide 23°C or below for locations around EMEA

Based on Hot Aisle return air temperature of 35DegC



Hours per year that Oasis™ IEAC can provide 27°C or below for locations around EMEA

Based on Hot Aisle return air temperature of 39DegC



Expected annual costs of Energy and Water

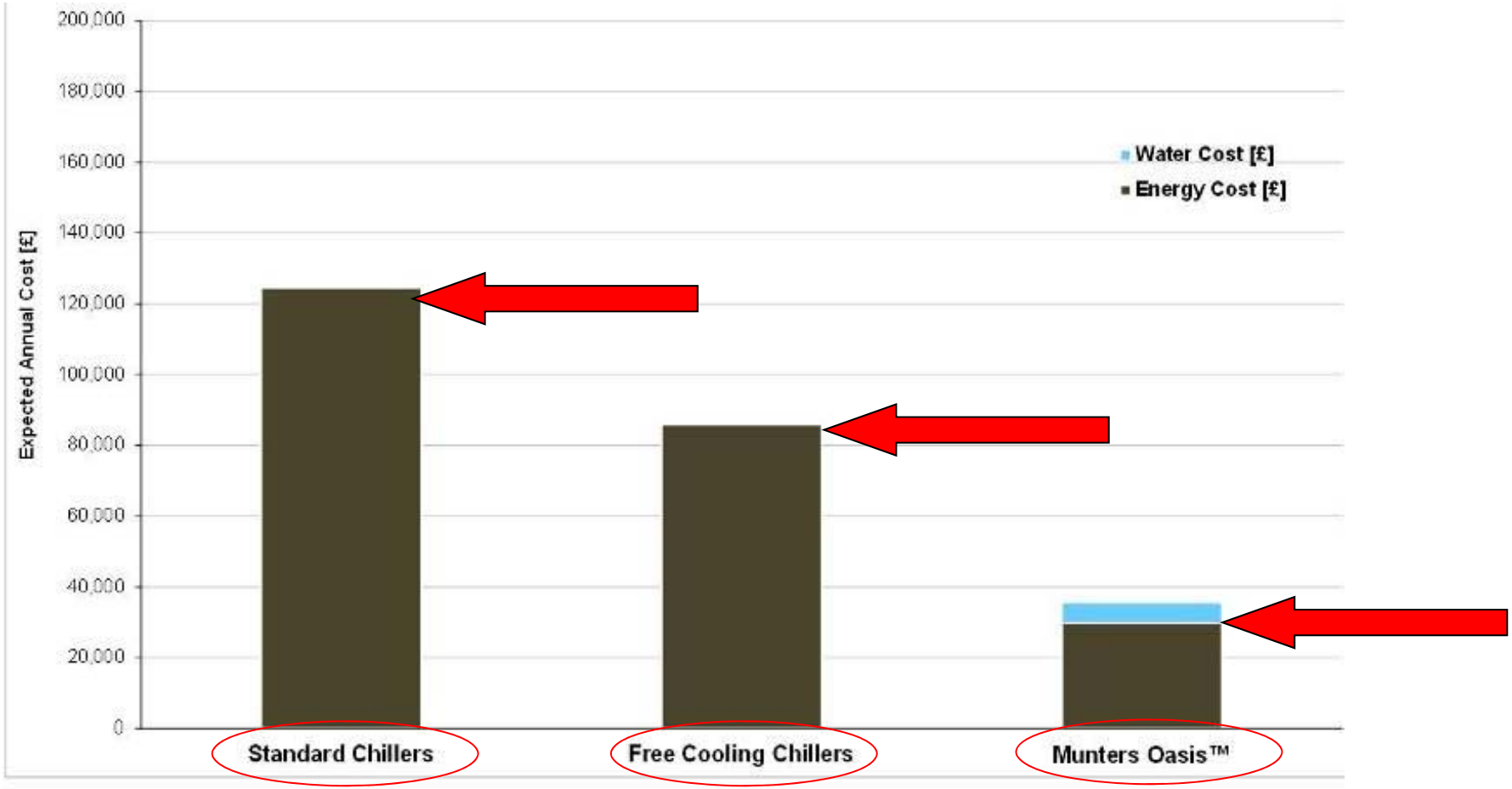


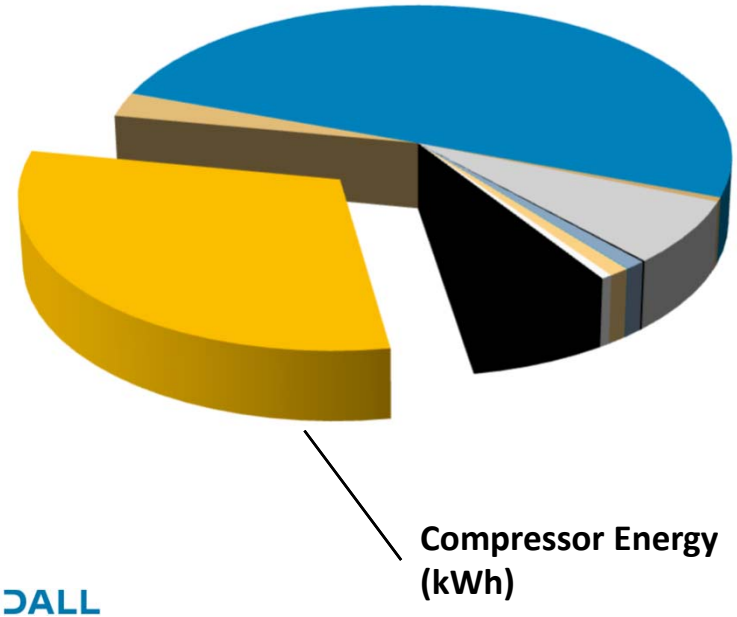
Figure 5.1.2. Total annual costs of energy and water consumed by the data hall.

Oasis™ Indirect Evaporative Cooler Energy savings vs Chillers

		Standard Chillers	Free Cooling Chillers	Munters Oasis™
Seasonal Cooling COP	Chillers + Evaporative	**6.5**	**11.9**	**175**
	Total Cooling*	**4.5**	**6.5**	**18.6**
PUE (partial)**		**1.22**	**1.16**	**1.05**
Chiller Operating hours [h]		8760h	8760h	DX - 14h Evaporative - 8388h
Energy Consumption [kWh]	Chiller + Evaporative	1,419,282	776,906	52,914
	Fans (cooling only)	581,865	581,865	496,712
	Pumps	73,866	73,866	-
	Total	**2,075,013**	**1,432,637**	**496,782**
Annual Costs [£]***	Energy	124,501	85,958	29,807
	Water	0	0	5,721
	Total Costs	**124,501**	**85,958**	**35,528**
	Cost Savings [%]	0%	31%	71%

Where is Energy Consumed?

Annual Energy Consumption
Typical Site: Chillers + CRACs
PUE: 2.0



Compressor Energy (kWh)

- IT Load
- Data Hall Lighting
- UPS Losses
- Switchgear & Cable Losses
- Transformer Losses
- VSD Losses
- Generator Ancillaries
- Tx no load losses
- Miscellaneous
- Fan Power
- Chiller Power
- Pump Power
- Humidification Power

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The largest energy consuming element apart from the IT load is the Compressor

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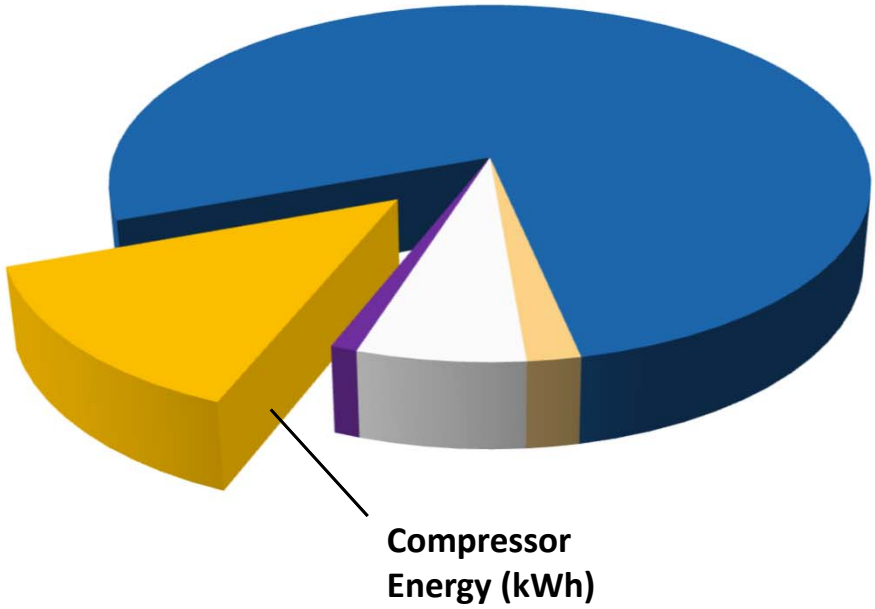
Where is Energy Consumed?

Annual Energy Consumption
Best Practice: Free Cooling chillers and CRACs
PUE: 1.3 – 1.35



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Even when Free Cooling Chillers are used, the largest energy consuming element apart from the IT load remains the Compressor

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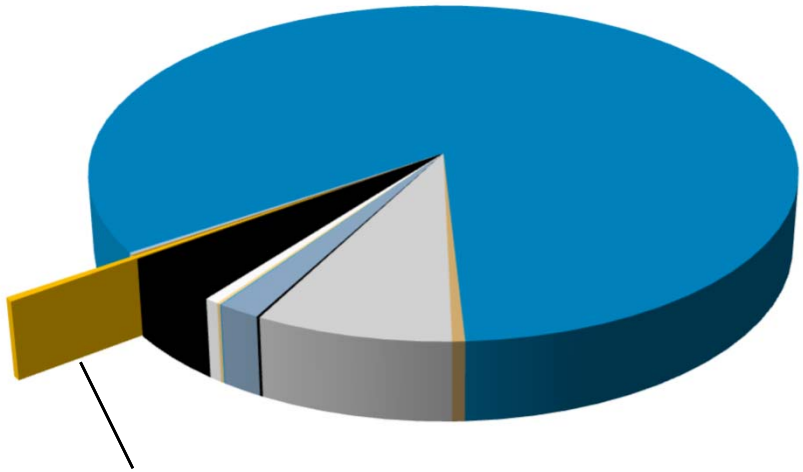
Where is Energy Consumed?

Annual Energy Consumption
Best Practice: Indirect Air Optimisation
PUE: 1.2



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Compressor Energy may be significantly reduced by use of IAO

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pPUE Comparisons IEC vs Free cooling chiller

Lower capital cost for key cooling plant

40% lower annual operating cost

Low partial PUE

Region	Oasis IEAC pPUE	Free-Cooling Chiller pPUE
London Heathrow	**1.05**	**1.16**
Madrid	**1.05**	**1.18**
Abu Dhabi	**1.09**	**1.32**
Beijing	**1.06**	**1.2**
Shanghai	**1.07**	**1.22**
Moscow	**1.05**	**1.14**

***based on hypothetical test case 1MW data centre (N+1)**
full details in Cundalls product engineering review, copy available on request

Oasis Capital cost won't cost you more

System Description	Main Cooling Plant	Capital Cost per unit (£)	Total Cost (£)
Oasis™ Indirect Evaporative Air Cooler (floor mounted)	Oasis unit (×6) Smaller Oasis units (×2) AHU (x1) Ductwork Water storage for 2no. tanks Total	£110k £87k £25k £50k £ for water tank £ for pumps £ for water treatment £4k for pipework = £24k	£660k £174k £25k £50k £48k **£957k**
Water-side Economisation Chilled Water	Free-Cooling Chillers(×3) CRAC units (×14) Pumps + Pipework AHU (x1)	£132 £18k £350k £25K	£396k £253k £350k £40k **£1,039k**

Financial Outcome - CAPEX

Capital Costs (CAPEX)

– When considering the lower capacity requirement of the electrical to mechanical power loads, the plant, equipment and machinery power infrastructure can be reduced:

Diesel generator size:

Transformer size:

Proportional diesel storage, electrical distribution, switchgear savings, etc.

Or alternatively, this 'stranded capacity' within power infrastructure can be re-engineered to deliver additional power capacity to the DC.

Cooling by Evaporation

Air Quality – Why Indirect ?

Server Reliability vs. Contamination

Particulate and gaseous contamination becomes a more important consideration when there is an increased use of economizer systems.

The air quality and building materials should be checked carefully for sources of pollution & particulates and additional filtration should be added to remove gaseous pollution and particulates, if needed.

Products of Combustion

Pollen

Dirt

Smoke

Indirect Evaporative Cooling

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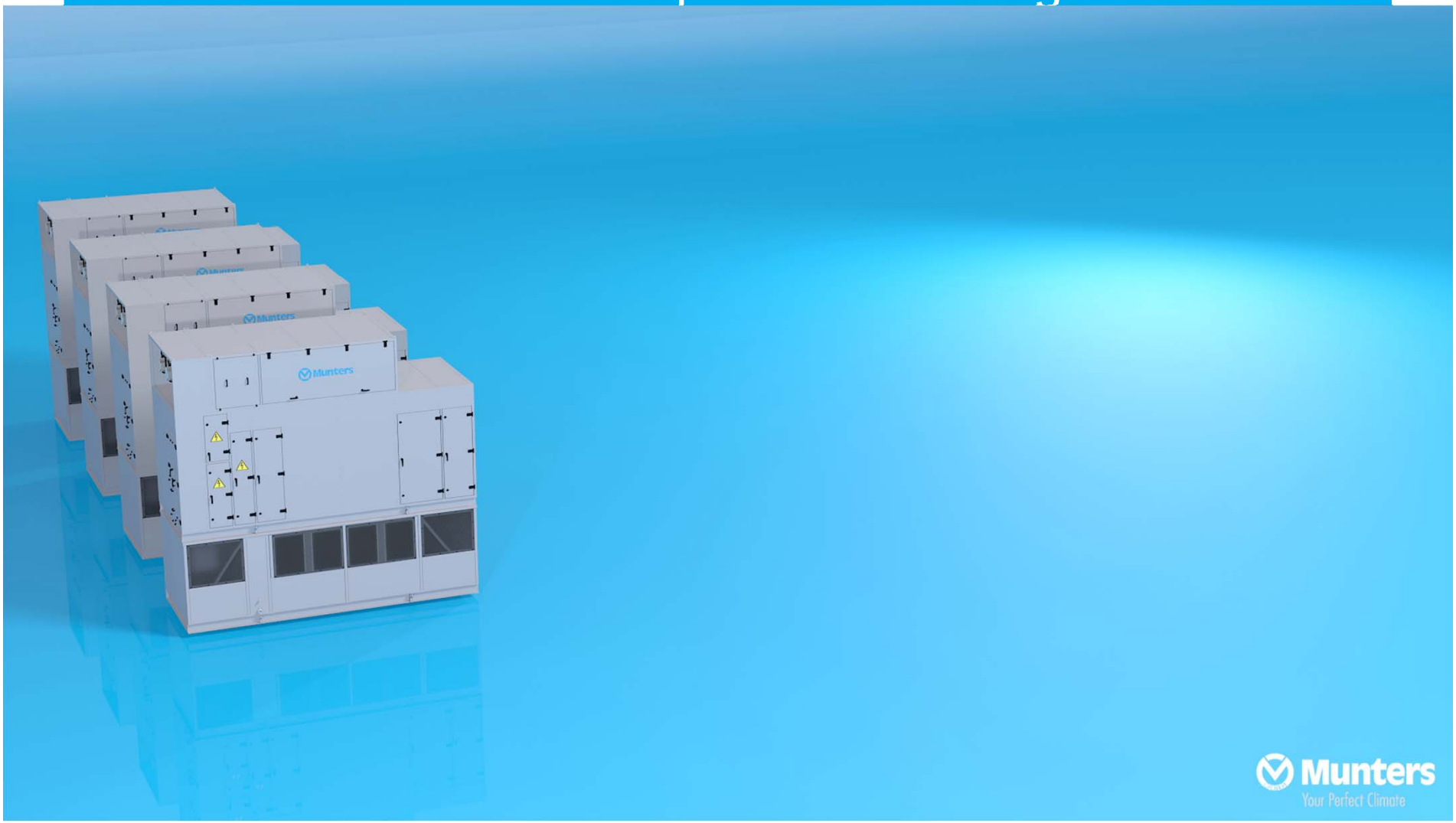
OASIS™ Indirect Evaporative Cooler

Indirect Evaporative Cooling



Dison video

Data Centre Test Facility

- Leakage testing
- Controls and Alarm simulation testing
- A visual inspection of the unit
- Variable load/performance testing, 1.7°C up to 33°C WB
- Real server rack simulation over 300kW load

Tests performing in accordance with ASHRAE-std143-2015

Fully Calibrated & Certified by LEUVEN KUL University

Test Facilities

- Leakage testing.
- Controls and alarm simulation testing.
- Variable load performance testing, in a climate controlled chamber 2°C up to 33°C WB, 45°C DB.
- 60,000m^3/hr airflow capacity
- Real server rack simulation with up to 300kW load.
- Tests in accordance with ASHRAE Std 143-2015.
- Fully calibrated & certified by LEUVEN University.

Climate Chamber - Dison


External Test Facility - Virginia


White Space with Load Banks - Dison

DigiPlex

–Energy efficiency of 1.12 PUE

DigiPlex

- Annual pPUE of 1.06
- Data Centre air fully separated from outside
- Lower capital costs on refrigeration/switchgear
- 52 Oasis IEC 200's

"Driving energy efficiency in our industry is a major focus for us and this system halves the amount of energy used to keep our servers working at an ideal temperature.

This not only helps save our customers thousands of pounds in energy costs but also ensures that our facilities are amongst the most sustainable in the sector"

EQUINIX Slough LD6

- One of the most energy efficient data centres in Equinix Portfolio
- 8,000m²
- Two three-storey, air-cooled buildings, for Phase 1
  - 2,770 Cabinets
  - 8MW IT Load

- 80 x Munters Oasis IEC
- Aim to become accredited to LEED Platinum Level
- Predicted cooling pPUE 1.06
- Predicted project PUE1 1.2
- Building Innovative design
  - Mechanical plant on top level to be closer to the a
  - Rainwater harvesting system

EQUINIX

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For more information

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