iSERVcmb Measured Energy Consumption Data by HVAC Component and Activity: European Union as a whole

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July 2014

Edited by Ian Knight

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Intelligent Energy – Europe (IEE) SAVE Project

May 7th 2011 to May 6th 2014

Project websites:

Main website: http://www.iservcmb.info
Database website: http://www.iservcmb.eu

iSERV Measured Data Analysis – Total EU HERO Dataset

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ACKNOWLEDGMENTS

The Co-ordinator wishes to thank all the contributors to the iSERVcmb project over the project period. Everyone associated with the project over the 3 years is shown in the table below.

This project was only possible to undertake through the coordinated actions and goodwill of all involved, and the findings and outputs are credited to all who actively participated in the project. Their efforts extended far beyond what they were contracted to do, and in particular the voluntary efforts of the Steering Group and non-contracted Partners were very welcome and important.

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Contents

1 Introduction

This report presents the measured HVAC component energy consumption and end use activity data obtained for the EU during the iSERVcmb project.

The report tabulates the recorded energy use and power demand information by floor area, HVAC component and sub-component type, for each activity type within the iSERVcmb system.

The figures presented include energy use data which has been apportioned across more than one activity and/or component in some cases. The apportionments have been made using a mixture of pre-existing data and data collected during the project period. Care has been taken to ensure the data produced is not simply self-referencing.

1.1 Measured data accuracy

The actual floor areas recorded for each building and system are expected to be between -1 to +4% of the value recorded in the associated iSERV spreadsheet.

While this document deals only with electricity, the maximum expected error in the read for each electricity and gas meter is ± 2% [Knight 2014]. For heat meters the expected errors are around -10% based on studies of the actual performance of installed heat meters in Sweden [Jomni 2006] and observations of installation practice in real buildings.

The data presented here should be read with these potential inaccuracies in mind.

1.2 Data overview

The datasets show that the measured overall average annual energy use and power demands by HVAC component type are as in Table 1. It can be seen that power demands are not a good indicator of likely annual energy use, and that ALL elements of an HVAC system appear to play a significant role in the overall annual energy consumption likely to arise from that system.

Table 1 – Overall measured average power demands and annual energy consumptions across the entire EU by HVAC component type

	Cold Generators	Air Handling Units	Heat Pump	Pumps	Terminal Units	Heat Generators	Heat Rejection	Heat Recovery	Dehumidification	All in One Systems
W/m2	9.9	6.8	3.6	1.8	4.3	1.4	0.7	0.1	0.01	14.6
kWh/m2	46.0	41.3	30.0	24.4	19.0	18.5	1.5	1.1		134.8

1.3 Major conclusions

The data presented shows that there are significant variations in the power demands and energy use of almost every combination of HVAC sub-component and activity. These variations are due to a variety of reasons ranging from climate, through building and system design, to simple inefficiency in operation and maintenance of the HVAC systems.

What the wider iSERVcmb project has shown is that the inefficiencies are a significant part of the variations being found in the data presented in this document.

The data presented in these tables is a look at the detail of how building services consume energy in operational buildings across Europe. However, on its own this information does not allow the owners/operators of the systems which contributed this data to know how or whether they should be doing better.

The full dataset from which this document is drawn, used in conjunction with the iSERVcmb approach, can however start this process by benchmarking individual systems and buildings against this data.

It has not been possible to fully describe the iSERVcmb dataset in a document yet, as there was too much work to do during the project just to assemble the raw data. Continuing analysis will produce further information and data out of this project which will form the basis of professional guidance and standards in the future.

2 HVAC Component and Activities Overview plus Data Summaries

This section covers the overall description of the HVAC components as given in the iSERV spreadsheets for the EU, as well as summarising the measured data from the more detailed parts of this report.

Table 1a - Number of meters serving each activity

Activity type	Coolth	Electricity	Gas	Heat	Heat and Coolth	Heat Meter	Heat Meter – Cooling	Heat Meter – Heating	Water
Heat Assembly areas / halls		66	6	3			5	5	
Bathroom		8	6						1
Bedroom		17	3			4	1	1	1
Catering: Bars	12	17		2	1				
Catering: Eating/drinking area	11	206	13	5	3	4	1	1	
Catering: Full Kitchen Preparing Hot Meals	40	235	6	17	1	8	7	7	1
Catering: Kitchenette (small appliances, fridge and sink)	1	77	11	11	1	9			1
Catering: Limited Hot Food Preparation Area	3	149	14	4		16	1	1	1
Catering: Snack Bar with Chilled Cabinets	3	56	5			4	1	1	
Catering: Vending Machines		20	4						
Cellular Office Area	60	335	24	27	3	4			5
Cellular Office Area - multiple occupation		175	9	7	17	26			
Circulation area (corridors and stairways)		404	21	12	5	25	4	4	2
Consulting/treatment room		52	2	1	2	4	1	1	
Dept Store Sales area - chilled		36							
Dept Store Sales area - electrical		3							
Dept Store Sales area - general	3	259				16	5	5	
Diagnostic Imaging		14	2	1			1	1	
Escalators		7							
Exhibition rooms, museum		11	1		3				
External Space		13	1		1				
Generic Checkin areas	27	33		7	1				
Generic Ward	1	18		2	2	4			
Greenhouses		1			1				
Heavy Plant Room		9	3	3					
Hotel room	34	21		21					
Hydrotherapy pool hall	16	6		6					
Industrial process area		11			10				
IT: High Density IT Suite	9	90	16	7					1
IT: LAN Rooms	8	88	17	4					3
IT: Server Room	17	164	6	15		7	1	1	
Laboratory		100	9	2			2	2	
Laboratory - Sterile		4	1			4			
Laboratory with fume cupboards		23	2	1			1	1	
Laundry		25	1			4	1	1	
Lecture theatre	23	100	11	11	1	10	4	4	3

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Activity type	Coolth	Electricity	Gas	Heat	Heat and Coolth	Heat Meter	Heat Meter – Cooling	Heat Meter – Heating	Water
Library - open stacks		46	7	1		4			
Library - reading room		28	3	1		4			
Library - stacks and storeroom		27	6	1					
Lifts		63	7		3				1
Light Plant Room		165	21	4	2				3
Lounges		78	2	1					
Meeting Room	3	146	14	7			1	1	1
Multi-storey car parks (office and private use)		23					1	1	
Multi-storey car parks (public use)		14							
Nursery		43				4			
Open Plan Office Area	2	426	7	8	3	13	13	13	
Operating Theatre		13				4	1	1	
Physiotherapy Studio		8				4	1	1	
Post Mortem Facility		7					1	1	
Reception		156	13	5		12	1	1	1
Recreational : Changing facilities with showers		123	5	3	3	16	3	3	
Recreational : Fitness Studio		17	1			4			
Recreational : Fitness Suite/Gym		39					1	1	
Recreational : Recreational Pool	11	5		1	1				
Recreational : Sports ground changing rooms		29	6						
Retail Warehouse Sales area - chilled		20	1						
Retail Warehouse Sales area - electrical	2	4							
Retail Warehouse Sales area - general	25	76	2	20					
Small Shop Unit Sales area - chilled		12							
Small Shop Unit Sales area - electrical		2							
Small Shop Unit Sales area - general	2	106	3	6		4			
Spectator area (theatres and event buildings)		13	2						1
Stage (theatres and event buildings)		7	1						
Storage Area/Cupboard		318	23	6	4	8	3	3	4
Teaching Areas		112	10	1	2	8			1
Toilet		365	20	11	6	4			3
Unoccupied space		33	1		2				
Waiting Rooms		41	4	1		4			1
Warehouse storage		89			3	4			
Workshop		27	6	2					

2.1 Overall HVAC Components and Activities Summary

Table 2b summarises the data collected for the HVAC Components and the iSERV Activity types available in the EU. It can be seen that the HVAC components in the EU service 71 different activity types with total areas ranging in size from 41 to 250,000 m^2. The most frequently encountered component types in the project were AHU's, pumps and terminal units.

Table 2b – Overall Systems Summary for EU showing numbers of components and spaces associated with each activity type

Activity Name	Floor Area m2	Num Spaces	Air Handling Units	All in One Systems	Cold Generators	Dehumidification	Flow Control	Heat Generators	Heat Pump	Heat Recovery	Heat Rejection	Humidifiers	Pumps	Storage Systems	Terminal Units
Assembly areas / halls	2187.22	14	23		15			7	2	4	2		74	12	40
Bathroom	2174.81	258	9		1			6					16	5	2
Bedroom	10815.79	252	25		6			3	3				35	3	1
Catering: Bars	1420.6	19	11		5			4			1		19	12	
Catering: Eating/drinking area	16453.83	91	110	4	53			43	13	13	18	2	202	17	127
Catering: Full Kitchen Preparing Hot Meals	15137.89	124	164	7	54			47	6	16	13	3	276	22	75
Catering: Kitchenette (small appliances, fridge and sink)	538.45	50	39		31			39	7	13	5	7	151	15	264
Catering: Limited Hot Food Preparation Area	2069.32	80	112	8	23			38	4	2	5		148	6	158
Catering: Snack Bar with Chilled Cabinets	1582.14	22	39	8	13			5	6		2		48	12	28
Catering: Vending Machines	1613.56	5	15		6			3			2		19	2	4
Cellular Office Area	251541.18	1306	243	3	102	1	3	72	81	9	15	34	281	5	413
Cellular Office Area - multiple occupation	32530.12	464	125	8	28		1	38	12	2	42	3	253	13	553
Circulation area (corridors and stairways)	110601.51	1298	471	10	91	1	2	73	18	37	18	48	553	39	596
Consulting/treatment room	23880.85	131	91	1	17			7	7		7	2	49		65
Dept Store Sales area - chilled	16591.38	23	43		15										
Dept Store Sales area - electrical	432	1		2											
Dept Store Sales area - general	227401.49	579	209	43	26			9	192	6	16		147	2	223
Diagnostic Imaging	2160.22	9	21		5			4	4				27		4
Escalators	3027.33	22	8		1										
Exhibition rooms, museum	9447.74	26	20	1	5			3			2	4	24		12
External Space	1278.47	9	12		2			5	13	1			9		13
Generic Checkin areas	16208.21	10	37		11			1	3		2		23	2	
Generic Ward	2180.47	47	20	1	4			4	3				9		
Greenhouses	200	1	1	1				1					3		
Heavy Plant Room	300.03	7	5		3			7					7	1	1
Hotel room	51889	2			17										
Hydrotherapy pool hall	170.81	1			2										
Industrial process area	27403.32	13	17					1					5		
IT: High Density IT Suite	4539.05	93	39	9	25			43	4	5	13	9	109	3	65
IT: LAN Rooms	1654.95	77	41	2	23			33	1	4	19	3	53	2	26
IT: Server Room	8162.83	185	114	33	32			17	11	12	68		99	1	255
Laboratory	16121.72	382	88	3	21		2	42	8	6	2	4	136	5	203
Laboratory - Sterile	40.89	2	2		1			2	3				10		
Laboratory with fume cupboards	1840.4	13	16		9			6	4		3	3	49	1	4
Laundry	409.37	12	25		9			5	3				39		1
Lecture theatre	10500.38	66	56		30			32	6	1	7	3	118		94
Library - open stacks	19975.1	43	19		9			13	5	6	4		51	2	101
Library - reading room	7009.71	31	20		7			14	7	5	2		58	14	99
Library - stacks and storeroom	2125.27	14	12		7	2		16		6	3	4	51	2	27
Lifts	913.58	62	46	1	11			20		1	3	27	38		6
Light Plant Room	8219.06	344	128	1	29		2	47	9	12	7	35	169	4	12
Lounges	4222.13	67	56		25			10	1	5	3	2	105	16	80
Meeting Room	9858.88	186	95	5	34			41	15	12	13	21	146	2	217
Multi-storey car parks (office and private use)	10636.71	4	17		5		1	4		4	2		27		3
Multi-storey car parks (public use)	76656.1	2	127												
Nursery	1045.12	18	31		6			2	3	7	5		59		13
Open Plan Office Area	171868.65	1083	303	53	83			52	39	53	73	24	388	27	1248
Operating Theatre	1516.09	15	31		4				3				28		

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Activity Name	Floor Area m2	Num Spaces	Air Handling Units	All in One Systems	Cold Generators	Dehumidification	Flow Control	Heat Generators	Heat Pump	Heat Recovery	Heat Rejection	Humidifiers	Pumps	Storage Systems	Terminal Units
Physiotherapy Studio	825.32	2	4		4				3				25		
Post Mortem Facility	184	1	7		3								17		
Reception	5766.42	46	97	2	38		1	37	15	11	14	5	258	17	117
Recreational : Changing facilities with showers	4431.86	68	70		30			23	7	11	3	1	166	7	57
Recreational : Fitness Studio	683.3	7	3	1	9			6	3		3	1	28	1	1
Recreational : Fitness Suite/Gym	847.12	4	7	1	11			4	1	4	3	1	28	12	
Recreational : Recreational Pool	641.71	1			2			1			1				
Recreational : Sports ground changing rooms	456.39	8	10	1	9			14			6	1	28		12
Retail Warehouse Sales area - chilled	9210.86	21	21		12			2					4	2	60
Retail Warehouse Sales area - electrical	375.66	4	9		1			2			1		8		120
Retail Warehouse Sales area - general	80136.66	45	82	17	29			9	2		2		15		24
Small Shop Unit Sales area - chilled	22278.73	109	14		5						1		25	19	1
Small Shop Unit Sales area - electrical	1656.19	1	2		1										
Small Shop Unit Sales area - general	41503.3	187	87	7	33			24	19	6	5	2	139	16	47
Spectator area (theatres and event buildings)	4232.38	12	20		8			3			1	1	29		2
Stage (theatres and event buildings)	5902.04	19	14		5			3			1		31	1	
Storage Area/Cupboard	19581.04	618	246	4	63		2	50	10	24	14	11	219	10	208
Teaching Areas	19841.11	375	86	1	23		2	45	3	7	22	1	129	4	170
Toilet	19812.69	975	351	4	75			77	6	30	8	30	374	43	181
Unoccupied space	5617.9	39	24	4	10			11	5	4	2		45		3
Waiting Rooms	1244.63	25	15		13			21	3	4	7	2	44	2	56
Warehouse storage	15308.75	151	102	4	19			14	3		6		102		26
Workshop	2433.26	42	40		4			20	4	1			54	2	33

3 Summary of measured annual energy use by HVAC Component and sub-component type servicing a given activity

This section summarises the range of electrical annual energy consumption per m^2 by activity served, that have been measured across all the HVAC sub-component types monitored in iSERVcmb.

The main observations from the tables are:

- Many of the HVAC components have significant average energy consumptions across a number of the end use activities
- IT related end uses are clearly the most significant loads on many HVAC components
- Air handling units and Cold generators have the highest average annual consumptions
- Pumps and Terminal Units also consume significant quantities of energy over a year – reflecting their more continuous operation, in particular for pumps.

A summary of the measured average annual energy use by activity type and HVAC component type is shown in Table 3. Values in brackets indicate the standard deviation found from this average. This data can be used to estimate the likely annual energy use range to be incurred by an HVAC component while servicing this type of activity in the European Union. The more detailed tables also show this information by HVAC sub-component as well.

Table 3 – Benchmarks for measured Average and Standard Deviation Annual Energy Use in kWh/m2 Summary by HVAC Component and Activity Type. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Assembly areas / halls	56.2	92.8			0.2	0.2	2.4	3.2	21.4		0.3	0.0	0.0	0.0	41.7	124.1		
Bathroom	4.9	4.4																
Bedroom	17.1	16.4																
Catering: Bars	34.7	1.4			66.1		150.1	236.5							28.6	12.8		
Catering: Eating/drinking area	17.9	19.6			45.1	48.8	1.7	4.5	26.3	4.0	1.3		0.1	0.0	5.6	17.6	4.7	4.4
Catering: Full Kitchen Preparing Hot Meals	176.1	278.2			265.4	528.4	6.4	10.8			0.3	0.0			9.8	13.8		
Catering: Kitchenette (small appliances, fridge and sink)	18.9	19.1			3.4	5.3	1.6	2.5	6.4	-	1.3				1.8	3.6		
Catering: Limited Hot Food Preparation Area	68.9	48.7	63.9	28.2	1.2	0.7	0.8	2.0	21.4				0.1	0.0	16.2	40.2		
Catering: Snack Bar with Chilled Cabinets	39.8	27.8	63.9	28.2	0.4	0.3	0.8	1.1	28.6	6.0			0.1	0.0	8.0	28.8	14.1	14.0
Catering: Vending Machines	26.0	26.1			8.4	13.8	0.0	-					0.1	0.0	16.0	34.0		
Cellular Office Area	10.9	30.6			32.9	34.5	2.2	4.6	48.2	140.0	1.3	0.0	0.4	0.5	5.3	16.7	24.0	25.7
Cellular Office Area - multiple occupation	25.8	47.4			4.0	4.7	2.3	2.6	18.3	22.3			0.1	0.2	5.6	14.5	5.1	1.5
Circulation area (corridors and stairways)	11.6	24.3			16.0	39.5	23.2	96.9	21.7	6.8	1.3	0.0	0.0	0.1	3.0	10.5	6.0	4.7
Consulting/treatment room	6.1	2.4			26.8	36.7	0.6	-	7.9	-					14.8	-	18.6	23.3
Dept Store Sales area - chilled	56.0	31.0			29.8													
Dept Store Sales area - general	35.4	32.4	44.8	22.5	73.3				12.8	35.8			17.5	-			4.0	7.0
Diagnostic Imaging	102.8	139.1			19.9	-	0.6	-	46.9	-					41.3	-	4.2	
Escalators	2.5	1.3			1.1													
Exhibition rooms, museum	5.4	0.6			1.8	-	2.0	-					0.3		0.2	0.1		
Generic Checkin areas	14.5				37.1	35.9	18.8						0.2		0.7	0.5		
Generic Ward	18.7	7.2					36.2											
Hotel room					19.1	-												
IT: High Density IT Suite	58.4	111.7	149.7		98.8	138.2	1.0	1.9	35.0	-	1.3		0.9	1.4	138.4	341.2	8.4	0.0
IT: LAN Rooms	19.6	57.4			40.8	33.8	0.9	1.9	41.2		1.3		6.6	4.9	181.3	378.8	22.0	9.1
IT: Server Room	10.2	15.2	775.5	349.8	791.9	1,041.5	2.0	3.0					6.7	6.9	210.3	515.6	28.9	18.6
Laboratory	56.9	131.3			22.5	24.7	0.6	0.8	41.5	56.1			0.4		8.6	15.4	30.5	11.4
Laboratory - Sterile	19.1																	
Laboratory with fume cupboards	167.8	271.9			16.2	0.0			9.5	-			0.4	0.0	1.8	1.3	6.8	
Laundry	87.5	74.5					0.1	-										
Lecture theatre	159.1	191.5			21.7	26.9	2.4	3.9					2.9		144.6	345.8	13.0	9.7
Library - open stacks	4.7	4.2			0.4	0.2	0.5	0.9	22.7		1.3	-	0.1	0.1	10.5	34.1	4.2	
Library - reading room	48.6	37.7			0.4		0.7	1.0			1.3				2.1	1.9		
Library - stacks and storeroom	5.8	3.4			0.7	1.0	0.0	0.0			1.3		0.2	0.3	2.6	10.6	6.8	

iSERV Measured Data Analysis – Total EU HERO Dataset

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
Lifts	2.7	1.4			0.3		0.7	0.9			1.3				8.8	9.3		
Light Plant Room	11.0	17.8			0.7	1.5					1.3	0.0	0.0	0.0				
Lounges	39.5	58.6			127.6	135.7			21.4						6.7	5.6	15.7	-
Meeting Room	20.6	27.7	64.2	26.4	18.9	28.2	1.7	2.7	23.4	16.9	1.3		0.2	0.2	10.1	22.6	8.7	5.5
Multi-storey car parks (office and private use)	0.2	0.2																
Nursery	2.4	2.0			86.9										8.2	2.3		
Open Plan Office Area	20.7	30.4	47.1	14.1	37.0	69.9	0.0	0.0	47.8	34.9	0.3	0.0	2.9	4.4	4.2	14.4	5.3	8.8
Operating Theatre	7.8	11.2																
Physiotherapy Studio	4.9																	
Reception	2.6	3.0			4.3	6.1	44.0	133.2	16.6	11.6			0.0	0.0	8.7	23.7	8.3	10.1
Recreational : Changing facilities with showers	38.5	12.4					0.2	0.2	108.8	-					5.1	2.9		
Recreational : Fitness Studio	20.5	1.5													0.4	0.4		
Recreational : Fitness Suite/Gym	83.2	128.8			0.0	0.0					0.3	0.0			2.7	3.6		
Recreational : Recreational Pool							386.4											
Recreational : Sports ground changing rooms	41.9	46.4					0.2	0.2							11.0	23.1	35.0	
Retail Warehouse Sales area - chilled	282.2																	
Retail Warehouse Sales area - general	12.0	33.4	38.8	2.0			0.5	0.8					1.9		52.5	69.6	4.7	2.5
Small Shop Unit Sales area - chilled	6.5	5.7			4.9	2.7							0.6		3.3	3.1	9.1	
Small Shop Unit Sales area - general	16.4	11.7	54.7	11.5	39.8	58.2	5.9	-	81.7	102.8					6.1	9.2	26.4	
Spectator area (theatres and event buildings)	73.0														22.3	0.0		
Stage (theatres and event buildings)	17.3	7.1			62.0	87.8							0.1		5.5	3.6		
Storage Area/Cupboard	17.7	19.8			1.5	2.0	22.5	94.3	16.5	11.9	1.3	0.0	0.0	0.0	27.0	64.3	15.0	21.5
Teaching Areas	12.2	21.9			5.2	4.8	0.4	0.7			1.3				4.6	5.8	84.2	0.0
Toilet	14.9	21.3	45.0	16.6	3.3	8.6	20.4	90.0	11.5	5.6	1.3	0.0	0.1	0.1	2.7	10.1	47.6	57.6
Unoccupied space	3.9	4.4					0.1	-							2.5	2.4		
Waiting Rooms	9.6	1.7			1.1		0.1	-							6.1	4.6	84.2	0.0
Warehouse storage	5.6	5.1			12.0	15.1												
Workshop	278.6	310.9			17.6	24.3	0.6	0.8	11.2	-					0.1		3.2	1.5

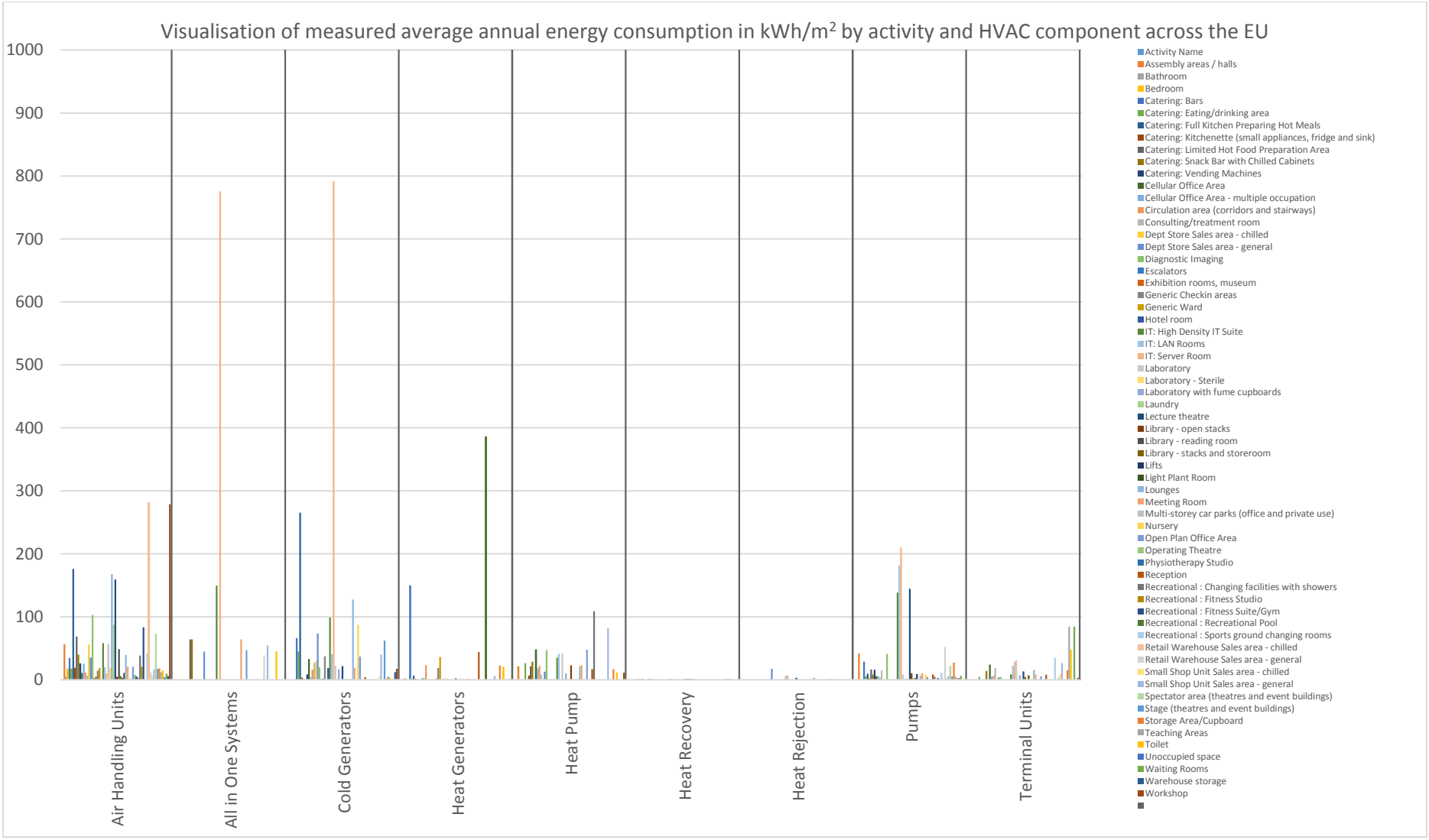

Figure 1 - Visualisation of measured average annual energy consumption in kWh/m2 by activity and HVAC component across the EU

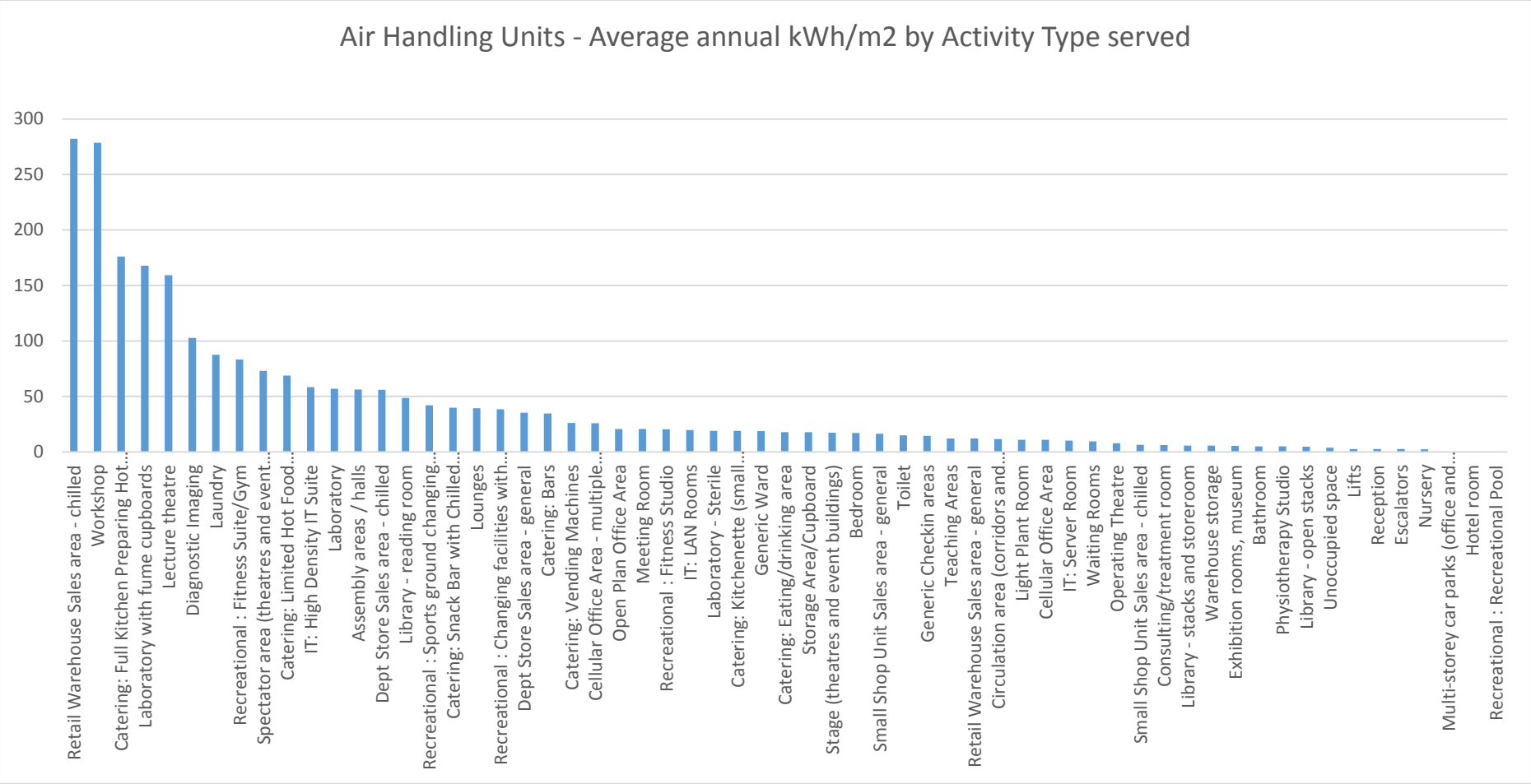

Figure 2 - Air Handling Units - Average annual kWh/m2 by Activity Type served

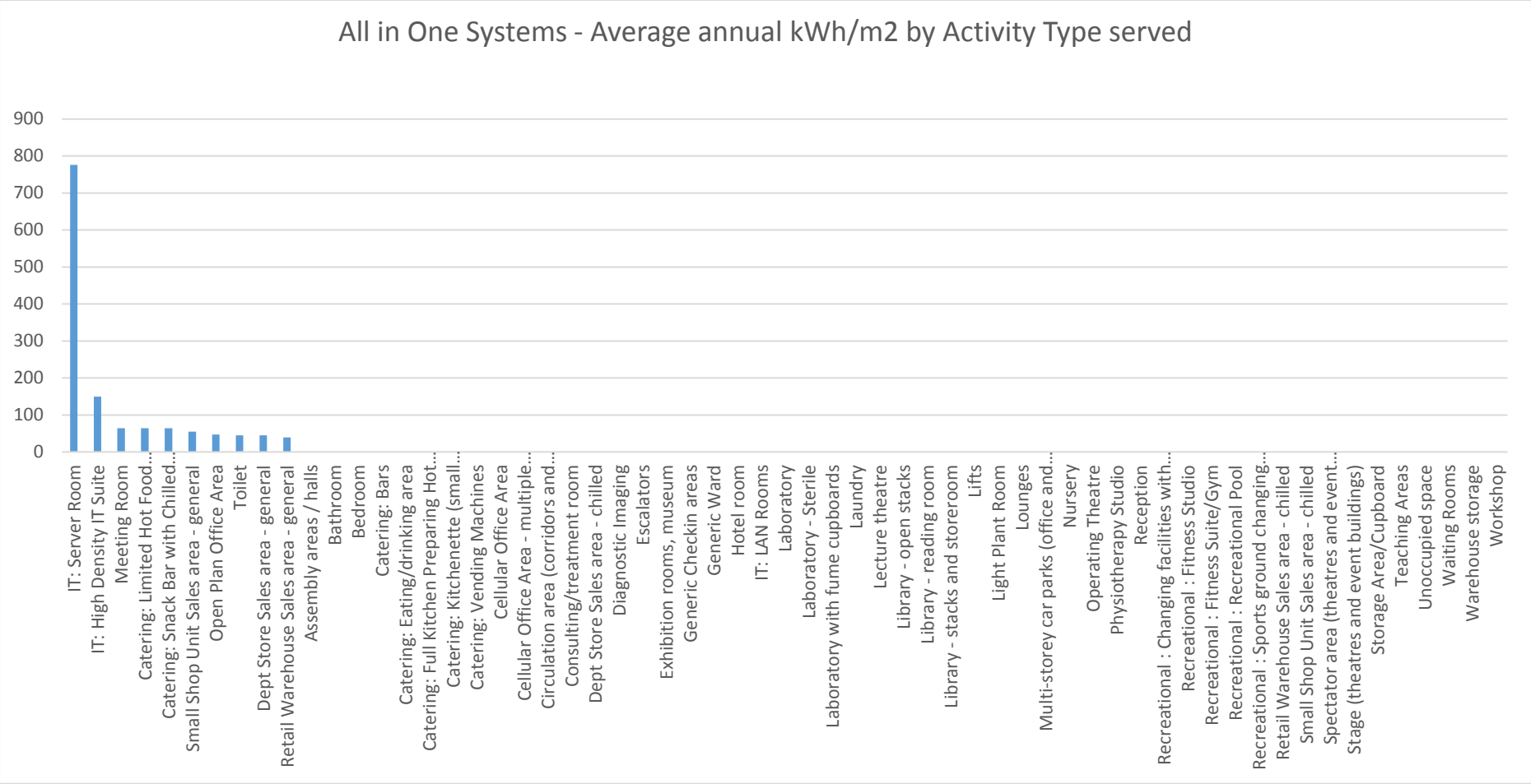

Figure 3 - All in One Systems - Average annual kWh/m2 by Activity Type served

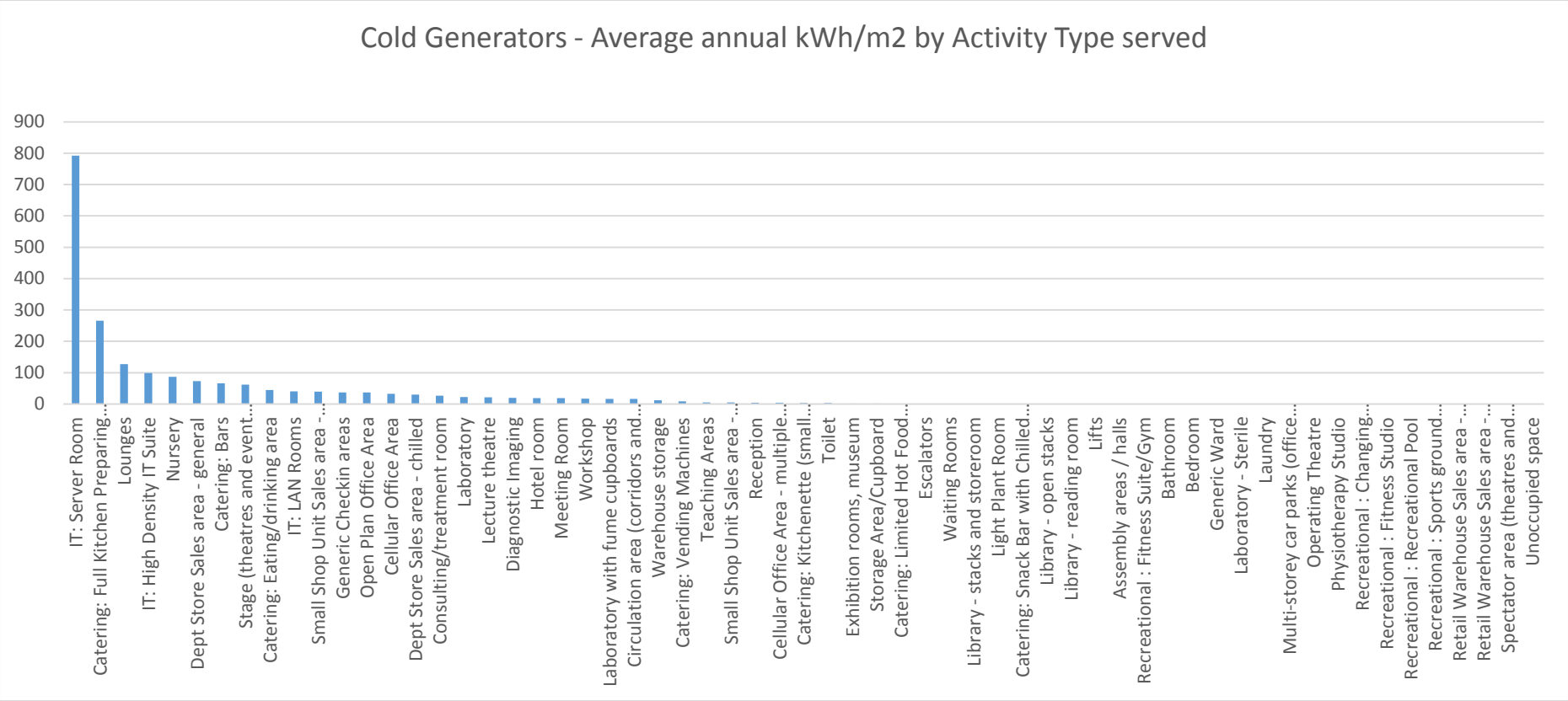

Figure 4 - Cold Generators - Average annual kWh/m2 by Activity Type served

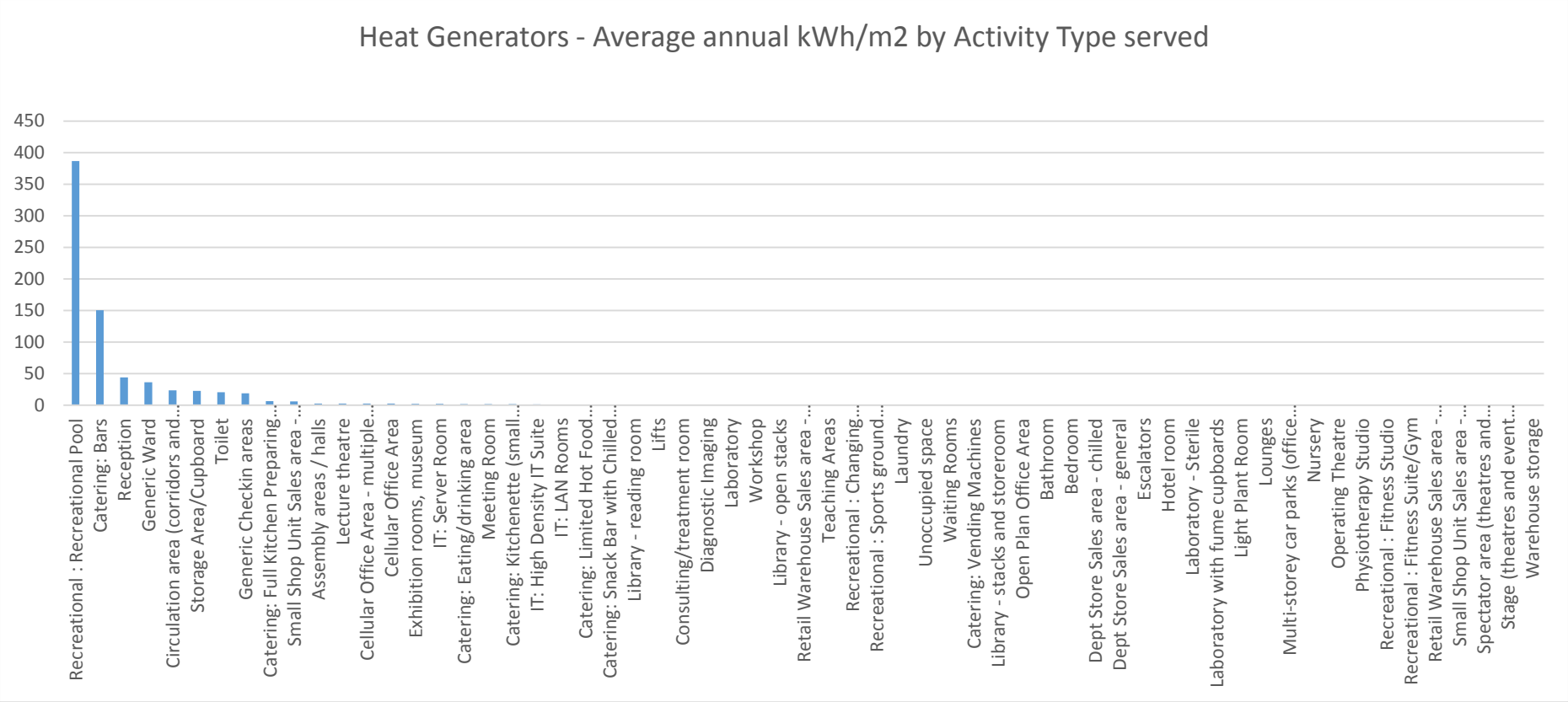

Figure 5 - Heat Generators - Average annual kWh/m2 by Activity Type served

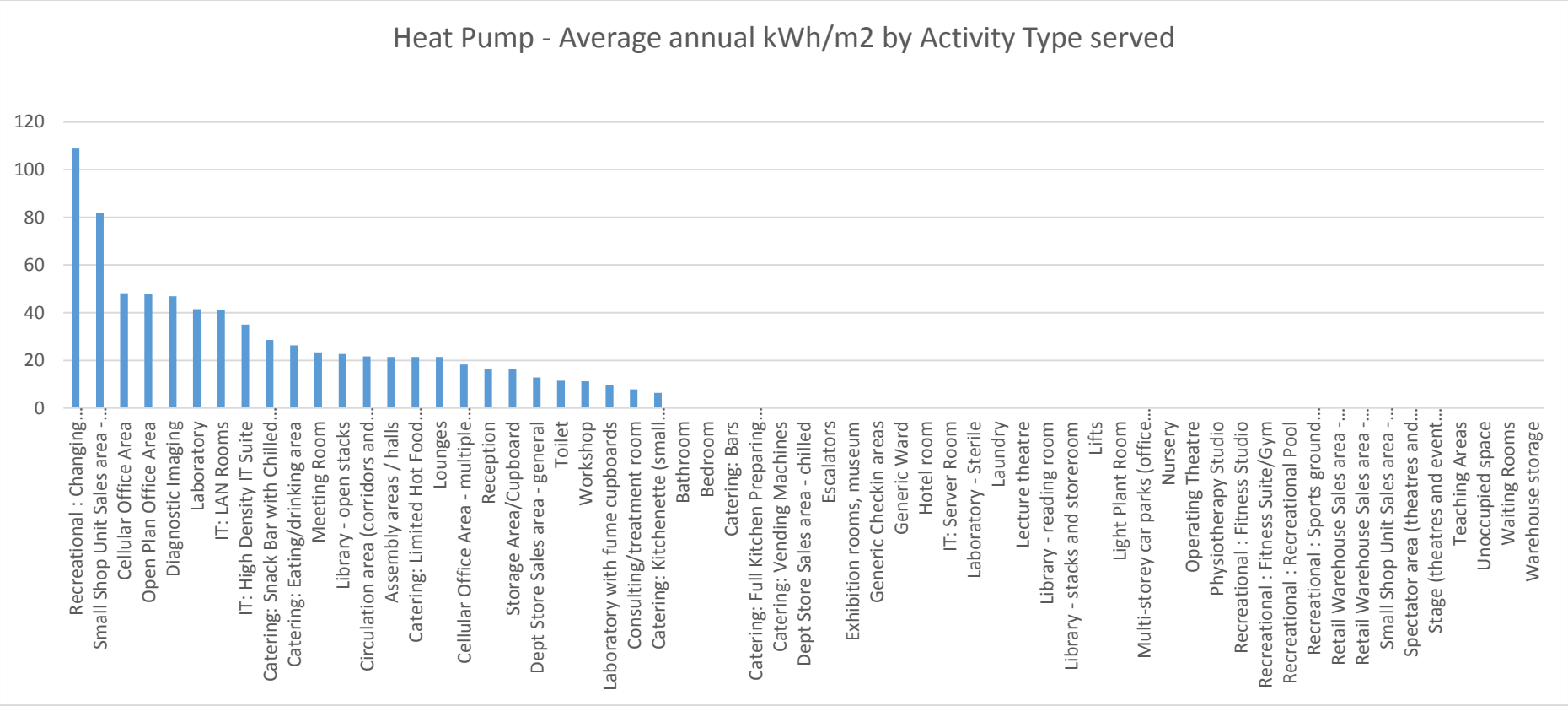

Figure 6 - Heat Pump - Average annual kWh/m2 by Activity Type served

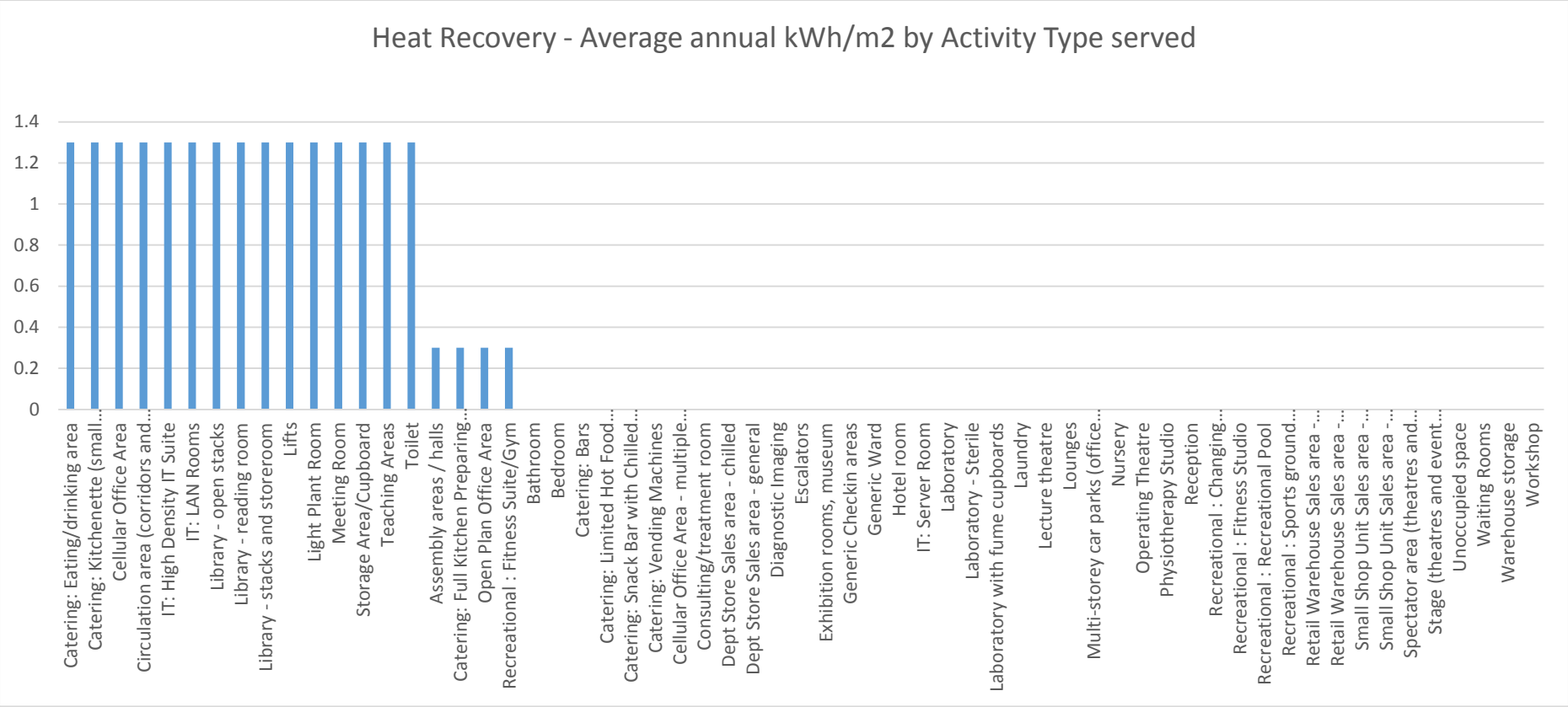

Figure 7 - Heat Recovery - Average annual kWh/m2 by Activity Type served

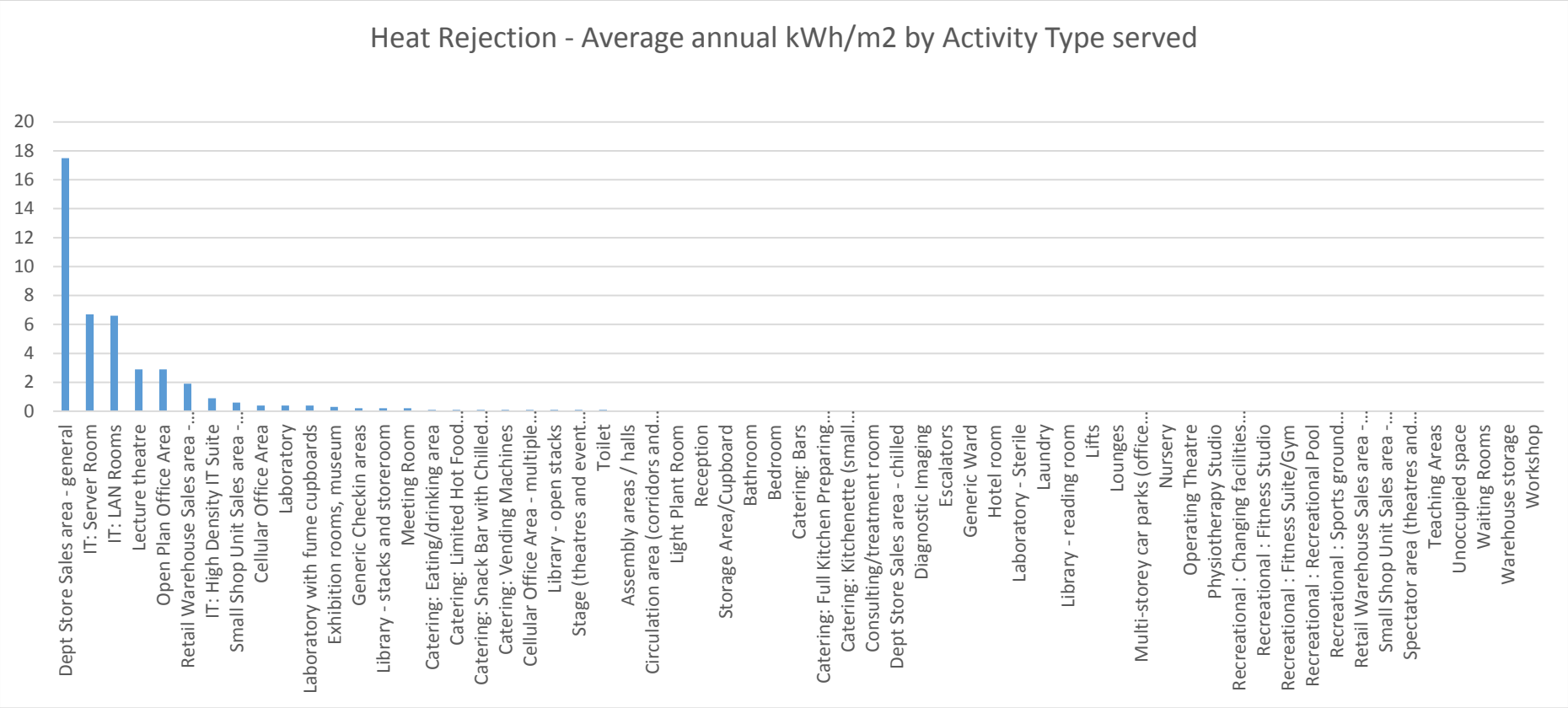

Figure 8 - Heat Rejection - Average annual kWh/m2 by Activity Type served

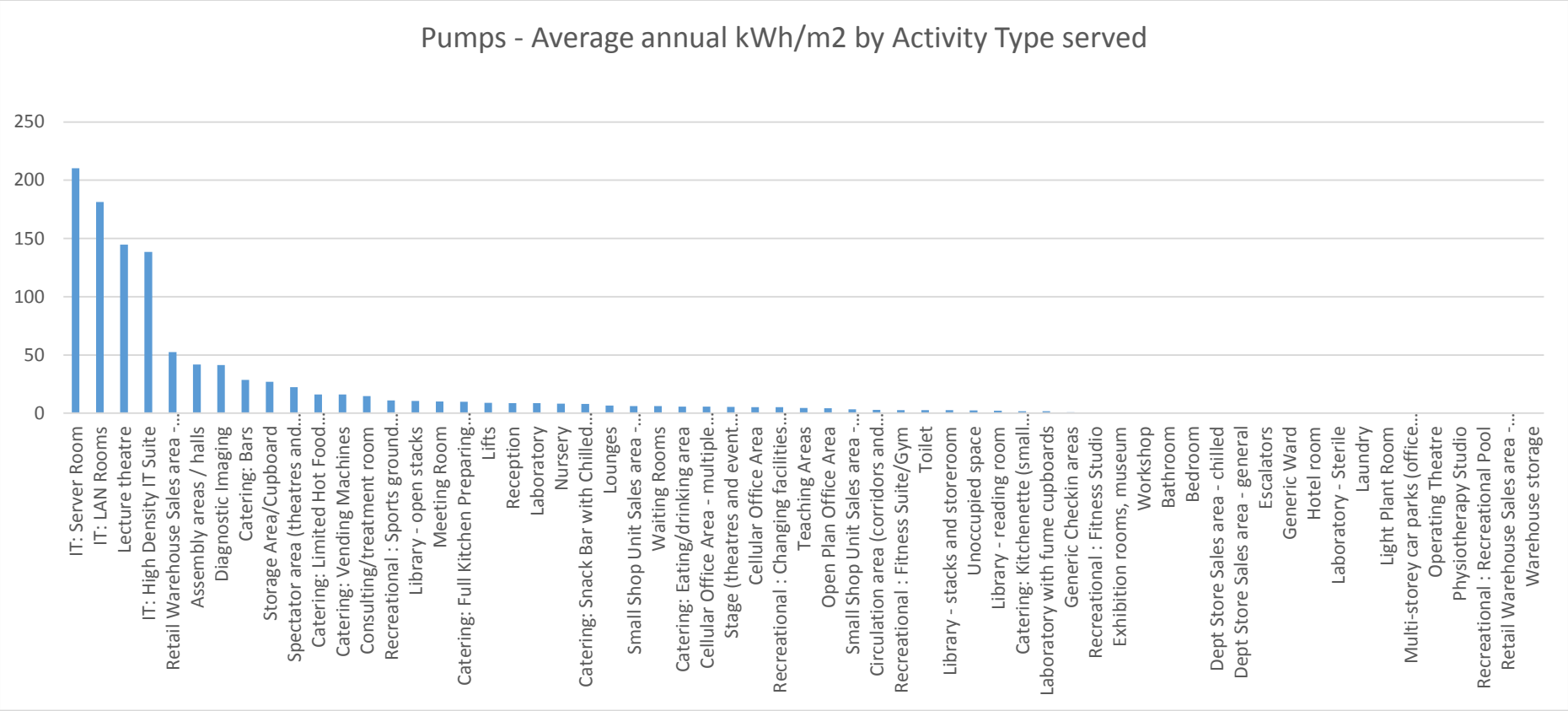

Figure 9 - Pumps - Average annual kWh/m2 by Activity Type served

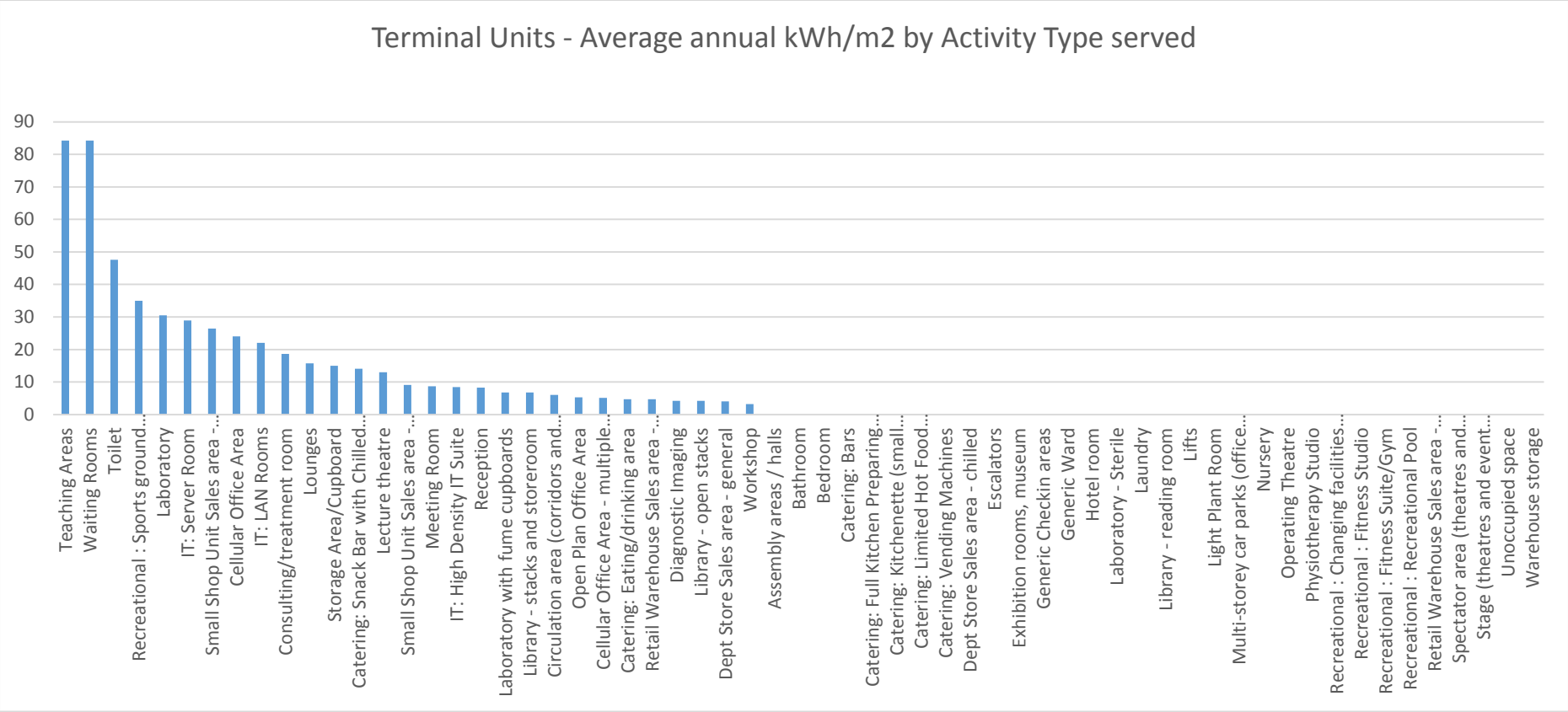

Figure 10 - Terminal Units - Average annual kWh/m2 by Activity Type served

3.1 Air Handling Units in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for the Air Handling Unit sub-components shown in each column.

Table 4 – Air Handling Units sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	Extract only		Supply and extract		Supply and extract with heating and cooling variants, etc		Supply only		Supply with heating and cooling variants	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Assembly areas / halls	66.7		133.8	131.8	0.6	1.1	34.6	45.4		
Bathroom	4.9	4.4								
Bedroom	1.5				21.0	16.0				
Catering: Bars	34.7	1.5					34.7	1.5		
Catering: Eating/drinking area	19.1	19.5	9.8		30.0	34.9	12.6	12.8	16.1	1.0
Catering: Full Kitchen Preparing Hot Meals	247.5	381.5	166.8	288.6	28.6	61.8	187.2	242.3		
Catering: Kitchenette (small appliances, fridge and sink)	7.6	4.0	43.2	4.0	31.0	30.6			19.3	
Catering: Limited Hot Food Preparation Area	80.2	41.0	21.1		51.0	77.0	41.0	48.4		
Catering: Snack Bar with Chilled Cabinets	42.4	5.0			42.3	44.8	34.0	19.5		
Catering: Vending Machines	18.6	-			100.0		17.2	3.2		
Cellular Office Area	4.1	5.4			29.8	56.7	3.9	5.4	9.2	0.0
Cellular Office Area - multiple occupation	35.0	38.5			31.9	66.6	23.6	34.8	0.4	-
Circulation area (corridors and stairways)	11.2	25.1	8.0	2.0	10.1	20.5	14.8	29.4	3.5	0.0
Consulting/treatment room					6.1	2.4				
Dept Store Sales area - chilled	56.6	31.1					55.1	37.9		
Dept Store Sales area - general	16.7	9.8			38.1	36.5	17.6	5.0	35.7	20.4
Diagnostic Imaging					102.8	139.1				
Escalators					2.6	1.3	1.8			
Exhibition rooms, museum					5.4	0.6				
Generic Checkin areas					14.5					
Generic Ward	30.5				16.3	4.8				
IT: High Density IT Suite	33.3				68.3	127.0	10.0		33.3	
IT: LAN Rooms	5.9	4.8			49.6	99.1	10.9	15.7	3.0	4.6
IT: Server Room	20.2	29.6			8.4	5.1	3.2	0.4		
Laboratory	93.9	90.5			55.5	143.3	9.9	-	157.9	
Laboratory - Sterile					19.1					
Laboratory with fume cupboards	29.8				473.5	298.3	9.9	-		
Laundry	118.7	105.4			22.4		80.4	55.6		
Lecture theatre	221.1	139.6			133.9	234.3	11.8		156.9	168.5
Library - open stacks	9.0	-			0.8	1.3	2.7		9.0	-
Library - reading room	58.6	38.2			9.0		71.0	35.6	14.6	9.7
Library - stacks and storeroom	9.4	0.3					3.1	0.2	9.2	
Lifts	3.5				1.1				3.5	
Light Plant Room	9.0	8.0			24.0	31.4	4.4	2.1	2.8	1.3
Lounges	42.7	60.3	7.4				38.7	60.7		
Meeting Room	19.7	14.1			31.7	38.7	14.2	13.8	3.5	6.4
Multi-storey car parks (office and private use)	0.3	-			0.1	0.0				
Nursery	2.4	2.3			1.2	1.3	4.5	-		
Open Plan Office Area	23.6	25.9	52.9	63.8	8.9	11.8	13.3	18.9	10.5	26.6
Operating Theatre	7.8	12.6			7.8	12.6				
Physiotherapy Studio					4.9					
Reception	0.8	0.3	9.8		3.5	2.6	1.8	2.1		
Recreational : Changing facilities with showers	46.4	11.3			28.4	12.7	39.2	-		
Recreational : Fitness Studio					20.5	1.5				
Recreational : Fitness Suite/Gym	249.5				0.1	0.0	249.5			
Recreational : Sports ground changing rooms					17.6	8.2	66.3	63.3		
Retail Warehouse Sales area - chilled					282.2					
Retail Warehouse Sales area - general	6.8	10.8			225.3		13.3	5.1		
Small Shop Unit Sales area - chilled	6.5	6.4					6.5	6.4		

Small Shop Unit Sales area - general	15.2	12.4	26.8	0.1			16.8	11.0		
Spectator area (theatres and event buildings)					73.0					
Stage (theatres and event buildings)	20.1	0.0			0.6	0.2	20.1	0.0		
Storage Area/Cupboard	20.5	15.5	14.5		18.5	29.2	10.3	12.0	4.8	0.0
Teaching Areas	62.1	73.6			8.3	8.6	5.2		10.1	
Toilet	16.6	18.4	37.8	64.6	23.4	24.9	7.6	11.5	5.7	0.0
Unoccupied space	5.3	4.9					1.1	0.2		
Waiting Rooms					9.6	1.7				
Warehouse storage	8.0	7.8			3.6	1.9	6.2	4.7		
Workshop	395.3	318.7			19.9	8.8	360.7	323.4		

3.2 *All in One Systems in EU – Electricity Average Annual Energy Consumption - kWh/m²*

The table shows the measured average and standard deviation annual energy use for all activity types for the All-in-one sub-components shown in each column.

Table 5 – All-in-one sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	ASHP Cooling Only		ASHP Reverse Cycle - Cooling Optimised	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Catering: Limited Hot Food Preparation Area	128.4		54.7	11.5
Catering: Snack Bar with Chilled Cabinets	128.4		54.7	11.5
Dept Store Sales area - general			44.8	22.5
IT: High Density IT Suite	149.7			
IT: Server Room	775.5	349.8		
Meeting Room	79.5	-	33.7	
Open Plan Office Area	31.7	-	53.3	11.5
Retail Warehouse Sales area - general			38.8	2.0
Small Shop Unit Sales area - general			54.7	11.5
Toilet			45.0	16.6

3.3 Cold Generators in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for the Cold Generator sub-components shown in each column.

Table 6 – Cold Generators sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	Absorption Chillers		Centrifugal Liquid Chillers		Direct evaporative cooler		Dry Coolers & Cooling Tower		Indirect evaporative cooler		Reciprocating Liquid Chillers		Screw Liquid Chillers		Scroll Liquid Chillers	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Assembly areas / halls							0.0	0.0					0.3	0.2		
Catering: Bars													66.1			
Catering: Eating/drinking area			52.5	36.2	60.7	30.1							38.8	62.9	10.3	
Catering: Full Kitchen Preparing Hot Meals							0.1	0.0					398.0	628.5		
Catering: Kitchenette (small appliances, fridge and sink)							0.2	0.0					8.6	5.3		
Catering: Limited Hot Food Preparation Area													1.2	0.7		
Catering: Snack Bar with Chilled Cabinets													0.4	0.3		
Catering: Vending Machines													8.4	13.8		
Cellular Office Area	0.0				41.1	13.8			46.5		4.7	-	33.1	44.7		
Cellular Office Area - multiple occupation											9.3		1.3	0.8		
Circulation area (corridors and stairways)	0.0						0.1	0.0			6.1		26.7	50.7	19.2	
Consulting/treatment room													0.9		52.8	
Dept Store Sales area - chilled															29.8	
Dept Store Sales area - general															73.3	
Diagnostic Imaging													19.9	-		
Escalators													1.1			
Exhibition rooms, museum											1.8	-				
Generic Checkin areas											6.0	-	68.3	-		
Hotel room													19.1	-		
IT: High Density IT Suite	0.8												115.2	143.8		
IT: LAN Rooms	1.7												48.6	31.1		
IT: Server Room					1,583.6	1,224.3					601.0		63.7	32.9		
Laboratory											16.2		25.7	34.0		
Laboratory with fume cupboards					16.2						16.2					
Lecture theatre	0.0		43.3	17.4									0.3			
Library - open stacks													0.4	0.2		
Library - reading room													0.4			
Library - stacks and storeroom											2.2		0.2	0.2		
Lifts													0.3			
Light Plant Room													0.7	1.5		
Lounges			62.5	43.1									225.1	195.4		
Meeting Room					54.2						7.1	3.5	19.0	36.0		
Nursery													86.9			
Open Plan Office Area	0.0		112.4	86.6			0.1	0.1					30.5	30.1	268.7	
Reception			11.3										0.8	0.5		
Recreational : Fitness Suite/Gym							0.0	0.0								
Small Shop Unit Sales area - chilled											8.0		3.3	0.3		
Small Shop Unit Sales area - general							0.2	0.1					62.6	73.5	61.9	48.7
Stage (theatres and event buildings)											11.3	-	163.4			
Storage Area/Cupboard									4.8				0.4	0.6	4.5	
Teaching Areas									9.5	0.0			0.9	1.4		
Toilet							0.1	0.0			1.4		5.0	10.3		
Waiting Rooms													1.1			
Warehouse storage													12.0	15.1		
Workshop													17.6	24.3		

3.4 Heat Generators in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for the Heat Generator sub-components shown in each column.

Table 7 – Heat Generators sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	Electric Boilers		Fuel Fired Boilers		Ground Source Heat Pump (GSHP)		Water Source Heat Pump (WSHP)	
Activity Name	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD
Assembly areas / halls			2.4	3.2				
Catering: Bars	423.1				18.8		8.5	
Catering: Eating/drinking area			0.8	1.9	18.8			
Catering: Full Kitchen Preparing Hot Meals			0.2	-	18.8			
Catering: Kitchenette (small appliances, fridge and sink)			1.2	1.9			8.5	
Catering: Limited Hot Food Preparation Area			0.8	2.0				
Catering: Snack Bar with Chilled Cabinets			0.8	1.1				
Catering: Vending Machines			0.0	-				
Cellular Office Area			1.0	1.9	18.8		8.5	
Cellular Office Area - multiple occupation			2.3	2.6				
Circulation area (corridors and stairways)	423.1		1.0	1.9				
Consulting/treatment room			0.6	-				
Diagnostic Imaging			0.6	-				
Exhibition rooms, museum			2.0	-				
Generic Checkin areas					18.8			
Generic Ward							36.2	
IT: High Density IT Suite			1.0	1.9				
IT: LAN Rooms			0.9	1.9				
IT: Server Room			2.0	3.0				
Laboratory			0.6	0.8				
Laundry			0.1	-				
Lecture theatre			2.4	3.9				
Library - open stacks			0.5	0.9				
Library - reading room			0.7	1.0				
Library - stacks and storeroom			0.0	0.0				
Lifts			0.7	0.9				
Meeting Room			1.2	2.1			8.5	
Open Plan Office Area			0.0	0.0				
Reception	423.1		1.9	2.4				
Recreational : Changing facilities with showers			0.2	0.2				
Recreational : Recreational Pool					386.4			
Recreational : Sports ground changing rooms			0.2	0.2				
Retail Warehouse Sales area - general			0.5	0.8				
Small Shop Unit Sales area - general			5.9	-				
Storage Area/Cupboard	423.1		1.5	2.8				
Teaching Areas			0.4	0.7				
Toilet	423.1		1.2	2.6				
Unoccupied space			0.1	-				
Waiting Rooms			0.1	-				
Workshop			0.6	0.8				

3.5 Heat Pumps in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for the Heat Pump sub-components shown in each column.

Table 8 – Heat Pump sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	ASHP Reverse Cycle - Cooling Optimised		ASHP Reverse Cycle - Heating Optimised		GSHP Reverse Cycle - Cooling Optimised		GSHP Reverse Cycle - Heating Optimised	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Assembly areas / halls			21.4					
Catering: Eating/drinking area	28.6	6.0	21.4				25.8	-
Catering: Kitchenette (small appliances, fridge and sink)							6.4	-
Catering: Limited Hot Food Preparation Area			21.4					
Catering: Snack Bar with Chilled Cabinets	28.6	6.0						
Cellular Office Area	51.2	144.8					7.7	-
Cellular Office Area - multiple occupation	58.2						8.3	-
Circulation area (corridors and stairways)	28.6	6.0	21.4				16.6	-
Consulting/treatment room							7.9	-
Dept Store Sales area - general	10.7	26.5			286.7			
Diagnostic Imaging							46.9	-
IT: High Density IT Suite							35.0	-
IT: LAN Rooms	41.2							
Laboratory							41.5	56.1
Laboratory with fume cupboards							9.5	-
Library - open stacks			22.7					
Lounges			21.4					
Meeting Room	36.0	15.6					10.9	-
Open Plan Office Area	50.8	36.6	27.0					
Reception	28.6	6.0	21.4				6.4	-
Recreational : Changing facilities with showers							108.8	-
Small Shop Unit Sales area - general	99.5		282.9				26.9	-
Storage Area/Cupboard	28.6	6.0					7.4	-
Toilet			21.4				9.0	-
Workshop							11.2	-

3.6 Heat Recovery in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for the Heat Recovery sub-components shown in each column.

Table 9 – Heat Recovery sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	Run-around-coil Heat Recovery (Air/Water)	
Activity Name	**AVG kWh/m2.a**	**SD**
Assembly areas / halls	0.3	0.0
Catering: Eating/drinking area	1.3	
Catering: Full Kitchen Preparing Hot Meals	0.3	0.0
Catering: Kitchenette (small appliances, fridge and sink)	1.3	
Cellular Office Area	1.3	0.0
Circulation area (corridors and stairways)	1.3	0.0
IT: High Density IT Suite	1.3	
IT: LAN Rooms	1.3	
Library - open stacks	1.3	-
Library - reading room	1.3	
Library - stacks and storeroom	1.3	
Lifts	1.3	
Light Plant Room	1.3	0.0
Meeting Room	1.3	
Open Plan Office Area	0.3	0.0
Recreational : Fitness Suite/Gym	0.3	0.0
Storage Area/Cupboard	1.3	0.0
Teaching Areas	1.3	
Toilet	1.3	0.0

3.7 Heat Rejection in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for the Heat Rejection sub-components shown in each column.

Table 10 – Heat Rejection sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	Air condensers		Closed Circuit Cooling Towers		Forced air condensers		Mechanical Draft Towers		Open Circuit Cooling Towers	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Assembly areas / halls					0.0	0.0				
Catering: Eating/drinking area					0.1	0.0				
Catering: Limited Hot Food Preparation Area					0.1	0.0				
Catering: Snack Bar with Chilled Cabinets					0.1	0.0				
Catering: Vending Machines					0.1	0.0				
Cellular Office Area			1.2		0.1	0.1				
Cellular Office Area - multiple occupation					0.0	0.0	0.3			
Circulation area (corridors and stairways)					0.0	0.0	0.2		0.0	-
Dept Store Sales area - general	17.5	-								
Exhibition rooms, museum					0.3					
Generic Checkin areas					0.2					
IT: High Density IT Suite			2.6		0.1	0.1				
IT: LAN Rooms	7.3	2.1	15.3		0.5	0.3				
IT: Server Room	12.2	7.4			2.5	2.2				
Laboratory							0.4			
Laboratory with fume cupboards					0.4		0.4			
Lecture theatre			2.9							
Library - open stacks					0.1	0.1				
Library - stacks and storeroom					0.1	0.1	0.6			
Light Plant Room					0.0	0.0				
Meeting Room					0.2	0.2				
Open Plan Office Area	3.6	4.6			0.1	0.0			0.0	-
Reception					0.0	0.0				
Retail Warehouse Sales area - general	1.9									
Small Shop Unit Sales area - chilled					0.6					
Stage (theatres and event buildings)					0.1					
Storage Area/Cupboard					0.0	0.0				
Toilet					0.0	0.0	0.3			

3.8 Pumps in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for Pump sub-components shown in each column.

Table 11 – Pump sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

Activity Name	Chilled water primary pumps		Chilled water secondary pumps		Condenser water pumps		DHW primary pumps		DHW secondary (circulation) pumps		Hot water primary pumps		Hot water secondary pumps	
	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD	AVG kWh/m2.a	SD
Assembly areas / halls	5.0	1.8	5.7	8.2							12.6	8.4	110.4	209.1
Catering: Bars													28.6	12.8
Catering: Eating/drinking area	1.9	5.7	2.3	2.5					0.4		6.2	9.2	8.0	25.7
Catering: Full Kitchen Preparing Hot Meals	1.7	3.1	2.6	0.0							11.0	14.7	15.6	16.7
Catering: Kitchenette (small appliances, fridge and sink)	0.5	0.1	0.5	0.1	0.1	0.0			0.3	0.1	6.6	5.3	2.4	4.2
Catering: Limited Hot Food Preparation Area	0.9		6.1	0.0					0.1		4.8	2.8	26.1	53.1
Catering: Snack Bar with Chilled Cabinets	0.6		3.8	3.3					0.1		2.3	1.3	11.0	35.3
Catering: Vending Machines			6.1						0.1		2.1		19.6	37.9
Cellular Office Area	0.3	0.4	3.7	2.7	0.2	-	0.4	-	0.3	0.1	2.1	3.9	14.1	27.7
Cellular Office Area - multiple occupation	0.5	-	1.7	2.4							1.2	0.1	7.2	16.7
Circulation area (corridors and stairways)	0.4	0.2	0.7	1.0	0.1	0.0	0.4	0.0	0.3	0.1	4.0	4.4	5.1	14.7
Consulting/treatment room											14.8	-	14.8	-
Diagnostic Imaging											41.3	-	41.3	-
Exhibition rooms, museum	0.2	-	0.5	-	0.2	-							0.1	-
Generic Checkin areas	0.6	-	1.3	-	0.2	-								
IT: High Density IT Suite			75.7						0.4		104.7	79.2	161.5	408.2
IT: LAN Rooms			75.7	0.0					0.4		51.3	42.0	220.3	426.0
IT: Server Room	15.9		137.1	66.1	0.4						33.1	28.3	436.6	822.1
Laboratory	4.1	4.5	1.8	-			0.4	-	0.3	0.0	16.0	16.5	9.9	17.9
Laboratory with fume cupboards	1.5	-	1.8	-					0.2		4.0	1.3	1.1	-
Lecture theatre	46.0	57.6									414.3	586.8	97.5	299.2
Library - open stacks	0.9		6.1						0.8		3.7	3.0	15.4	44.3
Library - reading room									0.4		2.3	1.1	2.1	2.0
Library - stacks and storeroom	0.2	-	0.7	0.9					0.4		0.6	0.4	5.3	16.1
Lifts									0.4		11.0	6.5	9.0	10.2
Lounges	8.0	11.9							0.1		10.5	10.7	6.3	3.8
Meeting Room	0.8	0.3	3.2	2.3	0.2	0.1			0.4		6.6	6.5	15.0	28.5
Nursery													8.2	2.3
Open Plan Office Area	3.2	10.0	0.9	1.3	0.1	0.0					8.1	12.9	7.0	20.4
Reception	0.7	0.2	3.3	2.4							7.0	7.2	11.6	29.6
Recreational : Changing facilities with showers											7.8	2.6	4.6	2.7

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Recreational : Fitness Studio									0.1		0.7			
Recreational : Fitness Suite/Gym	1.0		0.4	0.0							3.3		6.5	4.0
Recreational : Sports ground changing rooms									0.2		6.3	3.7	15.3	30.3
Retail Warehouse Sales area - general											96.3	83.5	36.1	61.6
Small Shop Unit Sales area - chilled	4.1		9.5		0.4								2.7	2.4
Small Shop Unit Sales area - general	0.9	0.6	1.2	0.5	0.1	0.0					8.1	2.6	11.0	11.0
Spectator area (theatres and event buildings)													22.3	0.0
Stage (theatres and event buildings)	0.6	-	1.3	-	0.2	-			0.1		1.1		8.0	0.0
Storage Area/Cupboard	0.2	0.3	3.3	3.0							35.6	89.1	33.3	65.6
Teaching Areas	1.5						0.4	-	0.3	0.1	8.2	6.1	5.2	6.3
Toilet	0.3	0.2	0.8	1.2	0.1	0.0	0.4		0.3	0.2	2.4	5.1	5.0	14.9
Unoccupied space											7.7		1.6	0.5
Waiting Rooms											7.7		5.9	4.9
Workshop									0.1					

3.9 Terminal Units in EU – Electricity Average Annual Energy Consumption - kWh/m²

The table shows the measured average and standard deviation annual energy use for all activity types for Terminal Unit sub-components shown in each column.

Table 12 – Terminal Unit sub-components in EU – Electricity Average and Standard Deviation Annual Energy Consumption - kWh/m².

	DX indoor unit		Fan Coils – 2 or 4 tubes		VRV/VRF indoor unit	
Activity Name	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**	**AVG kWh/m2.a**	**SD**
Catering: Eating/drinking area			4.7	4.4		
Catering: Snack Bar with Chilled Cabinets			14.1	14.0		
Cellular Office Area	22.7	14.0	39.4	24.9	1.8	-
Cellular Office Area - multiple occupation	4.2	0.0	6.8			
Circulation area (corridors and stairways)	4.9	-	6.1	4.8		
Consulting/treatment room			18.6	23.3		
Dept Store Sales area - general	4.0	7.5	14.3	-	2.4	3.0
Diagnostic Imaging			4.2			
IT: High Density IT Suite	8.4	0.0	8.4	0.0		
IT: LAN Rooms	22.0	9.1				
IT: Server Room	31.1	19.4	15.9			
Laboratory	29.0	1.1	30.5	11.7		
Laboratory with fume cupboards			6.8			
Lecture theatre			13.0	9.7		
Library - open stacks			4.2			
Library - stacks and storeroom			6.8			
Lounges			15.7	-		
Meeting Room			8.7	5.5		
Open Plan Office Area	6.8	16.9	5.2	4.7	0.4	1.0
Reception			8.3	10.1		
Recreational : Sports ground changing rooms			35.0			
Retail Warehouse Sales area - general	5.1	2.7	3.3	0.0		
Small Shop Unit Sales area - chilled			9.1			
Small Shop Unit Sales area - general			26.4			
Storage Area/Cupboard			15.0	21.5		
Teaching Areas			84.2	0.0		
Toilet	88.3		6.8			
Waiting Rooms			84.2	0.0		
Workshop			3.2	1.5		

4 Summary of measured electrical power demands by HVAC Component and sub-component type servicing a given activity

This section contains a table for each activity type for which we have data, summarising the range of electrical power demands found across all the HVAC component types monitored in iSERVcmb.

A summary of the measured average and standard deviation power demands by component and activity type is shown in Table 13. Values in brackets indicate the standard deviation found from this average. This data can be used to estimate the likely power demand to be to be incurred by the HVAC component while servicing this type of activity across Europe. The more detailed tables that follow Table 13 also show the annual average, maximum and minimum power demands found for this equipment servicing the specific activity noted.

Zero figures are excluded from the minima i.e. the minima shows how little power might be drawn by energised equipment, and the average is also drawn only from those readings when the equipment is operational.

Table 13 – Benchmarks for measured Average and Standard Deviation Power Demands in W/m² Summary by HVAC Component and Activity Type for EU

		Air Handling Units		All in One Systems		Cold Generators		Dehumidification		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
Activity Name	**Sample Size**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**	**AVG W/m²**	**SD**
Assembly areas / halls	23	2.37	3.55			0.43	0.46			0.00	0.00	3.23		0.04	0.00	0.01	0.00	1.92	3.74		
Bathroom	6	0.55	0.38			3.92															
Bedroom	24	6.79	0.83			7.53	6.31														
Catering: Bars	11	3.75	1.03			9.63				1.71	0.33							3.66	1.69		
Catering: Eating/drinking area	102	4.21	6.42	0.02		5.45	7.80			0.11	0.42	3.36	0.91	0.16		3.03	7.39	0.53	0.78	0.71	1.87
Catering: Full Kitchen Preparing Hot Meals	139	13.54	22.14	9.10	1.19	19.97	40.76			0.33	0.78			0.04	0.00	0.05	0.00	0.68	1.04		
Catering: Kitchenette (small appliances, fridge and sink)	38	18.47	47.76			1.07	2.72			0.25	0.51	0.77	-	0.16		0.01	-	0.44	0.55		
Catering: Limited Hot Food Preparation Area	99	7.81	7.72	10.62	2.79	5.64	5.13			2.93	10.91	3.23				0.01	0.00	0.79	0.87	0.06	0.10
Catering: Snack Bar with Chilled Cabinets	39	6.13	5.88	10.62	2.78	1.48	1.00			0.20	0.27	3.75	1.58			0.02	0.00	0.45	0.34	0.23	0.81
Catering: Vending Machines	15	2.36	2.79			1.23	1.49			0.00	-					0.02	0.00	0.75	0.51	0.14	-
Cellular Office Area	237	1.55	3.27			4.64	4.78	0.01		0.29	0.61	8.58	33.96	0.16	0.00	0.02	0.04	0.28	0.53	29.53	105.79
Cellular Office Area - multiple occupation	119	5.79	8.07	9.10	1.19	2.40	2.34			0.20	0.27	1.07	0.53			5.61	7.04	0.26	0.40	0.31	0.02
Circulation area (corridors and stairways)	453	1.60	4.01	0.76	-	3.45	5.51	0.01		0.06	0.15	2.81	1.23	0.16	0.00	1.00	2.60	0.51	0.75	0.29	1.21
Consulting/treatment room	90	2.06	1.57			4.97	4.69			0.03	0.03	0.95	-			1.41	2.80	0.56	0.66	1.82	5.03
Dept Store Sales area - chilled	43	6.58	5.56			13.59	9.51														
Dept Store Sales area - general	199	4.34	4.76	9.16	6.18	4.36	3.32					1.40	1.72			0.83	0.98	1.44	0.99	0.52	0.81
Diagnostic Imaging	21	13.06	14.55			4.92	3.06			0.06	-	5.65	-					3.44	1.55	2.37	
Exhibition rooms, museum	20	8.59	2.34			1.44	1.26			0.50	-					0.05		0.19	0.16		
Generic Checkin areas	37	0.32	0.66			6.56	8.01			1.91		1.17	0.91			0.03		0.07	0.07		
Generic Ward	8	16.10	26.23			8.85	9.28			6.90	1.74										
Heavy Plant Room	5	0.17	0.13			0.02	0.00														
Industrial process area	17	0.51																			
IT: High Density IT Suite	39	5.78	3.65	17.55		16.74	13.38			0.07	0.16	4.21	-	0.16		0.05	0.09	8.13	12.09	1.65	

		Air Handling Units		All in One Systems		Cold Generators		Dehumidification		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
IT: LAN Rooms	41	3.28	6.19	4.65		100.84	196.37			0.06	0.15			0.16		0.56	0.48	7.57	11.64	2.37	1.15
IT: Server Room	112	5.44	9.37	53.66	49.38	175.82	221.49			0.07	0.13	0.50	0.20			4.11	12.10	23.94	41.39	6.01	11.36
Laboratory	87	33.50	33.20			21.54	34.04			0.13	0.21	6.78	10.76			0.11		1.16	1.71	29.39	103.39
Laboratory - Sterile	2	5.83																1.48	-		
Laboratory with fume cupboards	16	37.05	27.92			7.66	1.32					1.15	-			0.13	0.03	0.71	0.62		
Laundry	22	16.76	15.85							0.01	-										
Lecture theatre	56	17.58	19.99			2.88	5.17			0.25	0.38					0.08	0.13	12.18	30.69	3.80	-
Library - open stacks	19	0.97	0.58			0.20	0.24			0.12	0.22	6.64	4.75	0.16	-	0.02	0.00	0.42	0.91		
Library - reading room	20	5.06	3.63			3.81	7.15			0.17	0.26	6.13	5.47	0.16				0.27	0.25		
Library - stacks and storeroom	12	6.74	14.08			0.24	0.44	0.01	0.00	0.00	0.00			0.16		0.06	0.07	0.12	0.30		
Lifts	46	0.79	0.50			0.42	0.31			0.10	0.20			0.16		0.00	0.00	0.81	0.93		
Light Plant Room	128	1.61	4.61			0.06	0.13							0.16	0.00	0.00	0.00	0.18	0.07		
Lounges	52	4.67	6.61			8.11	13.52			0.00	0.00	3.23				0.01	-	0.69	0.80	1.54	0.62
Meeting Room	95	5.74	7.40	18.98	12.92	6.76	13.04			0.27	0.54	3.19	2.90	0.16		0.89	2.23	0.79	1.34	7.64	14.09
Multi-storey car parks (office and private use)	17	0.01	0.00																		
Nursery	25	1.67	1.88			12.67												1.05	0.30	3.14	0.05
Open Plan Office Area	298	4.90	12.41	7.95	1.58	5.81	7.72			0.03	0.08	6.02	5.67	0.04	0.00	2.79	3.91	0.71	0.95	0.95	5.75
Operating Theatre	29	20.48	9.69			7.57	0.10														
Physiotherapy Studio	4	2.99				13.73	0.17														
Post Mortem Facility	3					7.57	0.10														
Reception	95	0.80	1.49	0.53	-	1.87	2.13			0.11	0.21	1.86	1.70			0.51	1.29	0.44	0.78	1.66	4.31
Recreational : Changing facilities with showers	69	11.61	18.93							0.02	0.02	#####	-					0.37	0.33	0.64	-
Recreational : Fitness Studio	3	2.48	1.43	28.06		2.30	1.39			0.00	-					0.01	-	0.09	0.08		
Recreational : Fitness Suite/Gym	7	8.24	13.69	28.06		1.73	1.59			0.00	0.00			0.04	0.00	0.01	0.00	0.21	0.32		
Recreational : Recreational Pool	1									39.28											
Recreational : Sports ground changing rooms	10	11.85	12.35	39.32						0.01	0.02							0.49	0.62	1.88	5.27
Retail Warehouse Sales area - chilled	21	4.30	11.32			3.35	0.44											2.17	2.24	0.76	0.10
Retail Warehouse Sales area - electrical	9	1.49	2.03																		
Retail Warehouse Sales area - general	82	1.37	2.49	11.40	15.55	2.10	2.29			0.04	0.05	0.54	-			0.31	0.13	3.50	4.29	0.76	0.82
Small Shop Unit Sales area - chilled	14	0.81	0.63			0.89	0.89									0.13		0.51	0.52	2.17	
Small Shop Unit Sales area - electrical	2	4.40	-			6.52															
Small Shop Unit Sales area - general	84	1.95	1.37	9.95	2.21	8.38	8.55					6.65	10.04			0.92	-	0.91	1.41	9.67	5.79
Spectator area (theatres and event buildings)	3	5.84				2.74	1.19											1.20	0.89	6.74	
Stage (theatres and event buildings)	14	2.23	0.91			9.16	12.70									0.02		0.71	0.46		
Storage Area/Cupboard	236	2.99	6.38			0.87	1.21			0.11	0.28	2.11	1.79	0.16	0.00	0.18	0.44	1.41	4.82	3.16	10.55
Teaching Areas	85	3.58	4.24			0.97	0.95			0.09	0.18			0.16				0.52	0.63		
Toilet	340	2.19	5.87	7.61	1.93	0.79	1.11			0.10	0.22	1.51	0.96	0.16	0.00	0.02	0.03	0.38	0.60	10.39	
Unoccupied space	24	0.40	0.54			0.68	0.33			0.01	-							0.39	0.40		
Waiting Rooms	14	2.39	1.93			2.81	6.23			0.01	0.00					0.01	-	0.31	0.43		
Warehouse storage	94	1.06	1.05			1.21	1.23									1.57	2.17			0.31	0.02
Workshop	40	44.09	39.92			5.07				0.13	0.21	1.35	-					0.02		1.18	

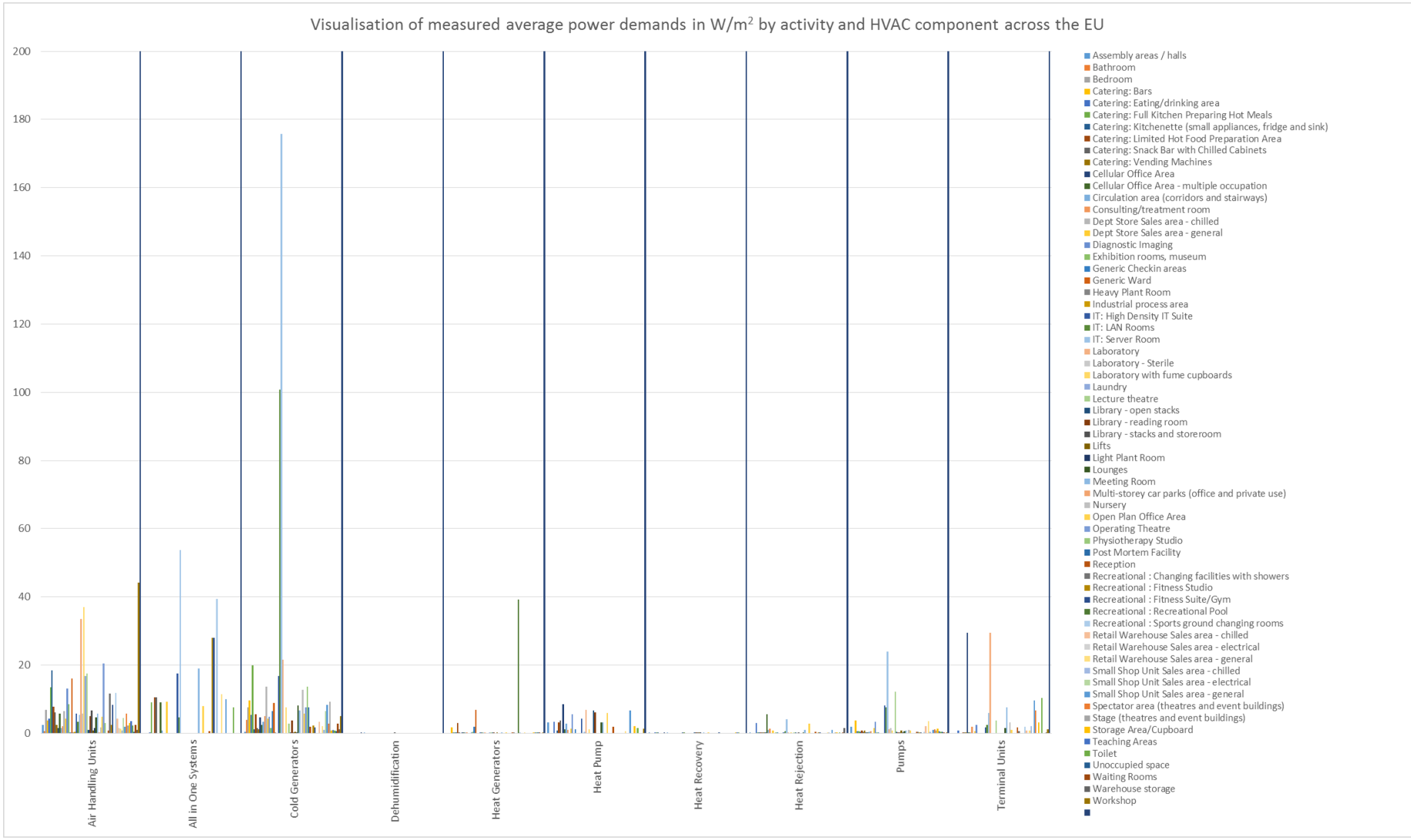

Figure 11 - Measured Overall Power Demand in W/m2 by HVAC Component type. Summary for EU

Figure 11 shows how the average power demand varies by HVAC component and activity served across the EU. It can be seen that the large majority of the power demand HVAC component: activity type combinations are less than 20 W/m^2 on average across the EU. Figure 11 is further broken down into individual HVAC components in Figure 12 to Figure 21, where the activities are rank ordered by their measured average power demands.

The following figures present this data by individual component type .The activities for each component are rank ordered to clarify which activities were measured as demanding the largest average power demand when the component was operational.

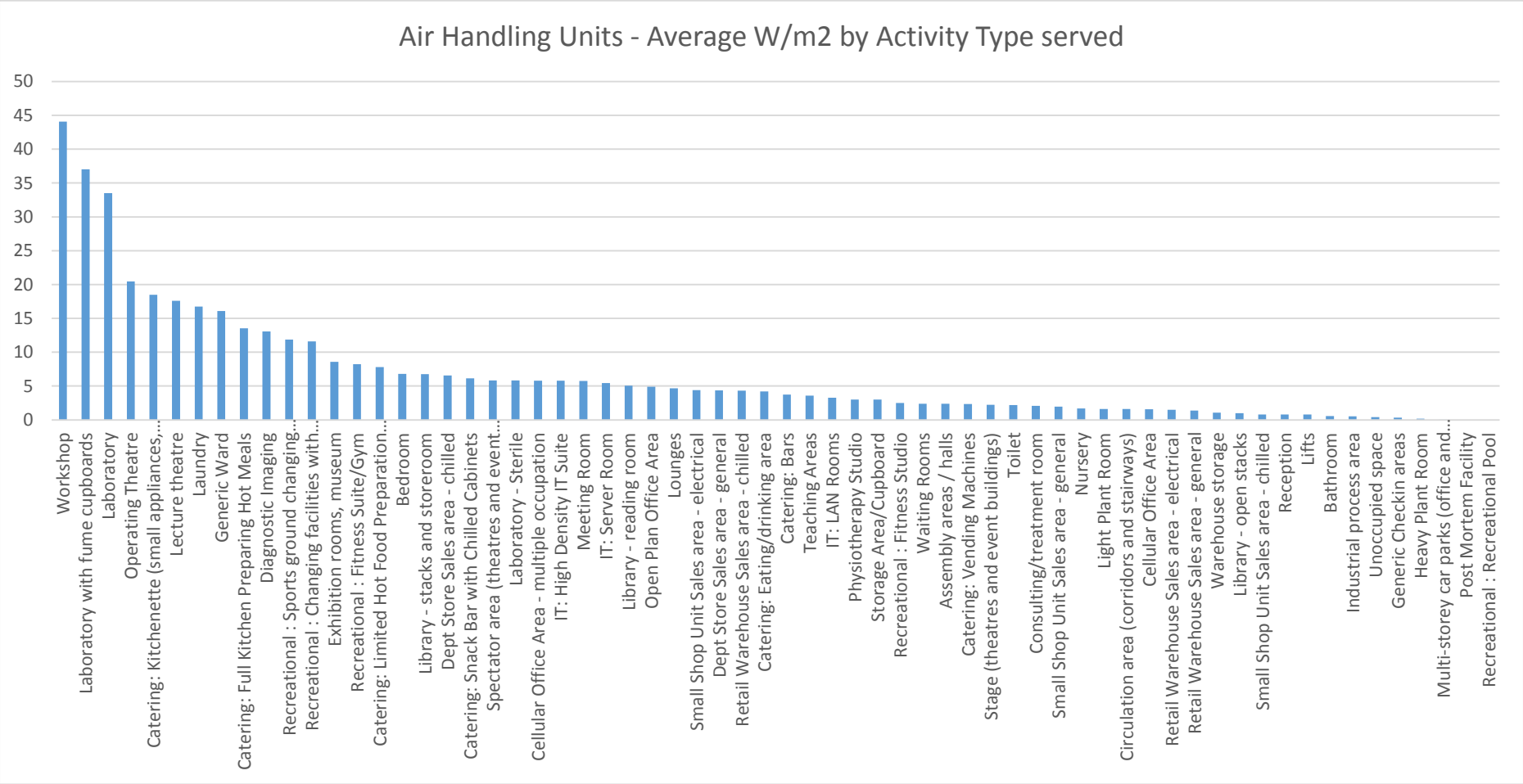

Figure 12 - Air Handling Units - Average W/m2 by Activity Type served

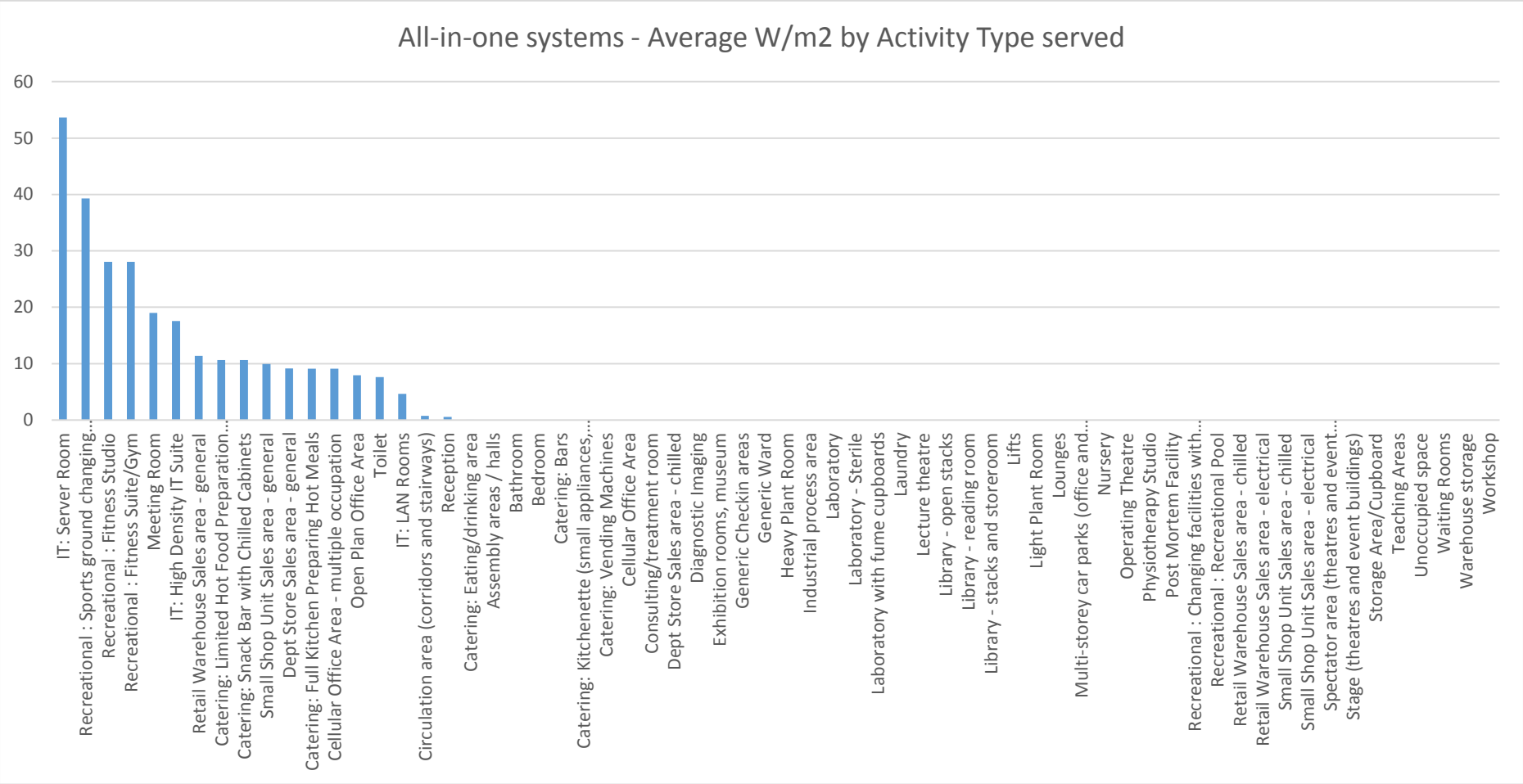

Figure 13 - All-in-one systems - Average W/m2 by Activity Type served

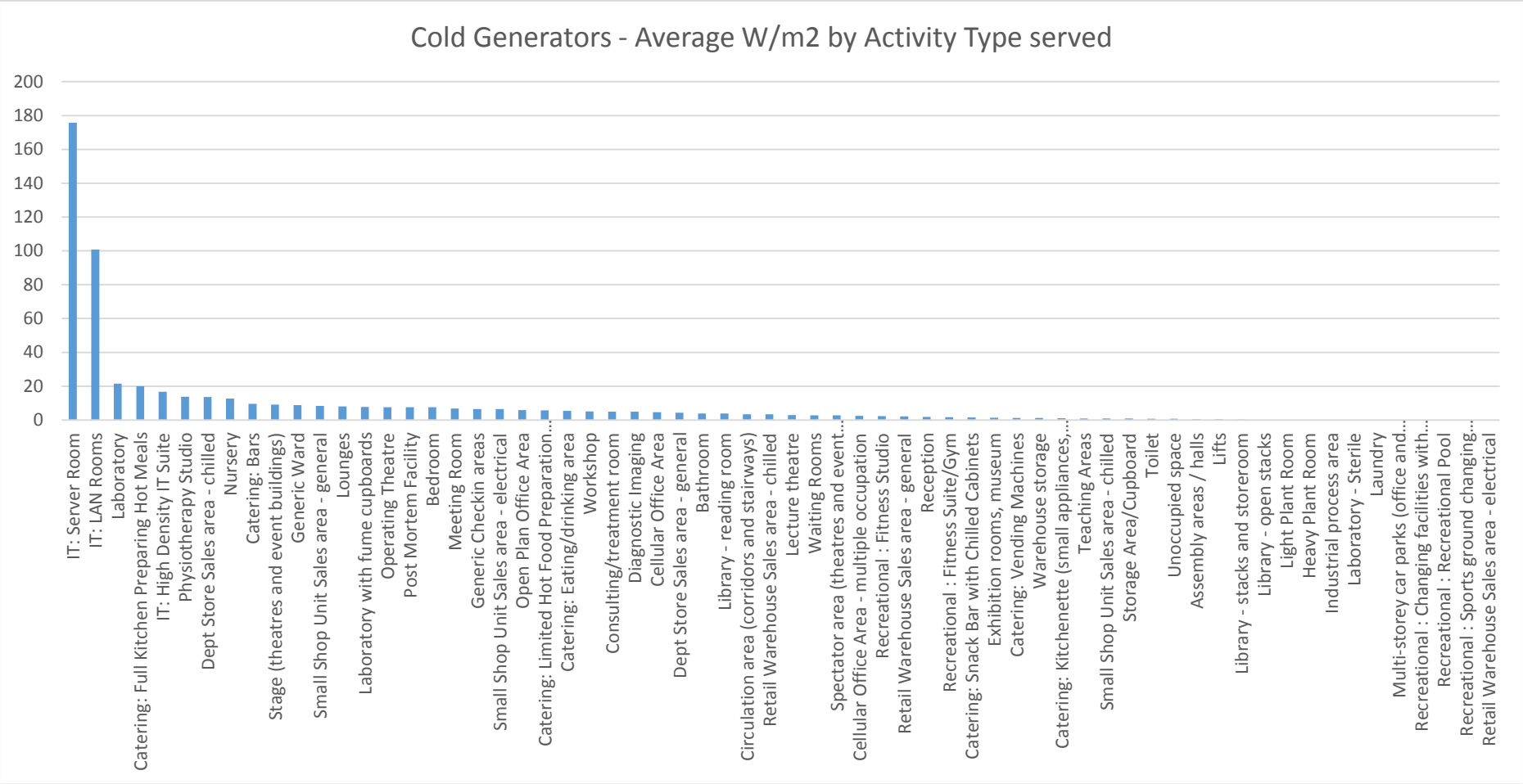

Figure 14 - Cold Generators - Average W/m2 by Activity Type served

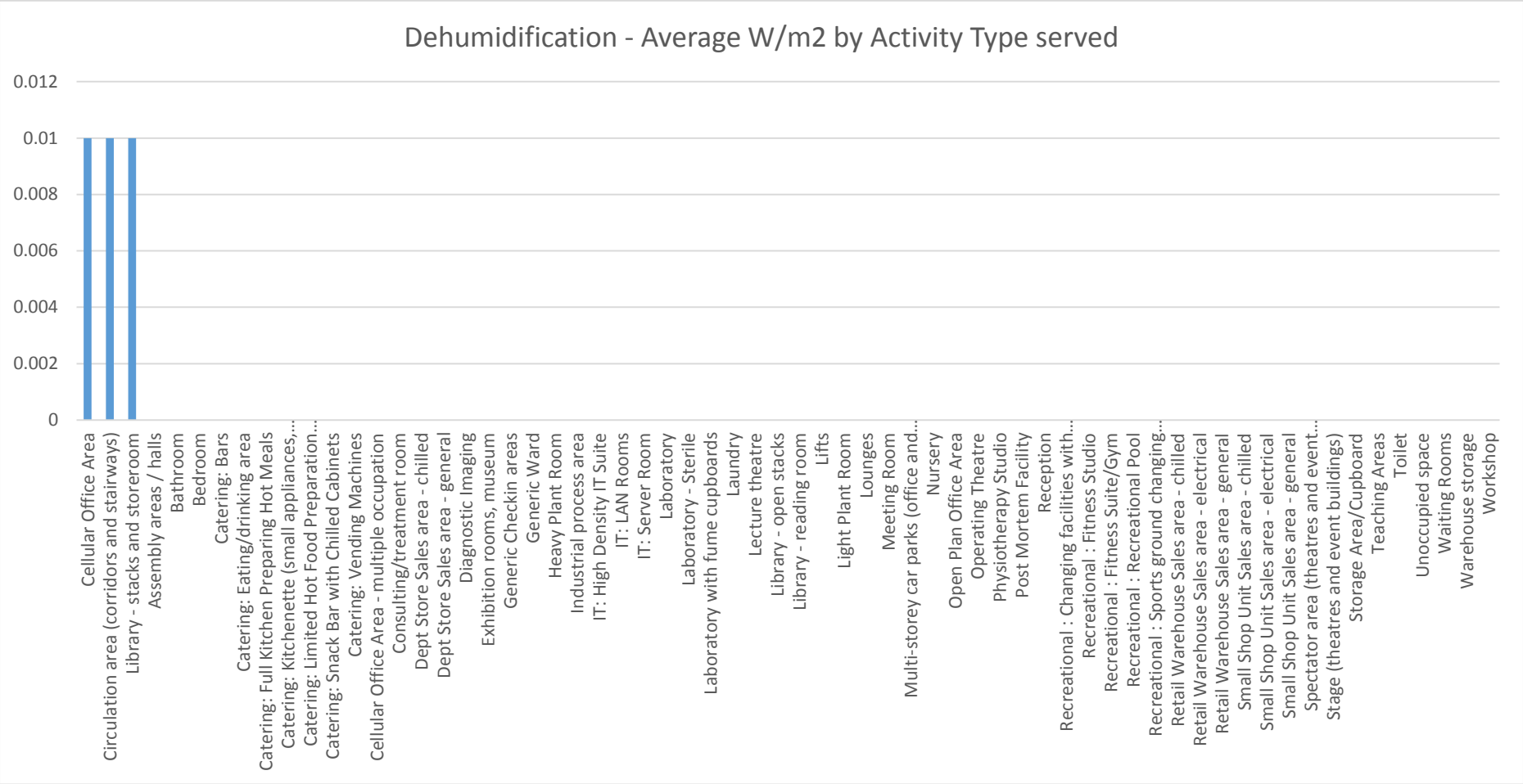

Figure 15 - Dehumidification - Average W/m2 by Activity Type served

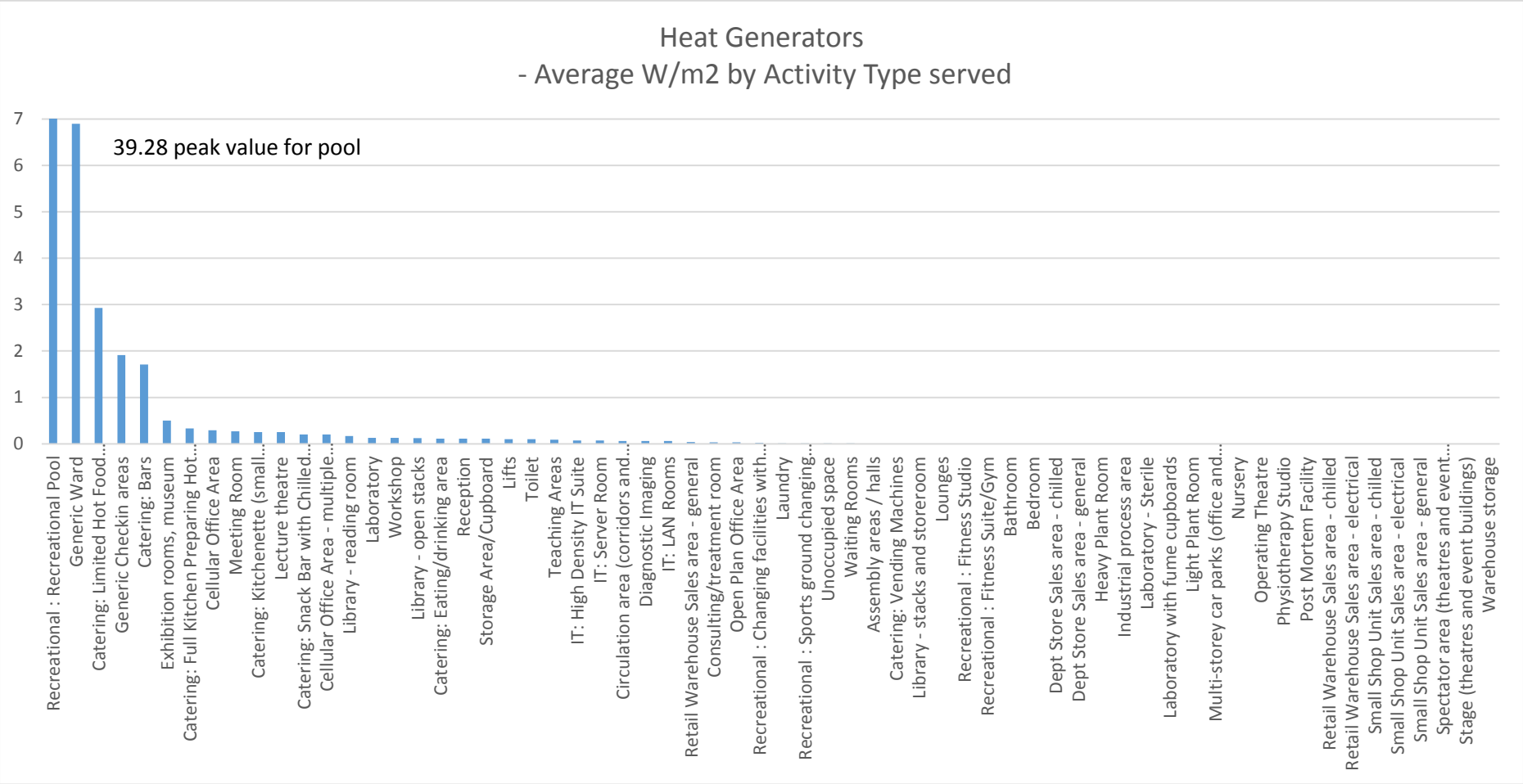

Figure 16 - Heat Generators – Average W/m² by Activity Type served

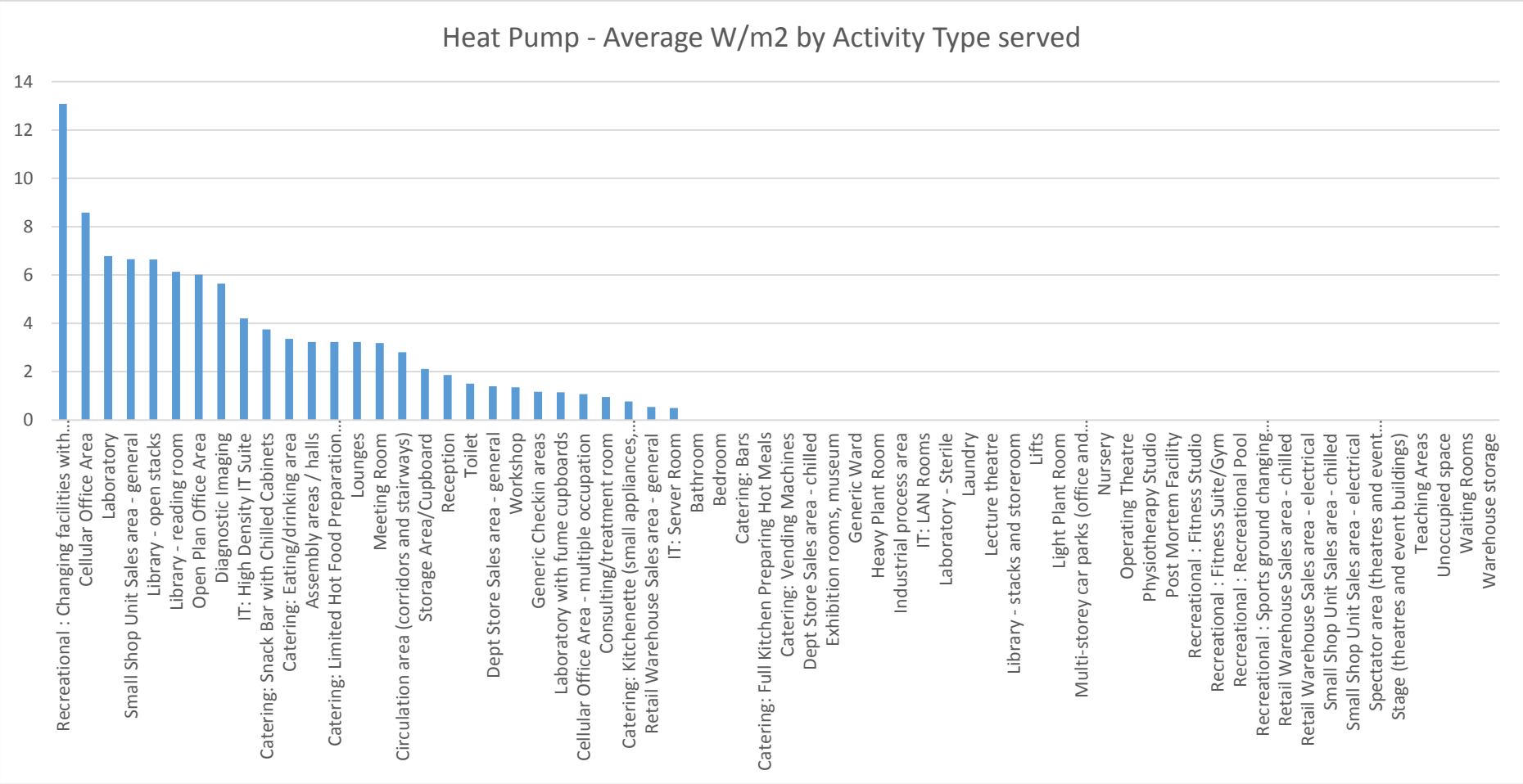

Figure 17 - Heat Pump - Average W/m2 by Activity Type served

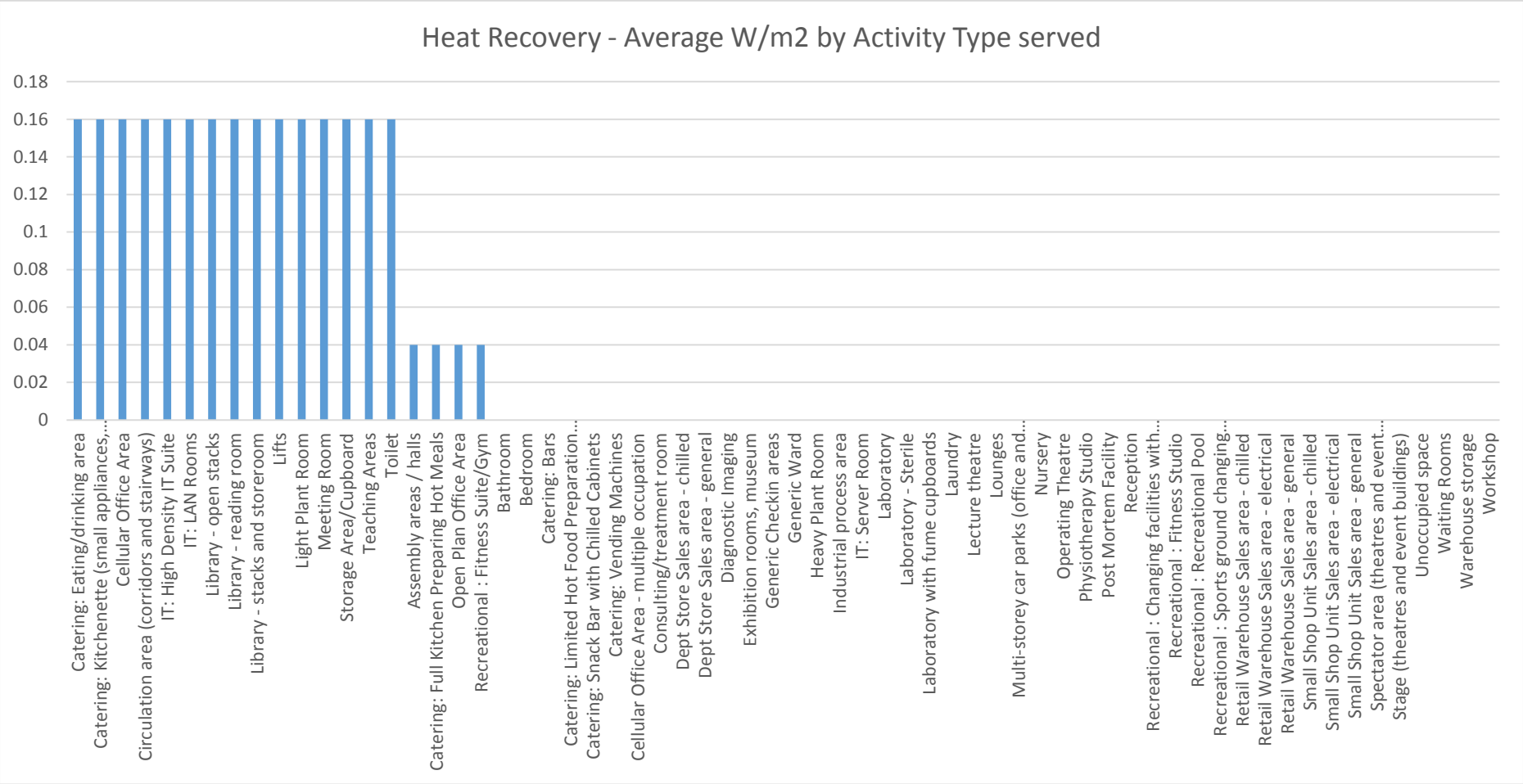

Figure 18 - Heat Recovery - Average W/m2 by Activity Type served

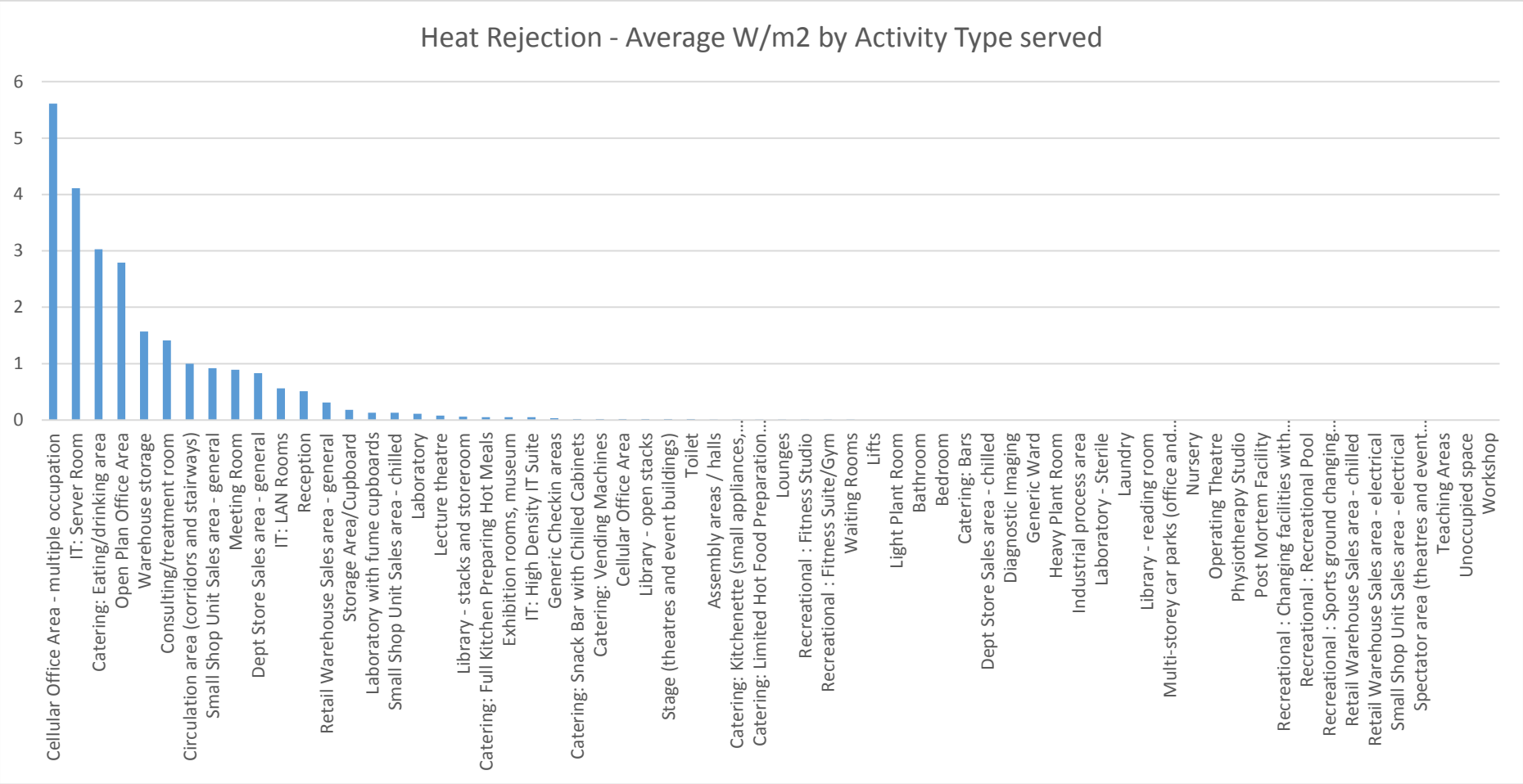

Figure 19 - Heat Rejection - Average W/m2 by Activity Type served

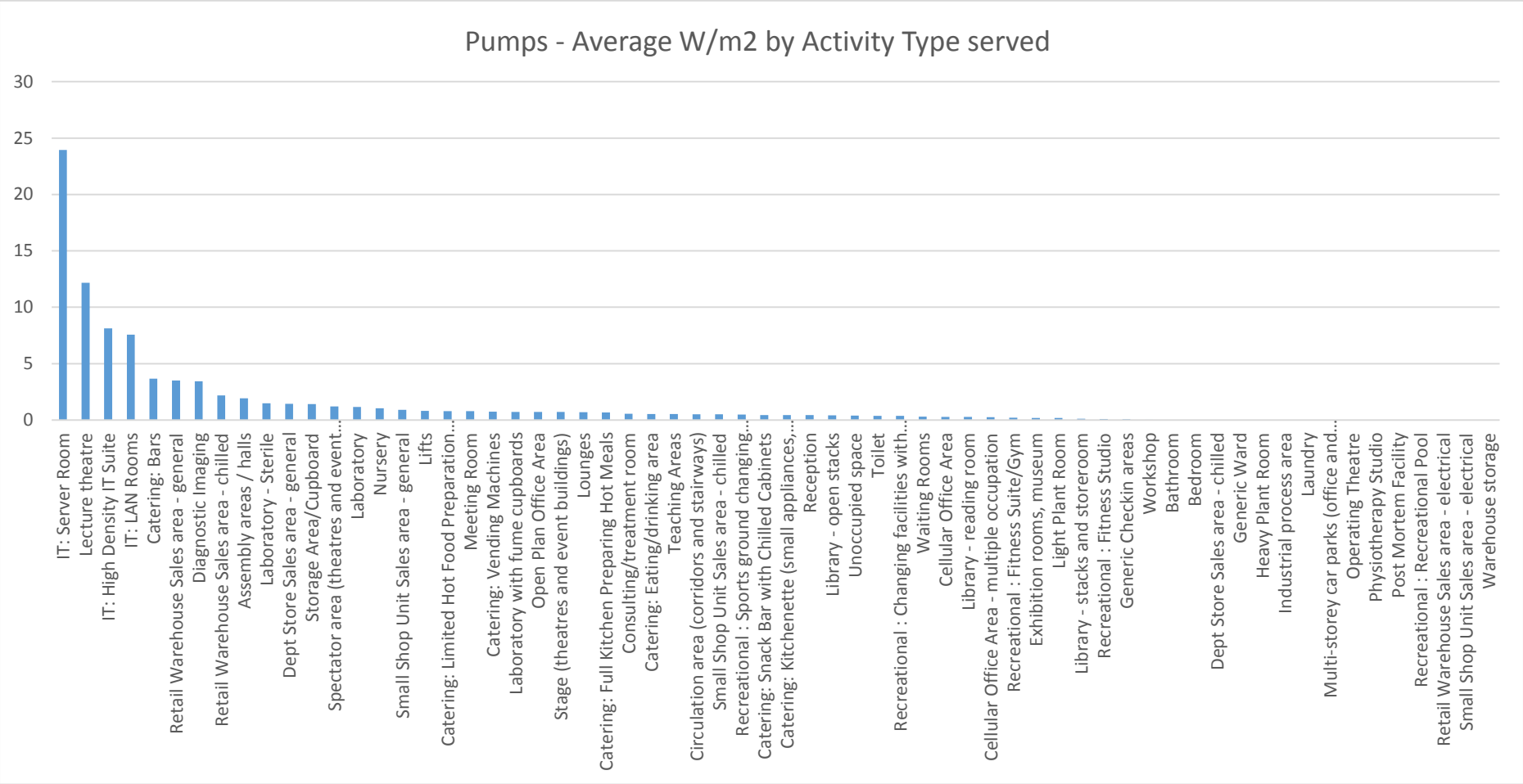

Figure 20 - Pumps - Average W/m2 by Activity Type served

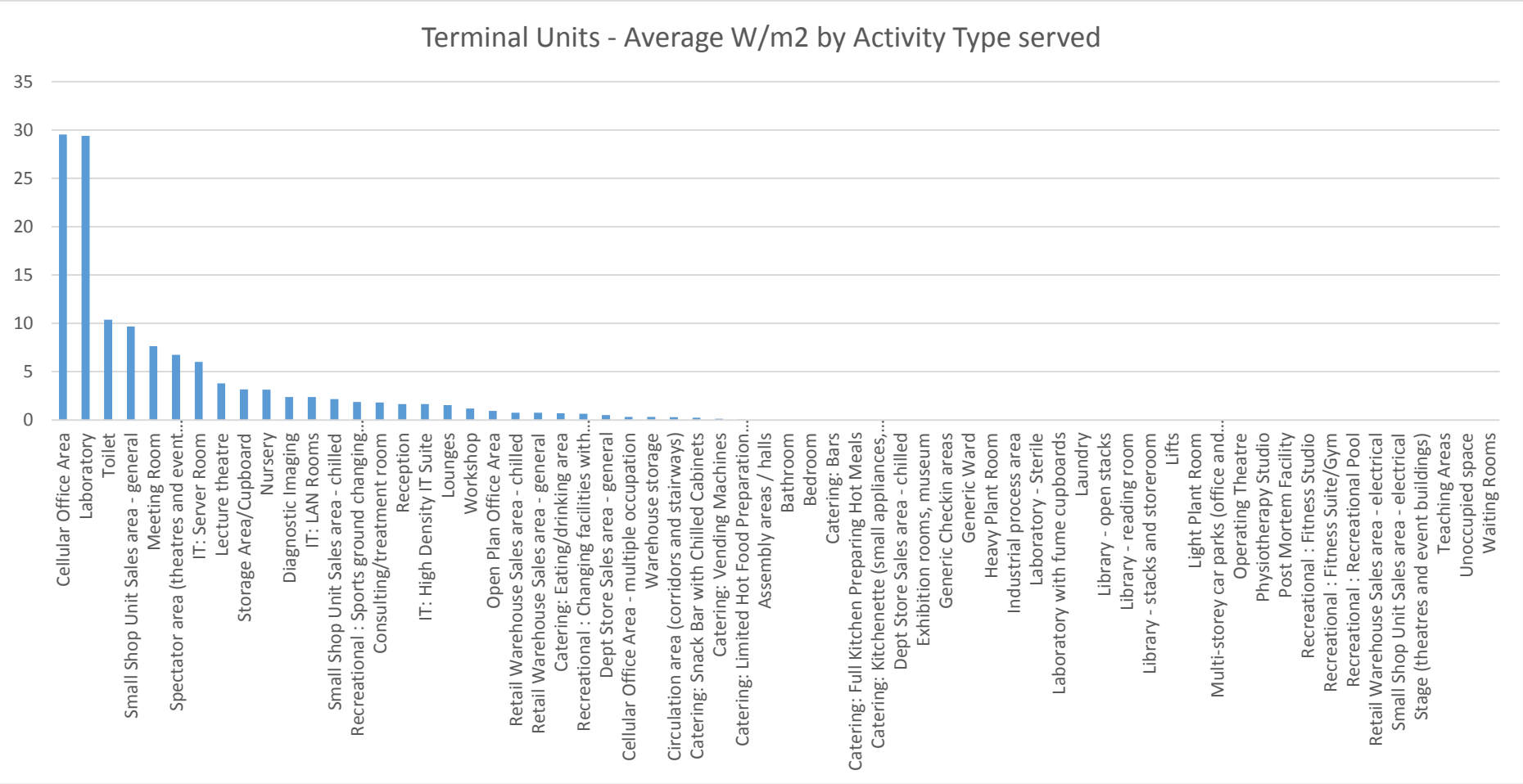

Figure 21 - Terminal Units - Average W/m2 by Activity Type served

The following tables shows the average, maximum and minimum power demands found from the data for specific activity types for the overall component type shown in each column.

4.1 Assembly areas / halls - Electricity power demand summary by component

Table 14– Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Assembly areas / halls. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.4	3.5	0.4	0.5	0.0	0.0	3.2		0.0	0.0	0.0	0.0	1.9	3.7
Maximum	6.5	10.0	6.8	13.7	0.0	-	11.7		1.9	0.0	0.3	0.1	17.4	27.0
Minimum	0.0	0.1	0.1	0.1	0.0	-	0.0		0.0	-	0.0	0.0	0.1	0.1
Sample Size	12.0		8.0		3.0		1.0		4.0		2.0		20.0	

4.2 Bathroom - Electricity power demand summary by component

Table 15 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Bathroom. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators	
	Average W/m2	SD	Average W/m2	SD
Average	0.6	0.4	3.9	
Maximum	6.5	5.5	26.3	
Minimum	0.0	0.1	0.1	
Sample Size	2.0		1.0	

4.3 Bedroom - Electricity power demand summary by component

Table 16 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Bedroom. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators	
	Average W/m2	SD	Average W/m2	SD
Average	6.8	0.8	7.5	6.3
Maximum	20.8	3.6	39.7	47.2
Minimum	0.3	0.4	0.4	0.3
Sample Size	5.0		4.0	

4.4 Catering: Bars – Electricity power demand summary by component

Table 17 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Bars. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	3.7	1.0	9.6		1.7	0.3	3.7	1.7
Maximum	8.3	2.3	46.6		19.2	18.8	9.1	4.3
Minimum	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Sample Size	11.0		1.0		3.0		12.0	

4.5 Catering: Eating/drinking area – Electricity power demand summary by component

Table 18 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Eating/drinking area. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	4.2	6.4	0.0		5.4	7.8	0.1	0.4	3.4	0.9	0.2		3.0	7.4	0.5	0.8	0.7	1.9
Maximum	9.9	11.8	0.3		30.7	45.3	0.4	1.5	13.8	3.5	0.6		10.8	25.8	1.5	2.2	1.7	3.4
Minimum	0.4	1.4	0.0		0.1	0.3	0.0	0.0	0.0	0.0	0.0		0.2	0.6	0.1	0.2	0.2	0.6
Sample Size	74.0		1.0		32.0		20.0		8.0		1.0		6.0		89.0		44.0	

4.6 Catering: Full Kitchen Preparing Hot Meals – Electricity power demand summary by component

Table 19 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Full Kitchen Preparing Hot Meals. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	13.5	22.1	9.1	1.2	20.0	40.8	0.3	0.8	0.0	0.0	0.0	0.0	0.7	1.0
Maximum	37.4	45.2	18.0	1.1	99.1	229.4	1.2	2.8	1.9	0.0	0.1	-	6.6	15.2
Minimum	0.8	1.7	0.0	0.0	0.8	1.8	0.0	0.0	0.0	-	0.0	-	0.0	0.1
Sample Size	72.0		6.0		21.0		6.0		4.0		3.0		71.0	

4.7 Catering: Kitchenette (small appliances, fridge and sink) – Electricity power demand summary by component

Table 20 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Kitchenette (small appliances, fridge and sink). Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	18.5	47.8	1.1	2.7	0.3	0.5	0.8	-	0.2		0.0	-	0.4	0.6
Maximum	60.0	168.1	5.4	13.6	2.8	9.2	2.8	-	0.5		0.0	0.0	1.1	1.4
Minimum	3.0	9.2	0.0	0.0	0.0	0.0	0.0	-	0.0		0.0	-	0.0	0.1
Sample Size	13.0		10.0		20.0		4.0		1.0		3.0		42.0	

4.8 Catering: Limited Hot Food Preparation Area – Electricity power demand summary by component

Table 21 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Limited Hot Food Preparation Area. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	7.8	7.7	10.6	2.8	5.6	5.1	2.9	10.9	3.2		0.0	0.0	0.8	0.9	0.1	0.1
Maximum	26.0	29.3	34.6	18.2	23.4	15.7	20.4	76.4	11.7		0.5	0.2	2.4	2.5	0.1	0.2
Minimum	1.2	3.5	0.5	0.2	1.7	2.7	1.1	4.0	0.0		0.0	0.0	0.2	0.4	0.0	0.1
Sample Size	57.0		8.0		10.0		14.0		1.0		2.0		35.0		129.0	

4.9 Catering: Snack Bar with Chilled Cabinets – Electricity power demand summary by component

Table 22 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Snack Bar with Chilled Cabinets. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	6.1	5.9	10.6	2.8	1.5	1.0	0.2	0.3	3.8	1.6	0.0	0.0	0.4	0.3	0.2	0.8
Maximum	13.1	14.0	34.6	18.2	7.5	6.4	0.7	0.9	18.0	0.2	0.5	0.2	1.1	0.7	1.5	5.1
Minimum	1.7	4.1	0.5	0.2	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.1
Sample Size	28.0		8.0		9.0		5.0		3.0		2.0		24.0		14.0	

4.10 Catering: Vending Machines – Electricity power demand summary by component

Table 23 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Catering: Vending Machines. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.4	2.8	1.2	1.5	0.0	-	0.0	0.0	0.7	0.5	0.1	-
Maximum	8.6	15.2	5.8	5.8	0.0	0.0	0.5	0.2	2.0	1.2	0.4	-
Minimum	0.1	0.2	0.1	0.1	0.0	-	0.0	0.0	0.0	0.0	0.0	-
Sample Size	15.0		6.0		3.0		2.0		15.0		4.0	

4.11 Cellular Office Area – Electricity power demand summary by component

Table 24 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Cellular Office Area. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Dehumidification		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.5	3.3	4.6	4.8	0.0		0.3	0.6	8.6	34.0	0.2	0.0	0.0	0.0	0.3	0.5	29.5	105.8
Maximum	4.4	8.3	22.3	29.7	0.0		2.8	8.9	1,577.2	12,745.3	0.6	0.0	0.7	1.0	1.3	2.5	70.5	211.5
Minimum	0.1	0.3	0.3	1.2	0.0		0.0	0.0	0.8	3.3	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.9
Sample Size	150.0		62.0		1.0		22.0		67.0		2.0		7.0		147.0		65.0	

4.12 Cellular Office Area - multiple occupation – Electricity power demand summary by component

Table 25 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Cellular Office Area - multiple occupation. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	5.8	8.1	9.1	1.2	2.4	2.3	0.2	0.3	1.1	0.5	5.6	7.0	0.3	0.4	0.3	0.0
Maximum	13.1	16.1	18.0	1.1	16.0	8.6	0.6	0.9	6.0	4.2	17.8	20.3	1.0	1.3	0.8	0.0
Minimum	0.2	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.1	0.0
Sample Size	23.0		6.0		6.0		5.0		7.0		6.0		60.0		29.0	

4.13 Circulation area (corridors and stairways) – Electricity power demand summary by component

Table 26 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Circulation area (corridors and stairways). Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Dehumidification		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.6	4.0	0.8	-	3.5	5.5	0.0		0.1	0.2	2.8	1.2	0.2	0.0	1.0	2.6	0.5	0.7	0.3	1.2
Maximum	4.2	7.8	10.2	-	31.3	46.4	0.0		0.2	0.5	11.8	5.4	0.6	0.0	3.5	9.1	1.8	1.9	0.9	3.8
Minimum	0.2	0.6	0.0	-	0.6	1.8	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.3	0.0	0.1
Sample Size	234.0		4.0		40.0		1.0		20.0		8.0		2.0		7.0		195.0		233.0	

4.14 Consulting/treatment room – Electricity power demand summary by component

Table 27 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Consulting/treatment room. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.1	1.6	5.0	4.7	0.0	0.0	1.0	-	1.4	2.8	0.6	0.7	1.8	5.0
Maximum	5.4	4.3	20.3	22.9	0.1	0.1	3.4	-	5.9	11.7	1.1	1.4	5.4	15.1
Minimum	0.4	0.7	0.4	0.4	0.0	0.0	0.0	-	0.0	0.1	0.0	0.0	0.1	0.2
Sample Size	10.0		14.0		5.0		4.0		4.0		17.0		12.0	

4.15 Dept Store Sales area – chilled – Electricity power demand summary by component

Table 28 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Dept Store Sales area – chilled. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators	
	Average W/m2	SD	Average W/m2	SD
Average	6.6	5.6	13.6	9.5
Maximum	16.5	20.9	70.6	43.8
Minimum	0.3	0.5	1.1	1.6
Sample Size	30.0		9.0	

4.16 Dept Store Sales area – general – Electricity power demand summary by component

Table 29 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Dept Store Sales area – general. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	4.3	4.8	9.2	6.2	4.4	3.3	1.4	1.7	0.8	1.0	1.4	1.0	0.5	0.8
Maximum	15.8	15.8	28.9	16.1	22.7	25.5	11.0	56.4	6.8	8.6	3.8	1.8	2.4	3.4
Minimum	0.1	0.7	0.2	0.2	0.9	1.3	0.0	0.1	0.1	0.1	0.4	0.9	0.0	0.0
Sample Size	147.0		29.0		11.0		164.0		8.0		17.0		154.0	

4.17 Diagnostic Imaging – Electricity power demand summary by component

Table 30 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Diagnostic Imaging. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m²	SD	Average W/m2	SD
Average	13.1	14.5	4.9	3.1	0.1	-	5.6	-	3.4	1.5	2.4	
Maximum	31.0	29.3	11.1	5.6	0.1	-	20.2	-	7.1	3.1	7.6	
Minimum	1.2	1.1	1.3	0.7	0.0	-	0.0	-	0.1	0.1	1.1	
Sample Size	3.0		4.0		2.0		4.0		7.0		1.0	

4.18 Exhibition rooms, museum – Electricity power demand summary by component

Table 31 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Exhibition rooms, museum. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	8.6	2.3	1.4	1.3	0.5	-	0.1		0.2	0.2
Maximum	19.5	13.7	11.6	10.5	1.6	-	4.1		1.9	2.2
Minimum	5.7	1.7	0.6	0.6	0.0	-	0.0		0.1	0.1
Sample Size	13.0		5.0		2.0		1.0		15.0	

4.19 Generic Checkin areas – Electricity power demand summary by component

Table 32 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Generic Checkin areas. Average W/m2 and Standard Deviation.

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps	
	Average W/m2	**SD**	**Average W/m2**	**SD**	**Average W/m2**	**SD**	**Average W/m2**	**SD**	**Average W/m2**	**SD**	**Average W/m2**	**SD**
Average	0.3	0.7	6.6	8.0	1.9		1.2	0.9	0.0		0.1	0.1
Maximum	6.4	32.0	55.2	37.9	6.8		9.2	5.0	2.6		2.8	5.4
Minimum	0.0	0.0	0.3	0.5	0.0		0.0	0.0	0.0		0.0	0.0
Sample Size	35.0		5.0		1.0		3.0		1.0		21.0	

4.20 Generic Ward – Electricity power demand summary by component

Table 33 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Generic Ward. Average W/m2 and Standard Deviation.

	Air Handling Units		Cold Generators		Heat Generators	
	Average W/m2	**SD**	**Average W/m2**	**SD**	**Average W/m2**	**SD**
Average	16.1	26.2	8.8	9.3	6.9	1.7
Maximum	38.2	51.8	37.5	44.6	108.2	93.3
Minimum	0.7	1.8	0.1	0.1	0.1	0.1
Sample Size	7.0		3.0		2.0	

4.21 Heavy Plant Room – Electricity power demand summary by component

Table 34 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Heavy Plant Room. Average W/m2 and Standard Deviation.

	Air Handling Units		Cold Generators	
	Average W/m2	**SD**	**Average W/m2**	**SD**
Average	0.2	0.1	0.0	0.0
Maximum	0.9	0.6	0.1	0.0
Minimum	0.0	0.0	0.0	0.0
Sample Size	5.0		3.0	

4.22 Industrial process area – Electricity power demand summary by component

Table 35 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Industrial process area. Average W/m2 and Standard Deviation.

	Air Handling Units	
	Average W/m2	SD
Average	0.5	
Maximum	1.2	
Minimum	0.1	
Sample Size	1.0	

4.23 IT: High Density IT Suite – Electricity power demand summary by component

Table 36 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for IT: High Density IT Suite. Average W/m2 and SD for component and activity (Standard Deviation).

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	5.8	3.7	17.6		16.7	13.4	0.1	0.2	4.2	-	0.2		0.1	0.1	8.1	12.1	1.6	
Maximum	16.1	10.2	62.4		119.4	89.8	0.2	0.5	15.1	-	0.6		1.1	1.8	19.7	28.8	7.5	
Minimum	0.5	0.6	2.3		1.4	3.3	0.0	0.0	0.0	-	0.0		0.0	0.0	0.4	0.6	0.1	
Sample Size	22.0		1.0		16.0		19.0		4.0		1.0		6.0		40.0		1.0	

4.24

4.25 IT: LAN Rooms – Electricity power demand summary by component

Table 37 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for IT: LAN Rooms. Average W/m2 and SD for component and activity (Standard Deviation).

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	3.3	6.2	4.6		100.8	196.4	0.1	0.2	0.2		0.6	0.5	7.6	11.6	2.4	1.1
Maximum	10.2	15.4	5.1		593.2	918.7	0.2	0.5	0.5		4.3	7.3	23.2	35.6	7.8	5.2
Minimum	0.3	0.6	0.6		1.8	3.2	0.0	0.0	0.0		0.1	0.1	0.5	1.2	0.4	0.3
Sample Size	26.0		1.0		20.0		20.0		1.0		13.0		36.0		8.0	

4.26 IT: Server Room – Electricity power demand summary by component

Table 38 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for IT: Server Room. Average W/m2 and SD for component and activity (Standard Deviation).

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	5.4	9.4	53.7	49.4	175.8	221.5	0.1	0.1	0.5	0.2	4.1	12.1	23.9	41.4	6.0	11.4
Maximum	17.8	32.1	117.7	106.3	922.2	1,113.1	0.3	0.7	3.1	1.2	16.3	49.9	119.7	213.5	21.4	38.9
Minimum	0.9	2.8	3.9	6.6	11.4	18.2	0.0	0.0	0.0	0.0	0.2	0.4	0.2	0.4	0.5	0.9
Sample Size	60.0		10.0		18.0		4.0		3.0		39.0		18.0		52.0	

4.27 Laboratory – Electricity power demand summary by component

Table 39 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Laboratory. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	33.5	33.2	21.5	34.0	0.1	0.2	6.8	10.8	0.1		1.2	1.7	29.4	103.4
Maximum	82.9	105.2	72.4	84.8	0.4	0.7	23.7	37.2	0.3		3.1	4.2	81.6	238.0
Minimum	1.7	1.4	2.8	6.0	0.0	0.0	0.4	0.8	0.0		0.1	0.2	1.3	2.1
Sample Size	11.0		13.0		9.0		5.0		1.0		48.0		34.0	

4.28 Laboratory – Sterile – Electricity power demand summary by component

Table 40 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Laboratory - Sterile. Average W/m2 and Standard Deviation

	Air Handling Units		Pumps	
	Average W/m2	SD	Average W/m2	SD
Average	5.8		1.5	5.8
Maximum	14.2		3.2	14.2
Minimum	0.0		0.0	0.0
Sample Size	1.0		2.0	1.0

4.29 Laboratory with fume cupboards – Electricity power demand summary by component

Table 41 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Laboratory with fume cupboards. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Pump		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	37.0	27.9	7.7	1.3	1.1	-	0.1	0.0	0.7	0.6
Maximum	77.3	58.7	22.4	7.7	4.1	-	0.5	0.2	1.8	1.2
Minimum	0.9	1.0	1.0	0.9	0.0	-	0.0	0.0	0.0	0.0
Sample Size	4.0		4.0		4.0		2.0		13.0	

4.30 Laundry – Electricity power demand summary by component

Table 42 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Laundry. Average W/m2 and Standard Deviation

	Air Handling Units		Heat Generators	
	Average W/m2	SD	Average W/m2	SD
Average	16.8	15.8	0.0	-
Maximum	31.3	36.2	0.0	0.0
Minimum	0.3	0.4	0.0	-
Sample Size	10.0		5.0	

4.31 Lecture theatre – Electricity power demand summary by component

Table 43 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Lecture theatre. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	17.6	20.0	2.9	5.2	0.3	0.4	0.1	0.1	12.2	30.7	3.8	-
Maximum	79.6	92.4	9.4	11.9	0.9	1.6	1.3	2.6	43.2	131.5	9.2	-
Minimum	2.1	2.7	0.3	0.7	0.0	0.1	0.0	0.0	1.8	4.6	1.1	-
Sample Size	24.0		16.0		10.0		4.0		30.0		2.0	

4.32 Library - open stacks – Electricity power demand summary by component

Table 44 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Library - open stacks. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.0	0.6	0.2	0.2	0.1	0.2	6.6	4.7	0.2	-	0.0	0.0	0.4	0.9
Maximum	5.6	8.9	3.1	2.0	0.4	0.7	83.4	101.4	0.6	-	0.7	0.3	1.2	2.3
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Sample Size	15.0		7.0		9.0		2.0		2.0		2.0		20.0	

4.33 Library – reading room – Electricity power demand summary by component

Table 45 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Library – reading room. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	5.1	3.6	3.8	7.1	0.2	0.3	6.1	5.5	0.2		0.3	0.3
Maximum	9.7	6.2	19.8	31.4	0.5	0.8	98.1	80.6	0.6		0.7	0.9
Minimum	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0		0.0	0.0
Sample Size	17.0		4.0		6.0		2.0		1.0		25.0	

4.34 Library - stacks and storeroom – Electricity power demand summary by component

Table 46 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Library - stacks and storeroom. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Dehumidification		Heat Generators		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	6.7	14.1	0.2	0.4	0.0	0.0	0.0	0.0	0.2		0.1	0.1	0.1	0.3
Maximum	23.5	47.5	1.8	1.4	0.0	0.0	0.0	0.0	0.6		0.6	0.2	0.4	0.9
Minimum	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Sample Size	6.0		7.0		2.0		7.0		1.0		3.0		26.0	

4.35 Lifts – Electricity power demand summary by component

Table 47 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Lifts. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	0.8	0.5	0.4	0.3	0.1	0.2	0.2		0.0	0.0	0.8	0.9
Maximum	1.9	1.3	2.2	0.9	0.3	0.6	0.5		0.0	-	2.0	2.8
Minimum	0.1	0.1	0.0	0.0	0.0	0.0	0.0		0.0	-	0.1	0.1
Sample Size	35.0		7.0		11.0		1.0		3.0		22.0	

4.36 Light Plant Room – Electricity power demand summary by component

Table 48 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Light Plant Room. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.6	4.6	0.1	0.1	0.2	0.0	0.0	0.0	0.2	0.1
Maximum	4.1	7.5	0.4	0.6	0.6	0.0	0.0	0.1	0.2	0.1
Minimum	0.3	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sample Size	89.0		14.0		2.0		5.0		4.0	

4.37 Lounges – Electricity power demand summary by component

Table 49 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Lounges. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	4.7	6.6	8.1	13.5	0.0	0.0	3.2		0.0	-	0.7	0.8	1.5	0.6
Maximum	10.0	15.6	45.4	79.3	0.0	0.0	11.7		0.0	-	1.4	1.6	4.3	0.5
Minimum	0.1	0.3	0.2	0.5	0.0	0.0	0.0		0.0	-	0.1	0.1	0.4	0.3
Sample Size	51.0		18.0		3.0		1.0		3.0		68.0		3.0	

4.38 Meeting Room – Electricity power demand summary by component

Table 50 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Meeting Rooms. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	5.7	7.4	19.0	12.9	6.8	13.0	0.3	0.5	3.2	2.9	0.2		0.9	2.2	0.8	1.3	7.6	14.1
Maximum	17.0	24.9	60.2	28.9	34.4	47.3	3.3	10.0	29.9	48.4	0.6		2.3	3.6	3.6	7.0	15.9	25.3
Minimum	0.4	1.4	0.3	0.1	1.1	5.3	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.5	1.1
Sample Size	67.0		3.0		26.0		17.0		9.0		1.0		9.0		71.0		20.0	

4.39 Multi-storey car parks (office and private use) – Electricity power demand summary by component

Table 51 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Multi-storey car parks (office and private use). Average W/m2 and Standard Deviation

	Air Handling Units	
	Average W/m2	SD
Average	0.01	0.00
Maximum	0.02	0.00
Minimum	0.00	0.00
Sample Size	4.00	

4.40 Nursery – Electricity power demand summary by component

Table 52 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Nursery. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.7	1.9	12.7		1.1	0.3	3.1	0.0
Maximum	11.6	15.3	61.3		2.6	0.8	12.0	14.3
Minimum	0.2	0.6	0.0		0.0	0.0	0.7	0.4
Sample Size	23.0		1.0		10.0		5.0	

4.41 Open Plan Office Area – Electricity power demand summary by component

Table 53 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Open Plan Office areas. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	4.9	12.4	7.9	1.6	5.8	7.7	0.0	0.1	6.0	5.7	0.0	0.0	2.8	3.9	0.7	1.0	1.0	5.8
Maximum	14.2	26.7	30.4	5.0	33.3	51.7	0.0	0.1	37.0	43.8	1.9	0.0	97.4	130.1	2.3	3.4	2.3	10.2
Minimum	0.4	1.1	0.3	0.2	0.6	1.9	0.0	0.1	0.8	2.9	0.0	-	0.5	0.6	0.1	0.3	0.1	0.5
Sample Size	192.0		7.0		37.0		12.0		15.0		4.0		35.0		105.0		425.0	

4.42 Operating Theatre – Electricity power demand summary by component

Table 54 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Operating Theatre. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators	
	Average W/m2	SD	Average W/m2	SD
Average	20.5	9.7	7.6	0.1
Maximum	39.6	12.4	16.0	0.7
Minimum	12.8	8.3	1.9	0.0
Sample Size	20.0		2.0	

4.43 Physiotherapy Studio – Electricity power demand summary by component

Table 55 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Physiotherapy Studio. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators	
	Average W/m2	SD	Average W/m2	SD
Average	3.0		13.7	0.2
Maximum	8.4		28.9	1.2
Minimum	0.1		3.4	0.0
Sample Size	1.0		2.0	

4.44 Post Mortem Facility – Electricity power demand summary by component

Table 56 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Post Mortem Facility. Average W/m2 and Standard Deviation

	Cold Generators	
	Average W/m2	SD
Average	7.6	0.1
Maximum	16.0	0.7
Minimum	1.9	0.0
Sample Size	2.0	

4.45 Reception – Electricity power demand summary by component

Table 57 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Reception. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	0.8	1.5	0.5	-	1.9	2.1	0.1	0.2	1.9	1.7	0.5	1.3	0.4	0.8	1.7	4.3
Maximum	3.6	7.9	3.2	-	12.5	21.2	0.4	0.7	8.3	7.2	2.1	5.4	1.3	2.1	4.8	13.0
Minimum	0.0	0.1	0.0	-	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Sample Size	34.0		2.0		19.0		10.0		10.0		7.0		56.0		31.0	

4.46 Recreational: Changing facilities with showers – Electricity power demand summary by component

Table 58 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Recreational: Changing facilities with showers. Average W/m2 and Standard Deviation

	Air Handling Units		Heat Generators		Heat Pump		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	11.6	18.9	0.0	0.0	13.1	-	0.4	0.3	0.6	-
Maximum	26.1	32.6	0.0	0.0	46.9	-	0.9	0.8	2.0	-
Minimum	3.5	8.8	0.0	0.0	0.0	-	0.0	0.0	0.1	-
Sample Size	27.0		10.0		4.0		47.0		2.0	

4.47 Recreational: Fitness Studio – Electricity power demand summary by component

Table 59 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Recreational: Fitness Studio. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.5	1.4	28.1		2.3	1.4	0.0	-	0.0	-	0.1	0.1
Maximum	5.8	3.9	30.6		9.5	3.2	0.0	-	0.0	-	0.1	0.1
Minimum	0.0	0.0	3.6		0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Sample Size	3.0		1.0		6.0		3.0		3.0		12.0	

4.48 Recreational: Fitness Suite/Gym – Electricity power demand summary by component

Table 60 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Recreational: Fitness Suite/Gym. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Recovery		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	8.2	13.7	28.1		1.7	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3
Maximum	15.7	26.3	30.6		7.2	5.2	0.0	0.0	1.9	0.0	0.0	-	2.2	4.0
Minimum	0.1	0.1	3.6		0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Sample Size	7.0		1.0		8.0		3.0		4.0		3.0		22.0	

4.49 Recreational: Recreational Pool – Electricity power demand summary by component

Table 61 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Recreational: Recreational Pool. Average W/m2 and Standard Deviation

	Heat Generators	
	Average W/m2	SD
Average	39.3	
Maximum	139.3	
Minimum	0.1	
Sample Size	1.0	

4.50 Recreational: Sports ground changing rooms – Electricity power demand summary by component

Table 62 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Recreational: Sports ground changing rooms. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Heat Generators		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	11.9	12.3	39.3		0.0	0.0	0.5	0.6	1.9	5.3
Maximum	51.7	70.8	42.9		0.0	0.0	1.1	1.5	5.6	15.9
Minimum	1.3	1.6	5.1		0.0	0.0	0.0	0.0	0.1	0.1
Sample Size	5.0		1.0		13.0		19.0		11.0	

4.51 Retail Warehouse Sales area – chilled – Electricity power demand summary by component

Table 63 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Retail Warehouse Sales area – chilled. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	4.3	11.3	3.4	0.4	2.2	2.2	0.8	0.1
Maximum	9.4	23.5	6.9	0.9	10.0	14.5	1.6	0.2
Minimum	0.0	0.0	0.8	0.2	0.2	0.3	0.2	0.0
Sample Size	8.0		12.0		4.0		60.0	

4.52 Retail Warehouse Sales area – electrical – Electricity power demand summary by component

Table 64 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Retail Warehouse Sales area – electrical. Average W/m2 and Standard Deviation

	Air Handling Units	
	Average W/m2	SD
Average	1.5	2.0
Maximum	3.0	4.4
Minimum	0.1	0.1
Sample Size	4.0	

4.53 Retail Warehouse Sales area – general – Electricity power demand summary by component

Table 65 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Retail Warehouse Sales area – general. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.4	2.5	11.4	15.6	2.1	2.3	0.0	0.1	0.5	-	0.3	0.1	3.5	4.3	0.8	0.8
Maximum	5.2	8.3	20.9	21.4	18.8	22.9	0.1	0.2	3.3	-	0.9	0.2	12.7	16.1	2.8	2.0
Minimum	0.1	0.3	0.1	0.1	0.1	0.2	0.0	0.0	0.0	-	0.1	0.0	0.5	0.6	0.1	0.1
Sample Size	64.0		11.0		6.0		9.0		2.0		2.0		15.0		18.0	

4.54 Small Shop Unit Sales area – chilled – Electricity power demand summary by component

Table 66 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Small Shop Unit Sales area – chilled. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	0.8	0.6	0.9	0.9	0.1		0.5	0.5	2.2	
Maximum	3.3	2.5	10.6	7.3	1.3		2.8	5.2	21.5	
Minimum	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Sample Size	14.0		3.0		1.0		19.0		1.0	

4.55 Small Shop Unit Sales area – electrical – Electricity power demand summary by component

Table 67 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Small Shop Unit Sales area – electrical. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators	
	Average W/m2	SD	Average W/m2	SD
Average	4.4	-	6.5	
Maximum	28.9	-	76.8	
Minimum	0.1	-	0.1	
Sample Size	2.0		1.0	

4.56 Small Shop Unit Sales area – general – Electricity power demand summary by component

Table 68 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Small Shop Unit Sales area – general. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Pump		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.9	1.4	10.0	2.2	8.4	8.6	6.6	10.0	0.9	-	0.9	1.4	9.7	5.8
Maximum	6.0	4.7	28.2	2.8	46.5	42.8	51.5	96.4	2.2	-	3.4	3.6	29.0	4.3
Minimum	0.1	0.2	0.5	0.1	0.2	0.2	0.0	0.0	0.4	-	0.0	0.0	3.7	3.2
Sample Size	45.0		7.0		8.0		9.0		2.0		51.0		3.0	

4.57 Spectator area (theatres and event buildings) – Electricity power demand summary by component

Table 69 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Spectator area (theatres and event buildings). Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	5.8		2.7	1.2	1.2	0.9	6.7	
Maximum	9.9		4.9	2.1	3.2	3.1	11.5	
Minimum	3.9		1.3	0.5	0.3	0.3	4.5	
Sample Size	1.0		3.0		12.0		1.0	

4.58 Stage (theatres and event buildings) – Electricity power demand summary by component

Table 70 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Stage (theatres and event buildings). Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.2	0.9	9.2	12.7	0.0		0.7	0.5
Maximum	6.0	1.6	137.6	19.4	1.9		4.1	4.6
Minimum	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Sample Size	14.0		3.0		1.0		23.0	

4.59 Storage Area/Cupboard – Electricity power demand summary by component

Table 71 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Storage Area/Cupboard. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	3.0	6.4	0.9	1.2	0.1	0.3	2.1	1.8	0.2	0.0	0.2	0.4	1.4	4.8	3.2	10.6
Maximum	8.5	12.6	3.9	5.8	0.4	1.1	9.5	7.9	0.6	0.0	0.3	0.7	5.3	20.5	6.2	17.3
Minimum	0.2	0.6	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	0.1	0.1
Sample Size	142.0		30.0		21.0		7.0		2.0		7.0		81.0		38.0	

4.60 Teaching Areas – Electricity power demand summary by component

Table 72 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Teaching Areas. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Recovery		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	3.6	4.2	1.0	1.0	0.1	0.2	0.2		0.5	0.6
Maximum	18.9	20.8	4.4	4.4	0.3	0.6	0.6		1.4	1.6
Minimum	0.3	0.4	0.1	0.1	0.0	0.0	0.0		0.0	0.1
Sample Size	11.0		8.0		13.0		1.0		31.0	

4.61 Toilet – Electricity power demand summary by component

Table 73 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Toilet. Average W/m2 and Standard Deviation

	Air Handling Units		All in One Systems		Cold Generators		Heat Generators		Heat Pump		Heat Recovery		Heat Rejection		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.2	5.9	7.6	1.9	0.8	1.1	0.1	0.2	1.5	1.0	0.2	0.0	0.0	0.0	0.4	0.6	10.4	
Maximum	6.7	11.6	27.7	0.3	3.6	6.4	0.3	0.7	5.4	3.5	0.6	0.0	0.2	0.2	0.9	1.4	29.3	
Minimum	0.2	0.6	0.5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	
Sample Size	212.0		2.0		42.0		22.0		5.0		2.0		6.0		170.0		1.0	

4.62 Unoccupied Space – Electricity power demand summary by component

Table 74 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Unoccupied Space. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	0.4	0.5	0.7	0.3	0.0	-	0.4	0.4
Maximum	2.9	5.6	3.2	1.6	0.0	-	0.9	0.9
Minimum	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
Sample Size	16.0		7.0		5.0		7.0	

4.63 Waiting Rooms – Electricity power demand summary by component

Table 75 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Waiting Rooms. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Rejection		Pumps	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	2.4	1.9	2.8	6.2	0.0	0.0	0.0	-	0.3	0.4
Maximum	5.7	5.3	13.0	28.5	0.0	0.0	0.0	0.0	0.9	1.4
Minimum	0.4	1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Sample Size	6.0		9.0		8.0		3.0		27.0	

4.64 Warehouse Storage – Electricity power demand summary by component

Table 76 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Waiting Rooms. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Rejection		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	1.1	1.0	1.2	1.2	1.6	2.2	0.3	0.0
Maximum	2.1	2.5	6.1	7.1	4.7	5.7	0.8	0.0
Minimum	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.0
Sample Size	19.0		8.0		4.0		19.0	

4.65 Workshop – Electricity power demand summary by component

Table 77 – Measured Overall Power Demands in W/m² Summary by HVAC Component Type for Workshop. Average W/m2 and Standard Deviation

	Air Handling Units		Cold Generators		Heat Generators		Heat Pump		Pumps		Terminal Units	
	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD	Average W/m2	SD
Average	44.1	39.9	5.1		0.1	0.2	1.4	-	0.0		1.2	
Maximum	108.8	100.3	24.5		0.4	0.7	4.8	-	0.0		3.8	
Minimum	0.7	0.7	0.0		0.0	0.0	0.0	-	0.0		0.5	
Sample Size	24.0		1.0		9.0		4.0		1.0		1.0	

5 References

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