CUNDALL

Munters Oasis™ Indirect Evaporative Cooler

Product Engineering Review - Supplement

Doha, Dubai, Riyadh Data Sheets

Job No: 1005136

Doc No: -

Latest Revision: -

Date: 14/06/2013

Project name	Munters Oasis Indirect Evaporative Cooler	**Job Number**
Report Name	Product Engineering Review - Supplement	1005138

Document Revision History

Revision Ref	Issue Date	Purpose of issue / description of revision
-	14/06/2013	Information

Document Validation (latest issue)

Revision	Issue Date	Purpose of issue / description of revision / version			
-	14/06/2013	Click here to enter text.			
			Prepared by	Checked by	Verified by
		Initials	BJ	PL	MH
		Signature			

Executive Summary

This document is a supplement to the Product Engineering Review issued 19/12/2012. Results tables and graphs have been added for three locations in the Middle East; Dubai, Doha and Riyadh.

Due to the inefficiency of 'free cooling' chillers in these countries, a high efficiency Turbocor chiller has been used as a replacement. The Turbocor chiller is shown to be significantly more efficient than a standard screw.

The Oasis unit is shown to be significantly more efficient than both chiller options in all three locations. Water consumption however is high due to the high ambient conditions.

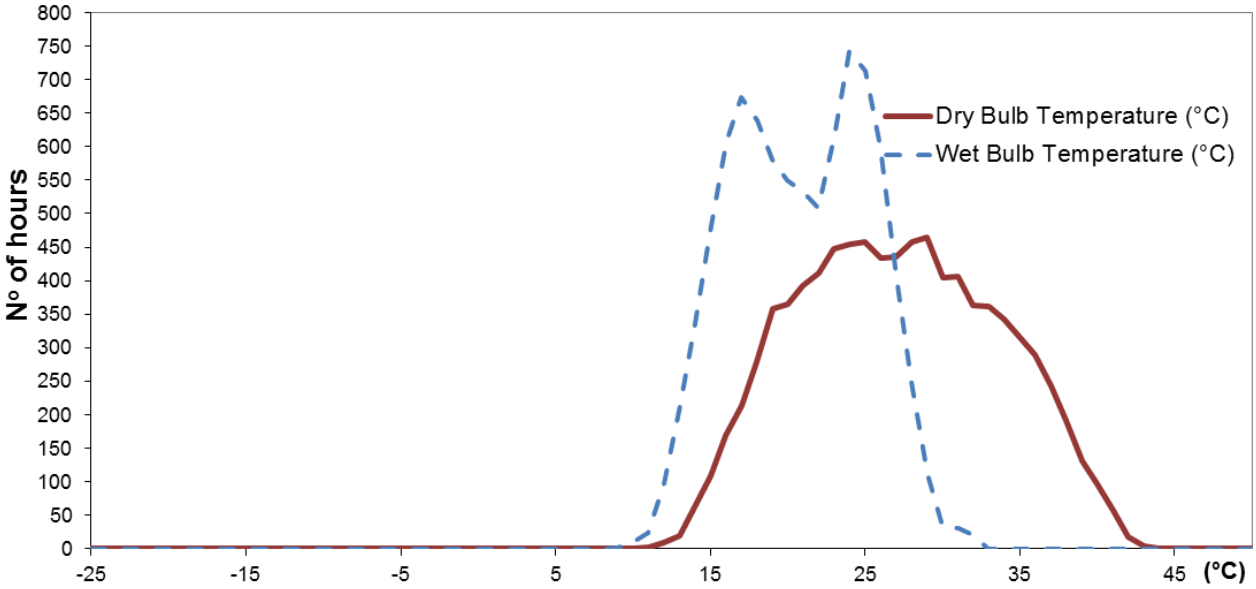
High wet bulb temperatures in Dubai and Doha result in DX cooling being used for a large percentage of the year. Unlike direct air cooling, indirect cooling does not require 100% mechanical DX backup, significantly reducing annual kWh.

The test scheme was originally designed for a cooler northern climate. In warmer southern regions a preference might be to increase the number of units, increasing initial capital costs but reducing total cost of ownership.

Contents

1. Comparison Results

1.1 Dubai



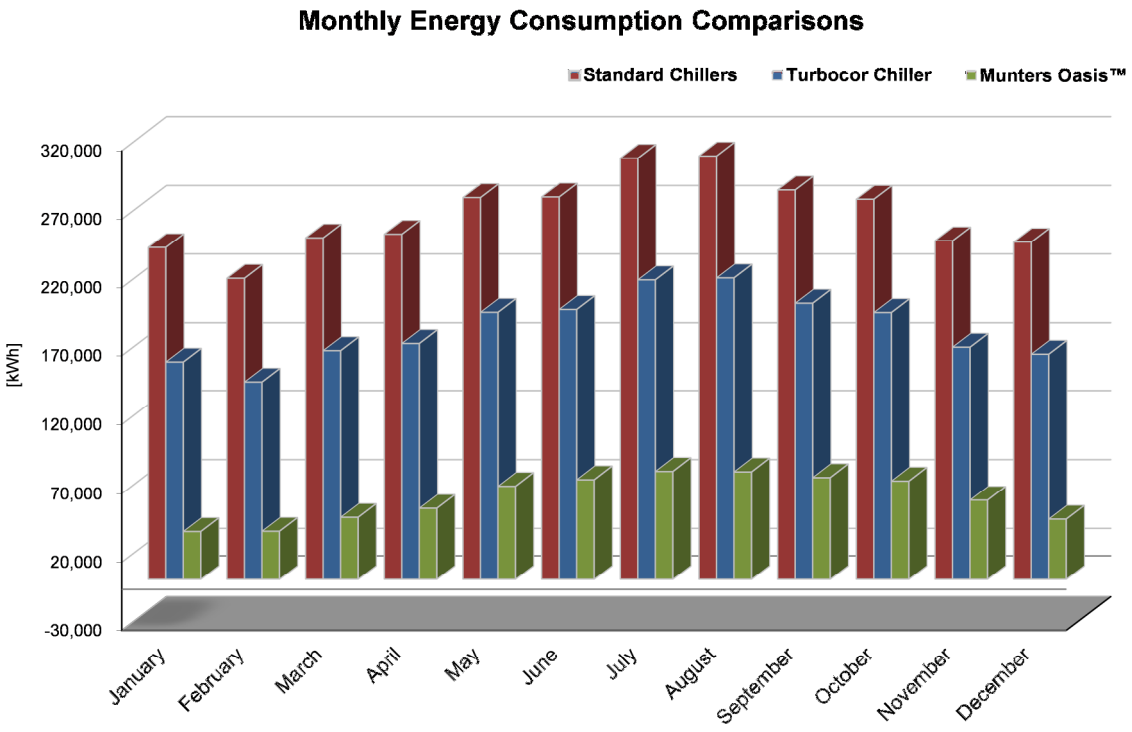
The annual energy consumption associated with the different cooling options is presented in the break down format in the table below, and is based on the key operational assumptions presented in Section 2.0. The data has been gathered using TRY weather data for Dubai.

		Standard Chillers	Turbocor Chiller	Munters Oasis™
Seasonal Cooling COP	Chiller + evaporative	**4.1**	**6.9**	**61**
	Total Cooling*	**2.8**	**4.1**	**12.3**
PUE (partial)**		**1.38**	**1.26**	**1.08**
Chiller Operating hours [h]		8760h	8760h	DX - 5692h, Evaporative - 8757h
Energy Consumption [kWh]	Chiller + evaporative	2,163,305	1,296,686	146,041
	Fans (cooling only)	587,764	587,764	582,537
	Pumps	664,750	474,821	-
	Total	**3,415,819**	**2,359,271**	**728,578**
Annual Costs [£]***	Energy	222,028	153,353	47,358
	Water	0	0	51,008
	Total Costs	**222,028**	**153,353**	**98,366**
	Cost Savings [%]	0%	31%	56%

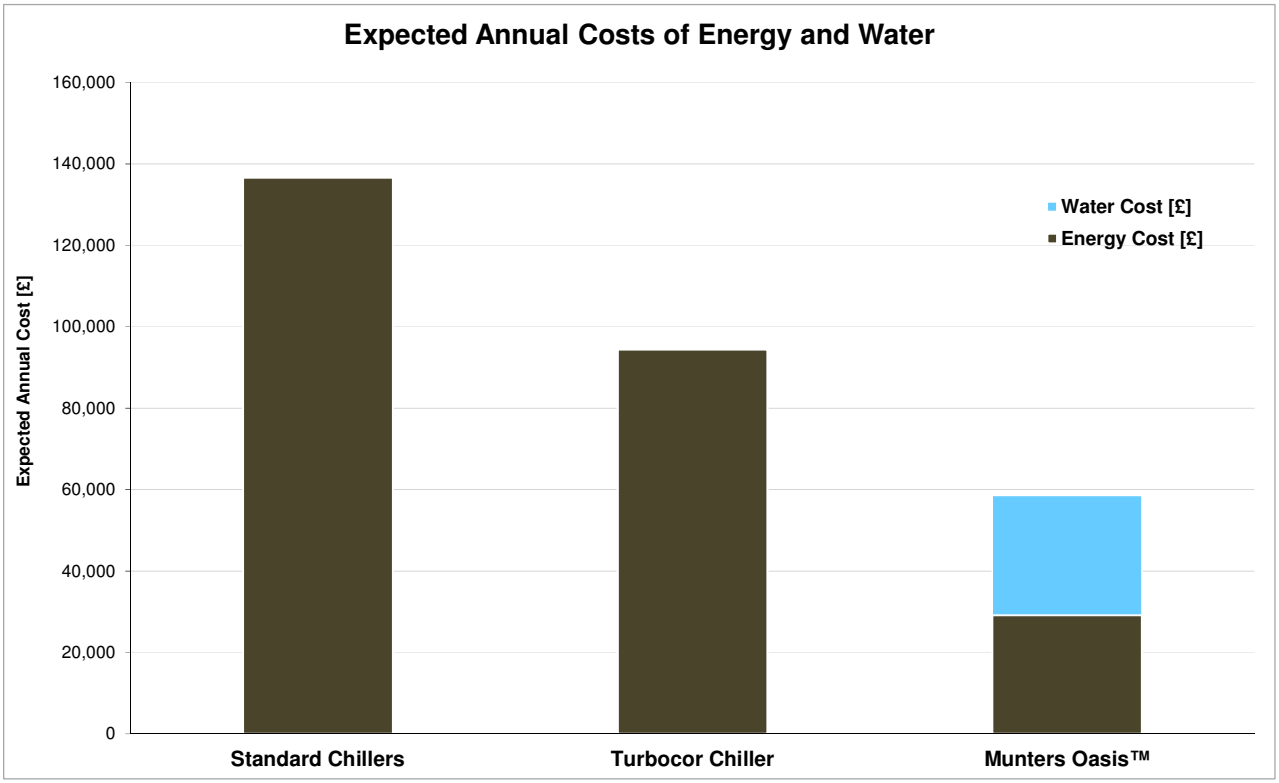
* - Total Cooling COP figure includes energy spent on chillers, evaporative cooling and fans (CRAC units or IAO units)

**- PUE(partial) includes cooling system of the data hall only, thus excludes UPS cooling system, electrical losses, fresh air ventilation, etc.

***- The cost of electricity and water is given in section 8.2.

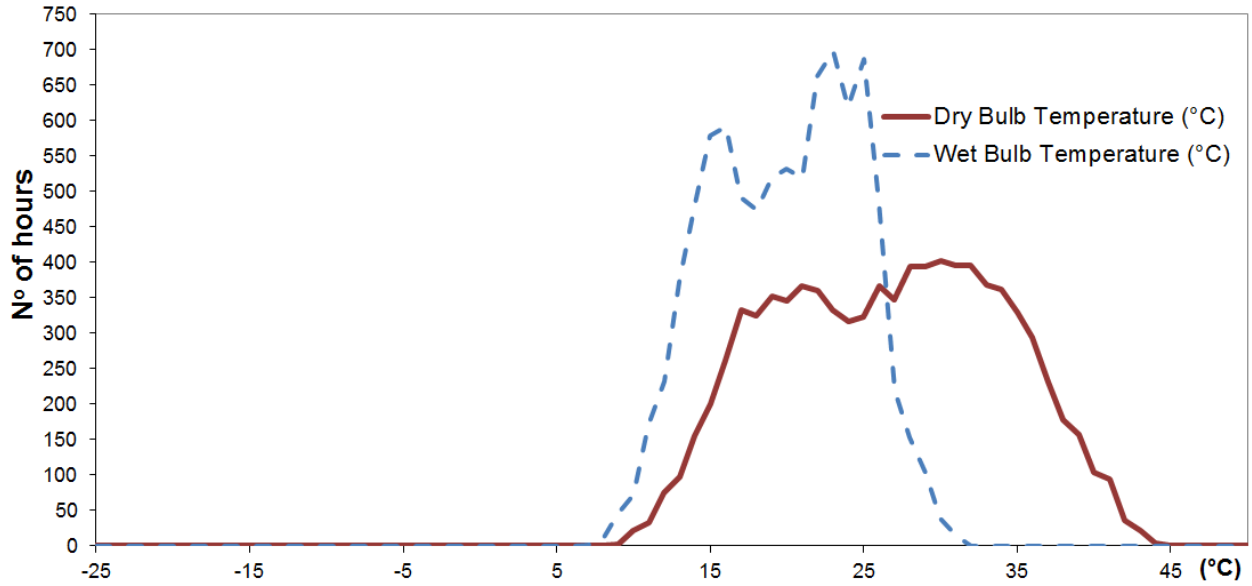


Annual Variation of Energy Consumption for all three cooling options



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

1.2 Doha



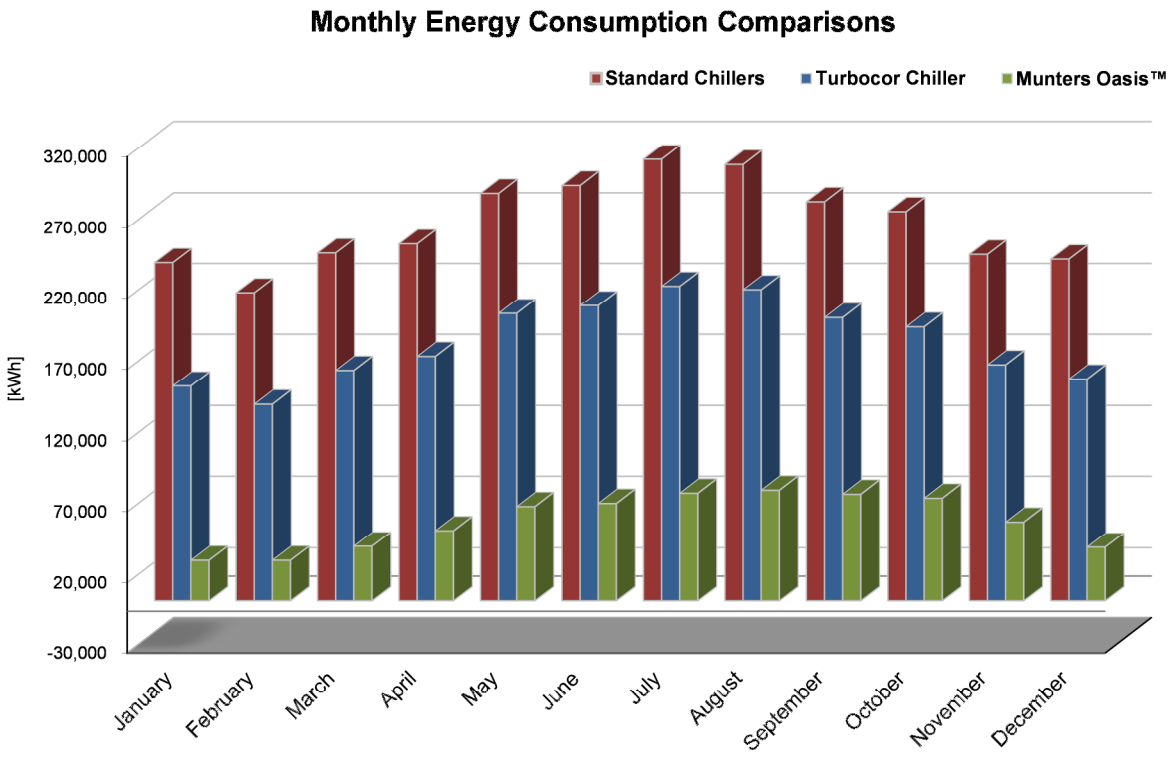
The annual energy consumption associated with the different cooling options is presented in the break down format in the table below, and is based on the key operational assumptions presented in Section 2.0. The data has been gathered using TRY weather data for Doha.

		Standard Chillers	Turbocor Chiller	Munters Oasis™
Seasonal Cooling COP	Chiller + evaporative	**4.1**	**6.9**	**67**
	Total Cooling*	**2.8**	**4.1**	**13.0**
PUE (partial)**		**1.38**	**1.26**	**1.08**
Chiller Operating hours [h]		8760h	8760h	DX - 5241h, Evaporative - 8674h
Energy Consumption [kWh]	Chiller + evaporative	2,162,084	1,285,200	132,978
	Fans (cooling only)	586,731	586,731	552,235
	Pumps	663,582	473,987	-
	Total	**3,412,398**	**2,345,919**	**685,213**
Annual Costs [£]***	Energy	221,806	152,485	44,539
	Water	0	0	53,785
	Total Costs	**221,806**	**152,485**	**98,324**
	Cost Savings [%]	0%	31%	56%

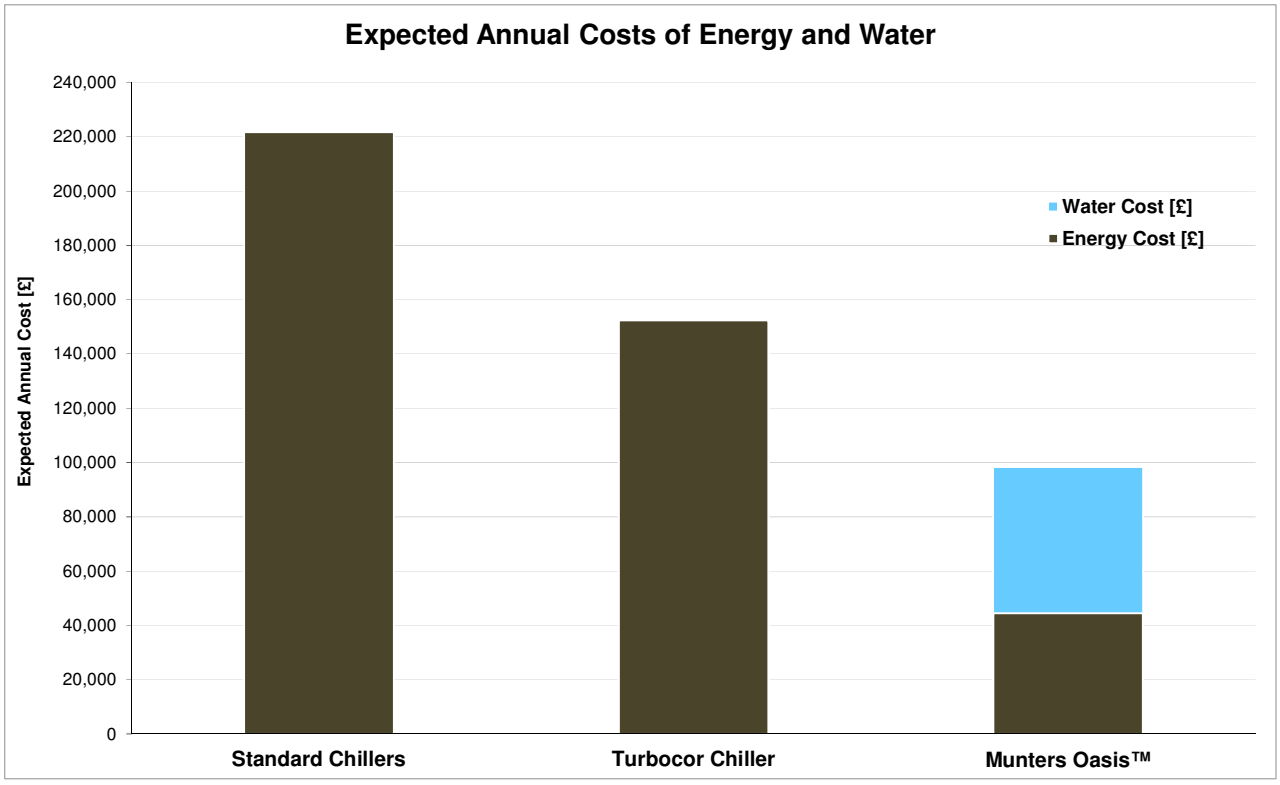
* - Total Cooling COP figure includes energy spent on chillers, evaporative cooling and fans (CRAC units or IAO units)

**- PUE(partial) includes cooling system of the data hall only, thus excludes UPS cooling system, electrical losses, fresh air ventilation, etc.

***- The cost of electricity and water is given in section 8.2.

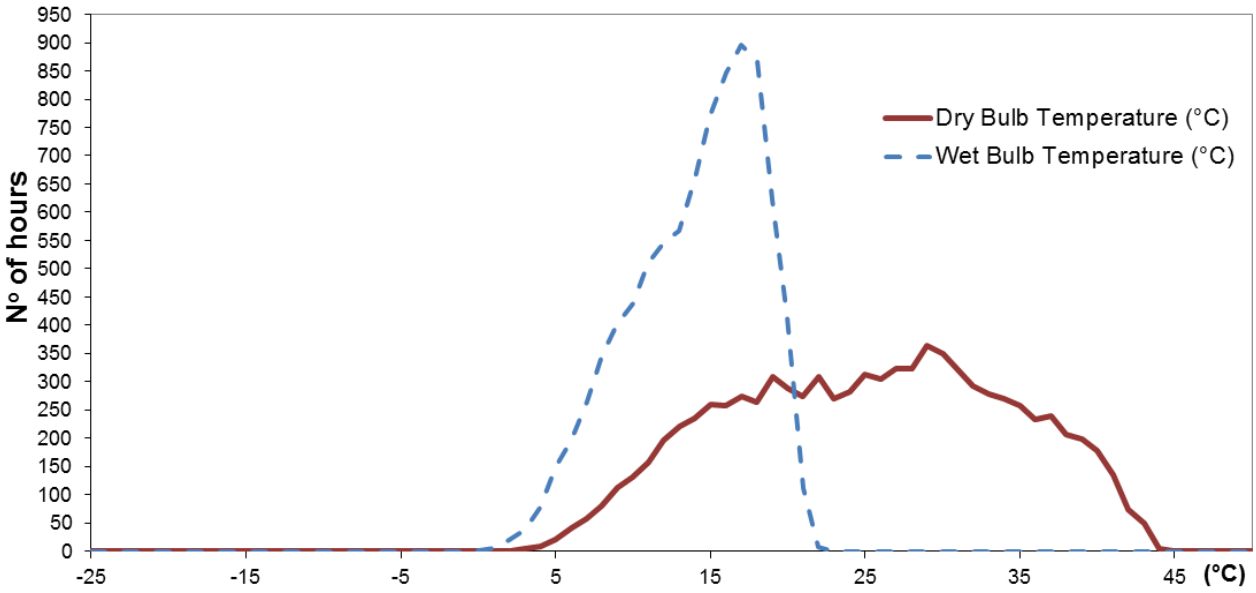


Annual Variation of Energy Consumption for all three cooling options



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

1.3 Riyadh



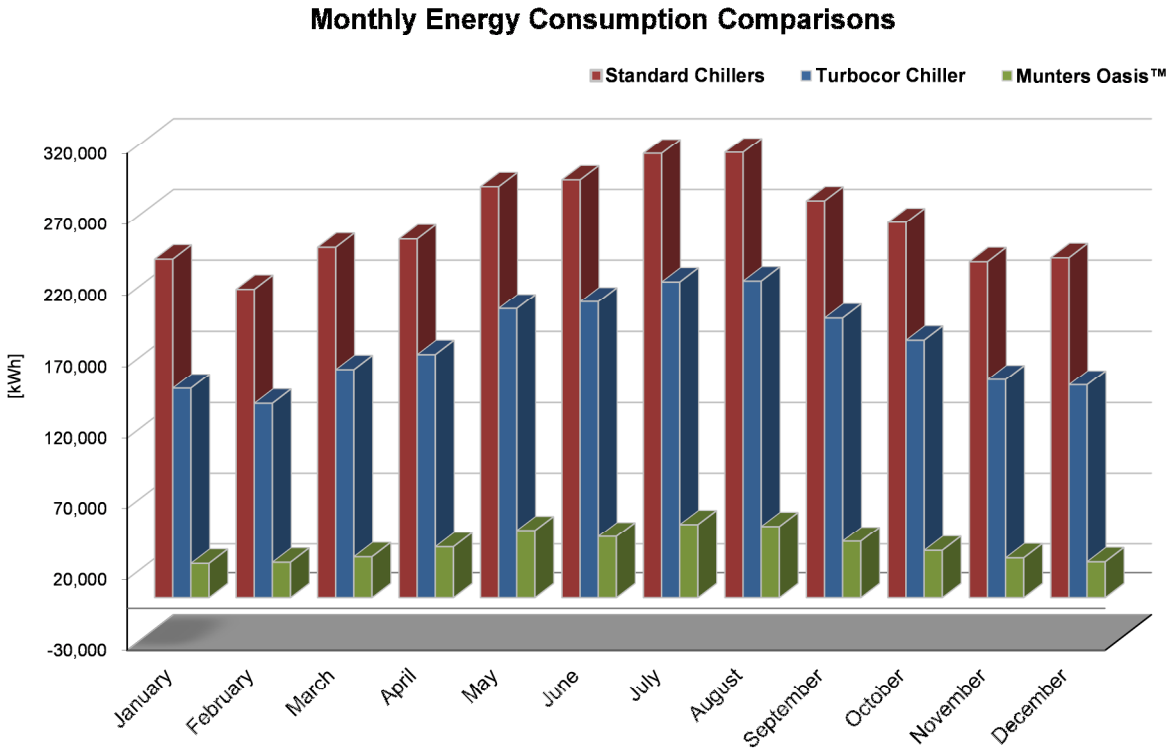
The annual energy consumption associated with the different cooling options is presented in the break down format in the table below, and is based on the key operational assumptions presented in Section 2.0. The data has been gathered using TRY weather data for Riyadh.

		Standard Chillers	Turbocor Chiller	Munters Oasis™
Seasonal Cooling COP	Chiller + evaporative	**4.1**	**7.1**	**186**
	Total Cooling*	**2.8**	**4.1**	**21.0**
PUE (partial)**		**1.38**	**1.26**	**1.05**
Chiller Operating hours [h]		8760h	8760h	DX - 1155h, Evaporative - 7038h
Energy Consumption [kWh]	Chiller + evaporative	2,151,684	1,249,146	48,111
	Fans (cooling only)	589,010	589,010	377,898
	Pumps	666,160	475,828	-
	Total	**3,406,854**	**2,313,985**	**426,009**
Annual Costs [£]***	Energy	136,274	92,559	17,040
	Water	0	0	34,867
	Total Costs	**136,274**	**92,559**	**51,907**
	Cost Savings [%]	0%	32%	62%

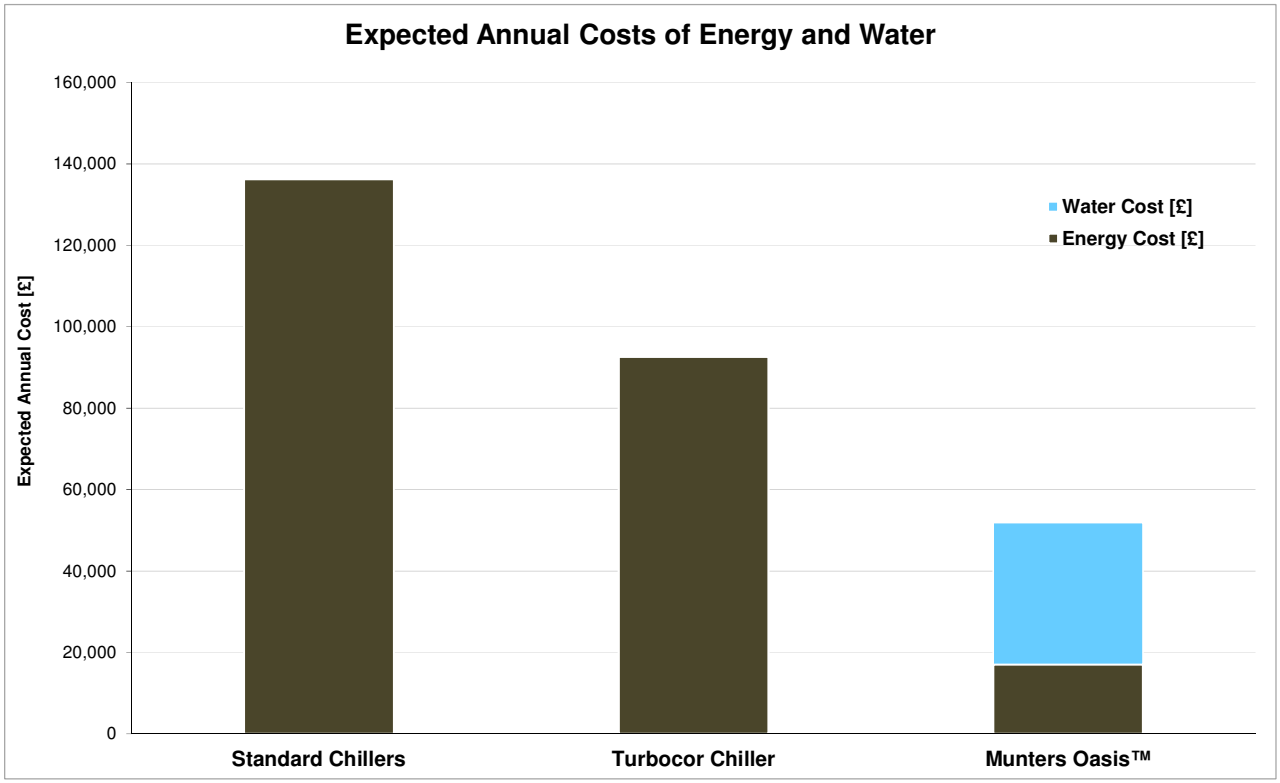
* - Total Cooling COP figure includes energy spent on chillers, evaporative cooling and fans (CRAC units or IAO units)

**- PUE(partial) includes cooling system of the data hall only, thus excludes UPS cooling system, electrical losses, fresh air ventilation, etc.

***- The cost of electricity and water is given in section 8.2.



Annual Variation of Energy Consumption for all three cooling options



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