TECHNICAL SUBMITTAL

Project:	Echo Street	**T.S No:**	63073-ABE-ZZ-ZZ-TS-M-09
A&B Contract No:	3898	**Date:**	12.11.24
Engineer:	Ian Buxton	**Rev:** C01	

F.T.A.O.	Name: Chinua Nisbitt Waterman Building Services Ltd
Copies To:	Issued on Viewpoint For Projects.

Plant Item:	Domestic Hot Water Central Plant.
Specified Manufacturer:	Not Applicable.
Proposed Manufacturer:	Mitsubishi Heavy Industries.
Proposal:	Mitsubishi Q-Ton Hot Water System.

Tower A

622509	ESA30EH2-25	MHI Q-Ton Outdoor Unit 30kW 3 Phase	5
622551	MTH-Q1E	MHI Q-Ton Wiring Kit 20M	3
622553	MTH-Q3E	MHI Q-Ton Hot Water Temperature Sensor	3
622554	MTH-Q4E	MHI Q-Ton Three Way Valve	5
622556	MTH-Q6E	MHI Q-Ton Slave Unit 20M Wire	2
622510	RC-Q1EH2	MHI Q-Ton Remote Controller	1
622503	RCI-MDQE2	MHI Q-ton Modbus Interface	1
183		Tier 1 Site Visit Charges	7
6935	FS/KIT-R	Heater Tape Termination Kit	10
155073	FSO/10-2	Self Limiting Heater Tape 10w 230V 1M	150
622575	CVM-RB-750-PSS2	Lapesa Tank 750L 2" Enamelled Steel	7
B9731	B9731	Big Foot Multi Frame XL	2
B9732	B9732	Big Foot Extension XL Kit	3

Tower B

622509	ESA30EH2-25	MHI Q-Ton Outdoor Unit 30kW 3 Phase	4
622551	MTH-Q1E	MHI Q-Ton Wiring Kit 20M	2
622553	MTH-Q3E	MHI Q-Ton Hot Water Temperature Sensor	2
622554	MTH-Q4E	MHI Q-Ton Three Way Valve	4
622556	MTH-Q6E	MHI Q-Ton Slave Unit 20M Wire	2
622510	RC-Q1EH2	MHI Q-Ton Remote Controller	1
183		Tier 1 Site Visit Charges	5
6935	FS/KIT-R	Heater Tape Termination Kit	8
155073	FSO/10-2	Self Limiting Heater Tape 10w 230V 1M	120
622575	CVM-RB-750-PSS2	Lapesa Tank 750L 2" Enamelled Steel	5
B9731	B9731	Big Foot Multi Frame XL	2
B9732	B9732	Big Foot Extension XL Kit	2

	Tower C 622509 ESA30EH2-25 MHI Q-Ton Outdoor Unit 30kW 3 Phase 2 622551 MTH-Q1E MHI Q-Ton Wiring Kit 20M 2 622553 MTH-Q3E MHI Q-Ton Hot Water Temperature Sensor 2 622554 MTH-Q4E MHI Q-Ton Three Way Valve 1 622510 RC-Q1EH2 MHI Q-Ton Remote Controller 1 622503 RCI-MDQE2 MHI Q-ton Modbus Interface 1 183 Tier 1 Site Visit Charges 3 6935 FS/KIT-R Heater Tape Termination Kit 4 155073 FSO/10-2 Self Limiting Heater Tape 10w 230V 1M 60 622575 Lapesa Tank 750L 2" Enamelled Steel 3 CVM-RB-750-PSS2 B9731 B9731 Big Foot Multi Frame XL 1 B9732 B9732 Big Foot Extension XL Kit 1
Attachments:	See attached technical proposals, as produced by Mitsubishi Heavy Industries.

Approval Required By:	A.S.A.P

Response:

Date: **Signed:**

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING EUROPE

Q-ton Air to Water

Project reference:	Echo St - IQ - Tower A - 616 Beds	**Prepared by :**	Craig Smith	**Mobile:**	0771 548 4827
Address:	Manchester	**Date :**	02.08.2023	**E-mail:**	support@mhitechnical.co.uk

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Note:

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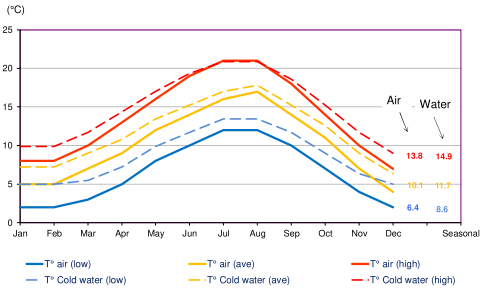
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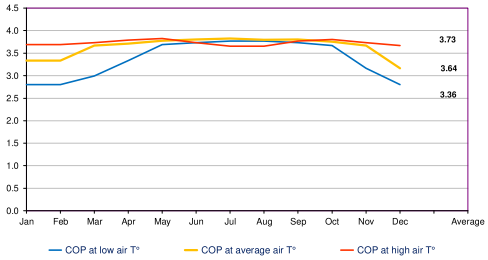
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I) Q-ton estimated COP

Ambient conditions in Manchester



Q-ton efficiency

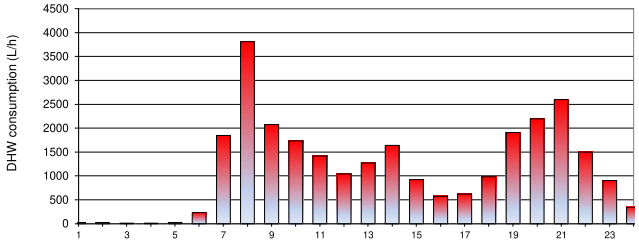


II) Hot water consumption profile

PERIOD	
0:00 to1:00	23
1:00 to 2:00	23
2:00 to 3:00	12
3:00 to 4:00	12
4:00 to 5:00	23
5:00 to 6:00	231
6:00 to 7:00	1848
7:00 to 8:00	3812
8:00 to 9:00	2079
9:00 to 10:00	1733
10:00 to 11:00	1421
11:00 to 12:00	1040
12:00 to 13:00	1271
13:00 to 14:00	1640
14:00 to 15:00	924
15:00 to 16:00	578
16:00 to 17:00	624
17:00 to 18:00	982
18:00 to 19:00	1906
19:00 to 20:00	2195
20:00 to 21:00	2599
21:00 to 22:00	1502
22:00 to 23:00	901
23:00 to 24:00	347

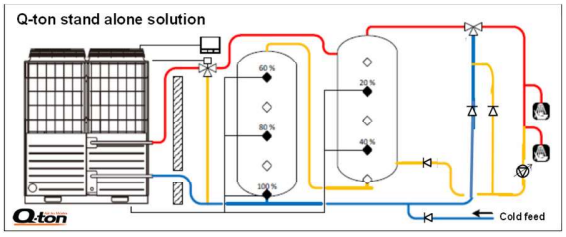
Total : **27720** litres per day

Daily consumption: **27720** litres



Consumption profil at 60°C

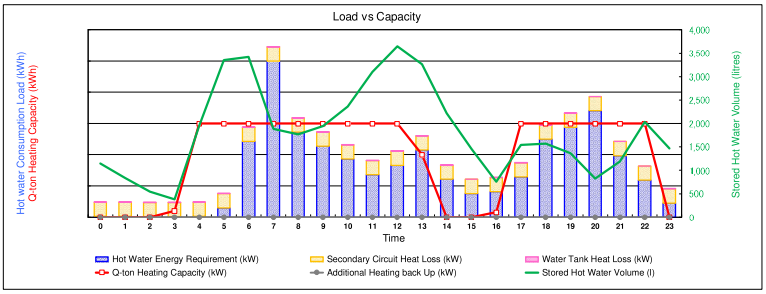
III) Basic installation water schematic



CALCULATION RESULTS

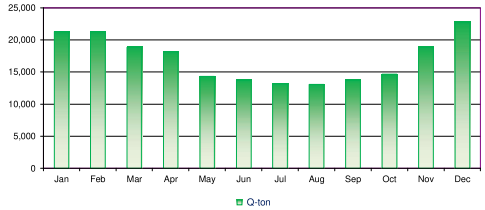
Energy output requirement	**150**	**kW**
Number of Q-ton required	**5**	
DHW storage volume required	**5,010**	**litres**

V) Typical one day operation patern (winter time)



IV) Your annual energy consumption and CO_2 emissions

Q-ton energy consumption (KW)



DHW storage temperature => **75 °C**

Seasonal air ambient temperature => **10.1 °C**

Estimated annual consumption
203,900 kW/yr

Estimated CO_2 emissions per year
97,872 kg

Q-ton - estimated annual COP => **3.64**

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AIR CONDITIONING EUROPE

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Air to Water

Q-ton

The most efficient way to produce your sanitary hot water!

MHI Specifications
561 Ipswich Road
Slough Trading Estate
Slough
Berkshire
SL1 4EP

Prepared for:	Mohammed Siddiqui - Watermans
Project reference:	Echo St - IQ - Tower A - 616 Beds
Address:	Manchester

Prepared by:	Craig Smith
Date:	02.08.2023
Mobile:	0771 548 4827
E-mail:	support@mhitechnical.co.uk

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I) Your hot water consumption at 60°C (m³/year)

Type	Description	consumption in litres @ 60°C	Number of units	Number of days/year	Total (m³/yr)	
Rented Apartment	per person/day	45	616	365	10118	m³/year

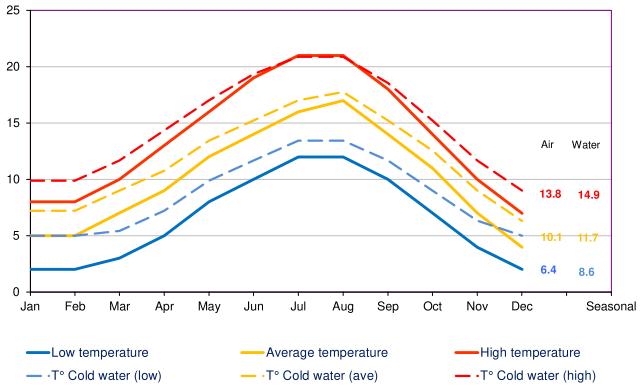
TOTAL : **10,118** m³/year

27,720 litres/day

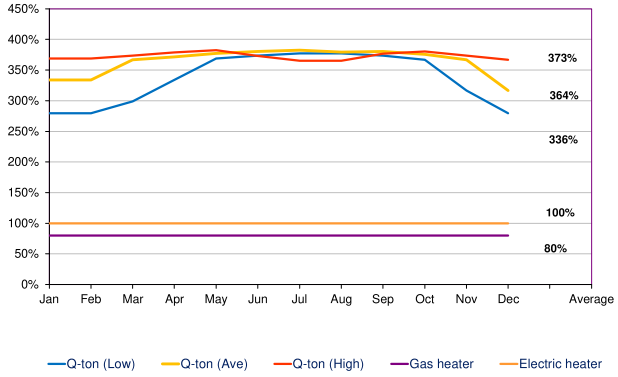
II) Ambient conditions and Efficiency

Plate heat exchanger usage? NO

Ambient conditions in **Manchester**



Efficiency comparison

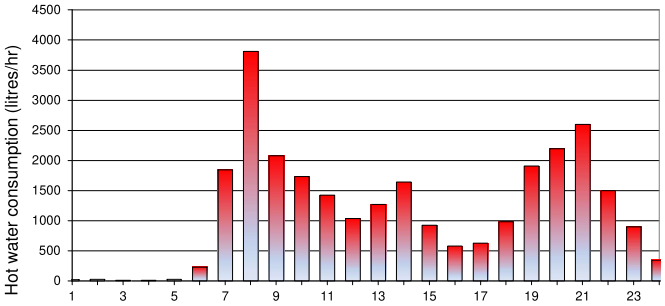


III) Energy load requirement and water storage capacity

PERIOD	
0:00 to1:00	23
1:00 to 2:00	23
2:00 to 3:00	12
3:00 to 4:00	12
4:00 to 5:00	23
5:00 to 6:00	231
6:00 to 7:00	1848
7:00 to 8:00	3812
8:00 to 9:00	2079
9:00 to 10:00	1733
10:00 to 11:00	1421
11:00 to 12:00	1040
12:00 to 13:00	1271
13:00 to 14:00	1640
14:00 to 15:00	924
15:00 to 16:00	578
16:00 to 17:00	624
17:00 to 18:00	982
18:00 to 19:00	1906
19:00 to 20:00	2195
20:00 to 21:00	2599
21:00 to 22:00	1502
22:00 to 23:00	901
23:00 to 24:00	347

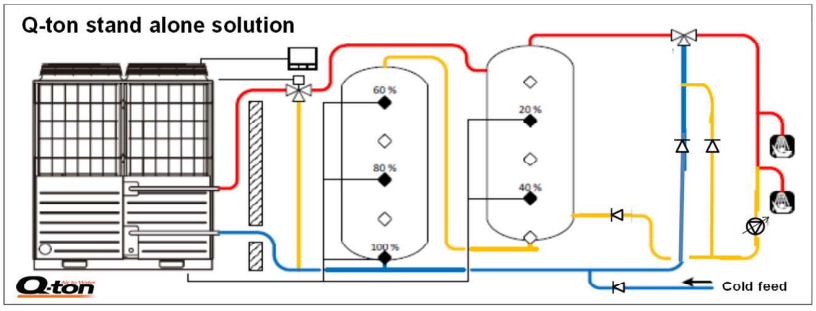
Total : **27720** litres per day

Daily consumption **27,720** litres/day



Hot water consumption profile at 60℃

Proposed schematic



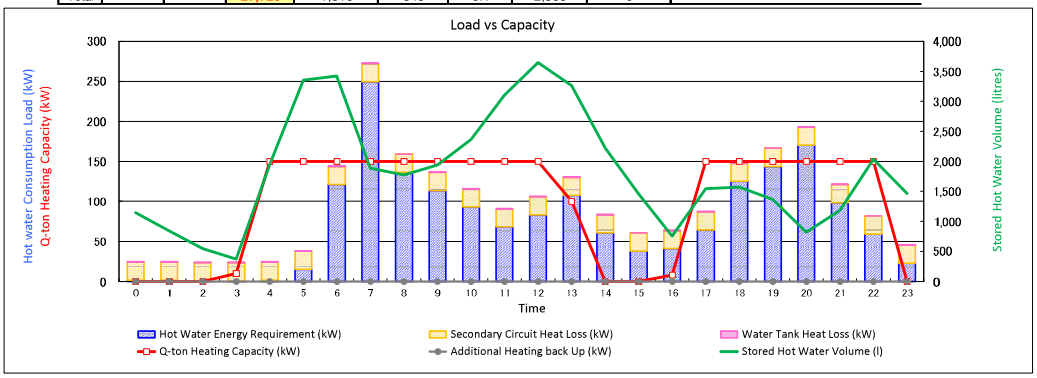
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Winter condition

Maximum stored energy : 1,049 [MJ]
Required water storage capacity at 60℃ : 4,670 [L]
Water storage temperature : 75 [℃]
Required water storage capacity at 75℃ : 3,649 [L]
Hot water load margins(input) : 5%

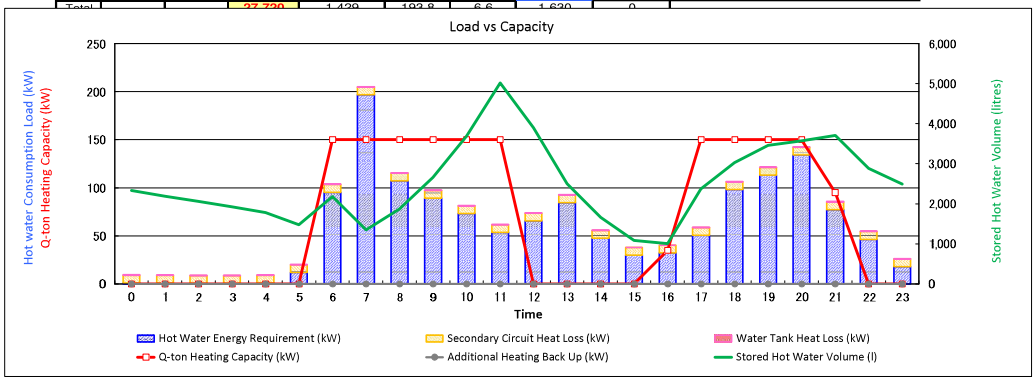
Time	Outside temp [℃]	Feed water temp [℃]	Hot water usage @60℃ [L/h]	① Hot water consumption load [kW]	①' Secondary circuit heat loss [kW]	①" Water tank heat loss [kW]	② Q-ton heating capacity [kW]	②' Additional heating back up [kW]	③Hourly heating capacity differential [kW] (②+②'-①-①'-①")	④ Stored hot water volume@75℃ [litres]	Stored energy ratio [%]
Remains of stored heat volume at 0:00 (Initial stored heat volume)･･･input										1454	40%
0	4.0	6.3	23	1.5	22.7	0.21	0.0	0.0	-24.4	1,148	31%
1	4.0	6.3	23	1.5	22.7	0.17	0.0	0.0	-24.4	842	23%
2	4.0	6.3	12	0.8	22.7	0.13	0.0	0.0	-23.6	546	15%
3	4.0	6.3	12	0.8	22.7	0.09	10.0	0.0	-13.6	376	10%
4	4.0	6.3	23	1.5	22.7	0.07	150.0	0.0	125.7	1,952	53%
5	4.0	6.3	231	15.1	22.7	0.27	150.0	0.0	111.9	3,354	92%
6	4.0	6.3	1,848	121.1	22.7	0.44	150.0	0.0	5.8	3,423	94%
7	4.0	6.3	3,812	249.7	22.7	0.45	150.0	0.0	-122.9	1,886	52%
8	4.0	6.3	2,079	136.2	22.7	0.26	150.0	0.0	-9.2	1,771	49%
9	4.0	6.3	1,733	113.5	22.7	0.25	150.0	0.0	13.6	1,941	53%
10	4.0	6.3	1,421	93.1	22.7	0.27	150.0	0.0	33.9	2,366	65%
11	4.0	6.3	1,040	68.1	22.7	0.32	150.0	0.0	58.9	3,103	85%
12	4.0	6.3	1,271	83.2	22.7	0.41	150.0	0.0	43.7	3,649	100%
13	4.0	6.3	1,640	107.5	22.7	0.48	100.0	0.0	-30.7	3,267	90%
14	4.0	6.3	924	60.5	22.7	0.43	0.0	0.0	-83.6	2,220	61%
15	4.0	6.3	578	37.8	22.7	0.30	0.0	0.0	-60.8	1,458	40%
16	4.0	6.3	624	40.9	22.7	0.21	8.0	0.0	-55.8	758	21%
17	4.0	6.3	982	64.3	22.7	0.12	150.0	0.0	62.9	1,545	42%
18	4.0	6.3	1,906	124.9	22.7	0.22	150.0	0.0	2.2	1,573	43%
19	4.0	6.3	2,195	143.8	22.7	0.22	150.0	0.0	-16.7	1,364	37%
20	4.0	6.3	2,599	170.3	22.7	0.20	150.0	0.0	-43.2	821	22%
21	4.0	6.3	1,502	98.4	22.7	0.13	150.0	0.0	28.8	1,183	32%
22	4.0	6.3	901	59.0	22.7	0.17	150.0	0.0	68.1	2,035	56%
23	4.0	6.3	347	22.7	22.7	0.28	0.0	0.0	-45.7	1,465	40%
Total			27,720	1,816	545	6.1	2,368	0			



Summer condition

Maximum stored energy : 1,200 [MJ]
Required water storage capacity at 60℃ : 6,790 [L]
Water storage temperature : 75 [℃]
Required water storage capacity at 75℃ : 5,010 [L]
Hot water load margins(input) : 5%

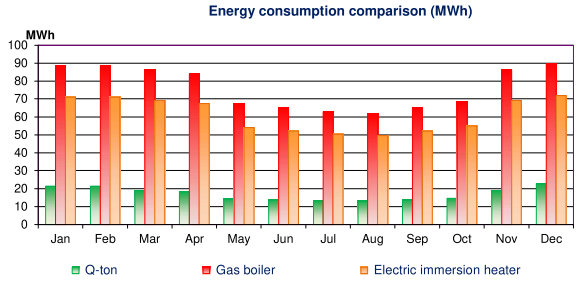
Time	Outside temp [℃]	Feed water temp [℃]	Hot water usage @60℃ [L/h]	① Hot water consumption load [kW]	①' Secondary circuit heat loss [kW]	①" Water tank heat loss [kW]	② Q-ton heating capacity [kW]	②' Additional heating back up [kW]	③Hourly heating capacity differential [kW] (②+②'-①-①'-①")	④ Stored hot water volume@75℃ [litres]	Stored energy ratio [%]
Remains of stored heat volume at 0:00 (Initial stored heat volume)･･･input										2480	50%
0	17.0	17.8	23	1.2	8.1	0.27	0.0	0.0	-9.5	2,338	47%
1	17.0	17.8	23	1.2	8.1	0.26	0.0	0.0	-9.5	2,192	44%
2	17.0	17.8	12	0.6	8.1	0.24	0.0	0.0	-8.9	2,058	41%
3	17.0	17.8	12	0.6	8.1	0.23	0.0	0.0	-8.9	1,925	38%
4	17.0	17.8	23	1.2	8.1	0.22	0.0	0.0	-9.5	1,783	36%
5	17.0	17.8	231	11.9	8.1	0.20	0.0	0.0	-20.2	1,478	30%
6	17.0	17.8	1,848	95.3	8.1	0.17	150.0	0.0	46.5	2,179	44%
7	17.0	17.8	3,812	196.5	8.1	0.24	150.0	0.0	-54.8	1,353	27%
8	17.0	17.8	2,079	107.2	8.1	0.16	150.0	0.0	34.6	1,874	37%
9	17.0	17.8	1,733	89.3	8.1	0.21	150.0	0.0	52.4	2,659	53%
10	17.0	17.8	1,421	73.2	8.1	0.29	150.0	0.0	68.4	3,691	74%
11	17.0	17.8	1,040	53.6	8.1	0.40	150.0	0.0	87.9	5,010	100%
12	17.0	17.8	1,271	65.5	8.1	0.53	0.0	0.0	-74.1	3,895	78%
13	17.0	17.8	1,640	84.5	8.1	0.42	0.0	0.0	-93.0	2,501	50%
14	17.0	17.8	924	47.6	8.1	0.28	0.0	0.0	-56.0	1,657	33%
15	17.0	17.8	578	29.8	8.1	0.19	0.0	0.0	-38.1	1,085	22%
16	17.0	17.8	624	32.2	8.1	0.13	35.0	0.0	-5.4	1,006	20%
17	17.0	17.8	982	50.6	8.1	0.12	150.0	0.0	91.2	2,375	47%
18	17.0	17.8	1,906	98.2	8.1	0.26	150.0	0.0	43.5	3,031	61%
19	17.0	17.8	2,195	113.1	8.1	0.33	150.0	0.0	28.5	3,457	69%
20	17.0	17.8	2,599	134	8.1	0.37	150.0	0.0	7.6	3,569	71%
21	17.0	17.8	1,502	77.4	8.1	0.39	95.0	0.0	9.1	3,707	74%
22	17.0	17.8	901	46.4	8.1	0.40	0.0	0.0	-54.9	2,885	58%
23	17.0	17.8	347	17.9	8.1	0.32	0.0	0.0	-26.3	2,488	50%
Total			27,720	1,429	193.8	6.6	1,630	0			

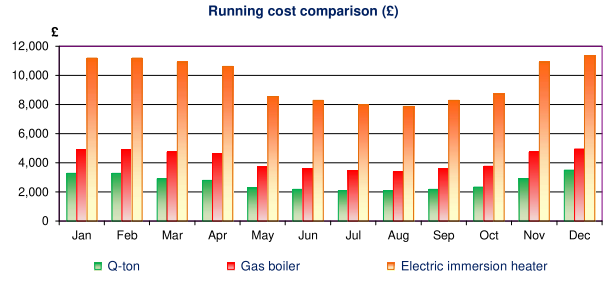


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IV) Your annual energy consumption, running cost saving and CO_2 emission





Energy Tariff (£/kWh)	Electricity:	0.1150	£ per kWh (0:00~7:00) *(Off peak tariff)*	0.1636	£ per kWh (7:00~24:00) *(Peak tariff)*	Gas:	0.0550 £ per kWh
CO_2 emission (kg/kWh)	Electricity:	0.4800	kg/kWh			Gas:	0.1980 kg/kWh

	Energy consumption		Running Cost (£)	Running Cost saving (£)	CO_2 emission (kg)	
Electric immersion heater efficiency :	100%					
Corresponding annual consumption :	733,383	kWh/year	115,796	83,952	352,024	72.20%
Gas oil boiler efficiency :	80%					
Corresponding annual consumption :	913,819	kWh/year	50,260	18,416	180,936	45.91%
Q-ton system				36.64% 72.50%		
Corresponding annual consumption : Q-ton :	203,900	kWh/year	31,844		97,872	
Boiler :	0	kWh/year				
Electric immersion heater :	0	kWh/year				

			Q-ton vs. Gas boiler	Q-ton vs. Electric Immersion heater
CRC - Carbon tax saving (if applicable) = Based on	0	pence per kg of CO2e	£0.00 per year	£0.00 per year
Existing Climate Change Levy tax = Based on	0	pence per kW of gas used	£0.00 per year	£0.00 per year
New Climate Change Levy tax = Based on	0	pence per kW of electricity used	£0.00 per year	£0.00 per year
Climate Change Levy tax saving =			£0.00 per year	£0.00 per year
RHI (Renewable Heat Incentive) *provisional Based on*	0	pence per kW output	£0.00 per year	£0.00 per year
Total cost saving compare to .... =			£18,416.39 per year	£83,952.00 per year

V) Mitsubishi Heavy Industries solution

Q-ton heating capacity : 150 kW
Maximum nessesary storage tank volume : 5,010 L (Water tank efficiency ratio 100%)

5	x Q-ton (x 30kW)	113,009
7	x 750 litres water tank storage	25,628
0	Water Treatment Device	0
1	Remote Monitoring System	5,127
	Installation cost (estimated)	0

VI) Investment cost comparison

	Gas heater	vs	Q-Ton System
Hot Water Device: Capital Cost	38,337		143,764
Installation Cost [estimated]	0		0
Total Installed Cost	38,337		143,764
Running Cost per year	50,260		31,844
Additional Investment [using Q-Ton]			105,427
Running Cost Saving [Compared to existing gas heater]			18,416
CRC + CCL + RHI Saving [Compared to existing gas heater system]			0
Running Cost Saving per year [using...]			18,416
Payback time period on additional cost compare to a gas boiler [years]			**5.7**
Payback time period on capital cost compare to a gas boiler [years]			**7.8**

	Electric heater	vs	Q-Ton System
Hot Water Device: Capital Cost	28,753		143,764
Installation Cost [estimated]	0		0
Total Installed Cost	28,753		143,764
Running Cost per year	115,796		31,844
Additional Investment [using Q-Ton]			115,011
Running Cost Saving [Compared to existing system]			83,952
CRC + CCL + RHI Saving [Compared to existing system]			0
Running Cost Saving per year [using...]			83,952
Payback time period on additional cost compare to an electric immersion heater [years]			**1.4**
Payback time period on capital cost compare to an electric immersion heater [years]			**1.7**

THIS IS AN ESTIMATION ONLY
PLEASE CHECK AND CONFIRM WITH MHIAE YOUR DAILY HOT WATER CONSUMPTION FOR AN ACCURATE RUNNING COST AND CARBON EMISSION SAVING.

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VII) Payback Curve

Our energy use estimations are based 11.5 pence per kWh (Off peak tariff) and 16.36 pence per kWh (Peak tariff) for electricity and 5.50 pence per kWh for gas.

Based on the current hot water requirement we estimate that the current utility cost would be £ 50,260 per annum. Based on a 5% fuel increase, year on year, a 15 year estimated running cost would be in the region of £ 1,122,876 based on the use of a like for like gas boiler replacement.

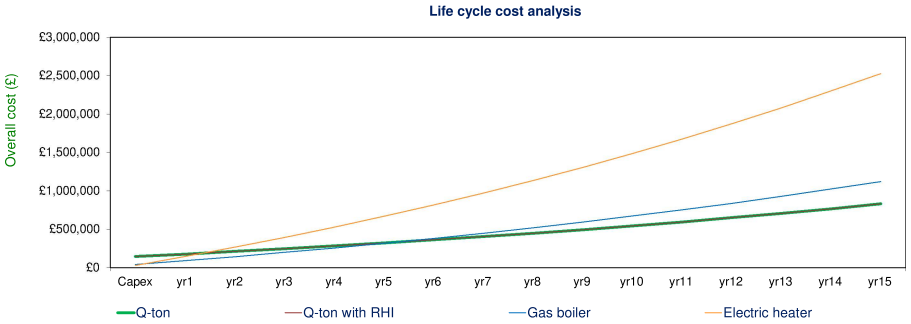
Based on these costs and the estimated running costs we estimate that the additional cost for the air source heat pumps would be paid back within less than 6 years based on current energy use.

The life cycle savings are based only on a 15 year payback period; however the heat pumps should have an operational life of 20 years and therefore would offer even greater savings.

Based on the 15 year operational life, we estimate the overall cost of operating the equipment over the period would be as follows.

15 year expenditure estimate (£)

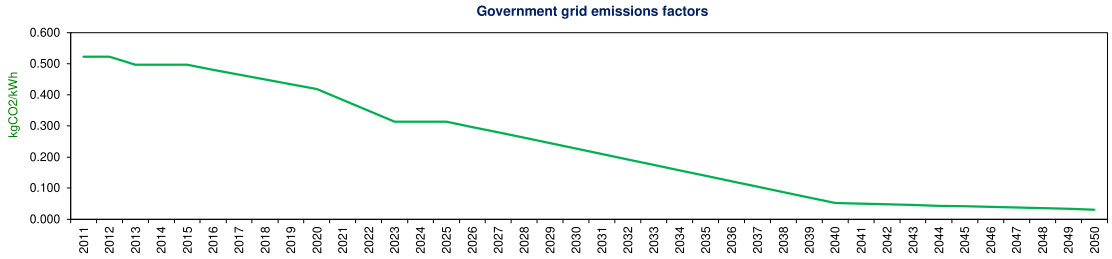
Electric heater	£2,527,456.56
Gas boiler	£1,122,876.43
Q-ton system	£830,904.20
Q-ton + RHI	£830,904.20



Q-ton heat pump option would offer a considerable saving when compared to the current heating set up; and would offer the greatest savings over the time period.

VIII) Future Use

The government is committed to reducing the carbon emissions for the UK and a key factor in achieving this is the decarbonisation of the electric grid.

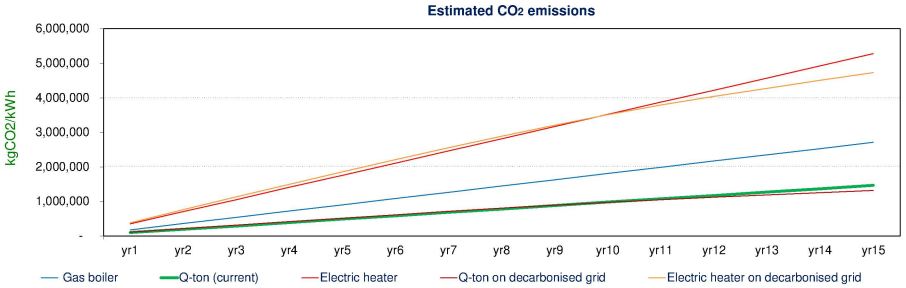


The graph above is based on the government's published targets. It shows the set targets and reductions and based on this the use of low energy electric heating system has been identified as one of the main factors to achieving the CO2 emission targets set by the European Union and UK Government.

We have shown the impact with the use of Q-ton on the current carbon emission and after the decarbonisation of the grid.

15 year CO_2 emission estimate (kg)

Electric Imer. heater	5,280,358
Elec + decarbonised grid	4,737,412
Gas boiler	2,714,042
Q-ton system	1,468,082
Q-ton + decarbonised grid	1,317,128



During our initial design we have accounted for these changes and is one of the reasons why we propose an electric heat pump system over the gas fired system. The current taxation on CO_2 emissions will only increase and thus it is imperative that we design our systems with as little CO_2 emissions as possible to not only protect the environment but also to reduce the impact on higher and higher fuel charges.

Therefore if an investment is made in electric heat pumps systems, the CO_2 emissions will fall year on year with the same operation, when used on the cleaner, decarbonised electric grid. As carbon will be taxed more in the future, future tax liability has to be considered.

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING EUROPE

Q-ton Air to Water

Project reference:	Echo St - IQ - Tower B - 416 Beds	**Prepared by :**	Craig Smith	**Mobile:**	0771 548 4827
Address:	Manchester	**Date :**	02.08.2023	**E-mail:**	support@mhitechnical.co.uk

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Note:

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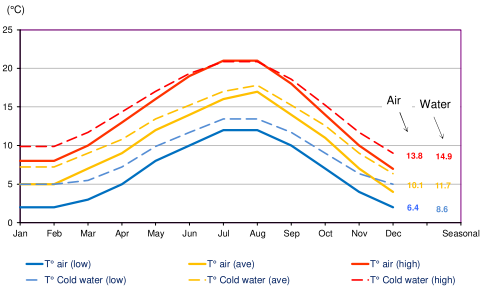
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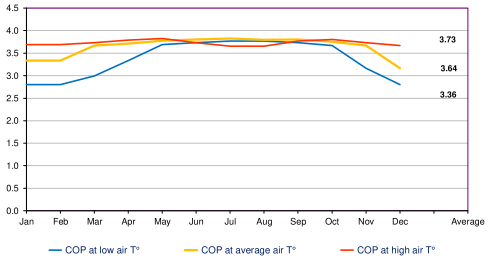
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I) Q-ton estimated COP

Ambient conditions in Manchester



Q-ton efficiency

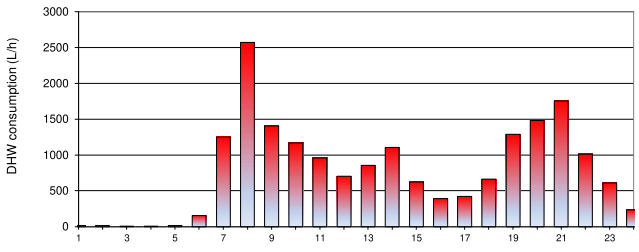


II) Hot water consumption profile

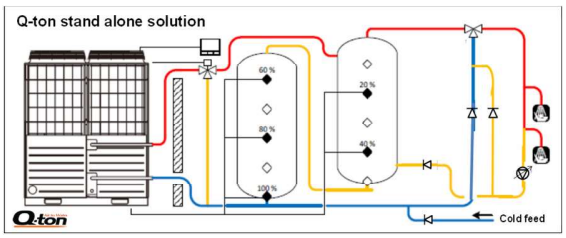
PERIOD	
0:00 to1:00	16
1:00 to 2:00	16
2:00 to 3:00	8
3:00 to 4:00	8
4:00 to 5:00	16
5:00 to 6:00	156
6:00 to 7:00	1248
7:00 to 8:00	2574
8:00 to 9:00	1404
9:00 to 10:00	1170
10:00 to 11:00	959
11:00 to 12:00	702
12:00 to 13:00	858
13:00 to 14:00	1108
14:00 to 15:00	624
15:00 to 16:00	390
16:00 to 17:00	421
17:00 to 18:00	663
18:00 to 19:00	1287
19:00 to 20:00	1482
20:00 to 21:00	1755
21:00 to 22:00	1014
22:00 to 23:00	608
23:00 to 24:00	234

Total : **18720** litres per day

Daily consumption: **18720** litres



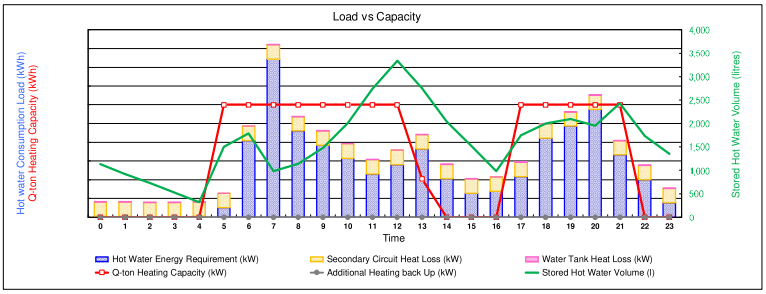
III) Basic installation water schematic



CALCULATION RESULTS

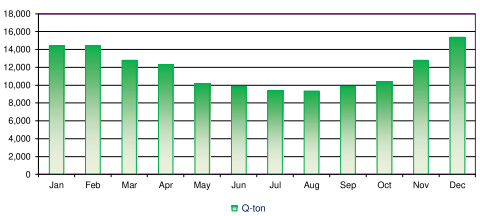
Energy output requirement	**120**	**kW**
Number of Q-ton required	**4**	
DHW storage volume required	**3,340**	**litres**

V) Typical one day operation patern (winter time)



IV) Your annual energy consumption and CO_2 emissions

Q-ton energy consumption (KW)



DHW storage temperature => **75 °C**

Seasonal air ambient temperature => **10.1 °C**

Estimated annual consumption
140,798 kW/yr

Estimated CO_2 emissions per year
67,583 kg

Q-ton - estimated annual COP => **3.64**

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING EUROPE

MITSUBISHI HEAVY INDUSTRIES, LTD.

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Air to Water

Q-ton

The most efficient way to produce your sanitary hot water!

MHI Specifications
561 Ipswich Road
Slough Trading Estate
Slough
Berkshire
SL1 4EP

Prepared for:	Mohammed Siddiqui - Watermans
Project reference:	Echo St - IQ - Tower B - 416 Beds
Address:	Manchester

Prepared by:	Craig Smith
Date:	02.08.2023
Mobile:	0771 548 4827
E-mail:	support@mhitechnical.co.uk

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I) Your hot water consumption at 60°C (m³/year)

Type	Description	consumption in litres @ 60°C	Number of units	Number of days/year	Total (m³/yr)	
Rented Apartment	per person/day	45	416	365	6833	m³/year

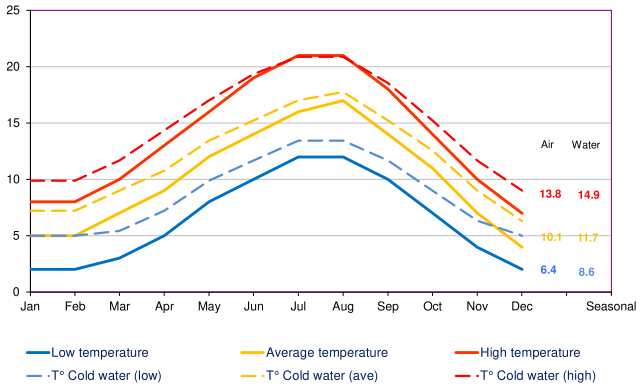
TOTAL : **6,833** m³/year

18,720 litres/day

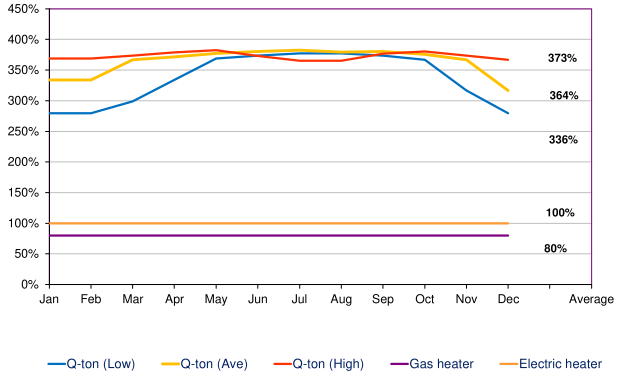
II) Ambient conditions and Efficiency

Plate heat exchanger usage? NO

Ambient conditions in **Manchester**



Efficiency comparison

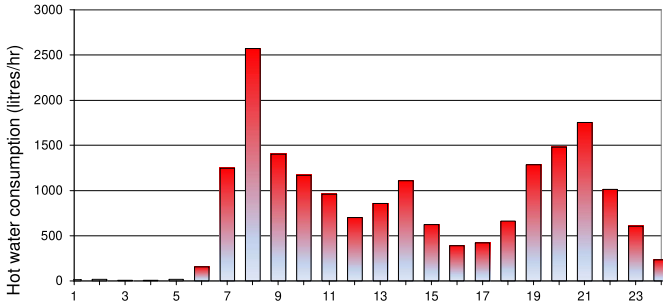


III) Energy load requirement and water storage capacity

PERIOD	
0:00 to1:00	16
1:00 to 2:00	16
2:00 to 3:00	8
3:00 to 4:00	8
4:00 to 5:00	16
5:00 to 6:00	156
6:00 to 7:00	1248
7:00 to 8:00	2574
8:00 to 9:00	1404
9:00 to 10:00	1170
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21:00 to 22:00	1014
22:00 to 23:00	608
23:00 to 24:00	234

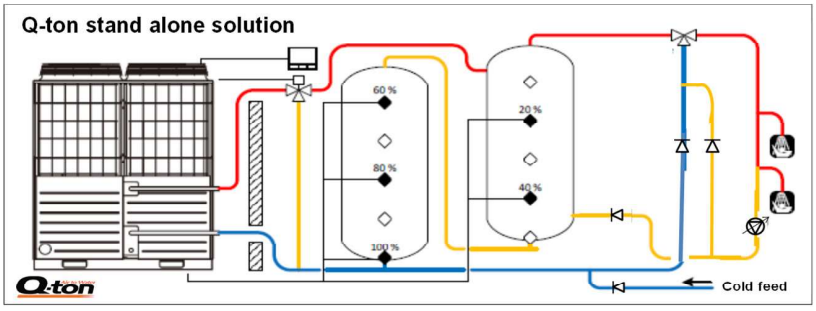
Total : **18720** litres per day

Daily consumption **18,720** litres/day



Hot water consumption profile at 60℃

Proposed schematic



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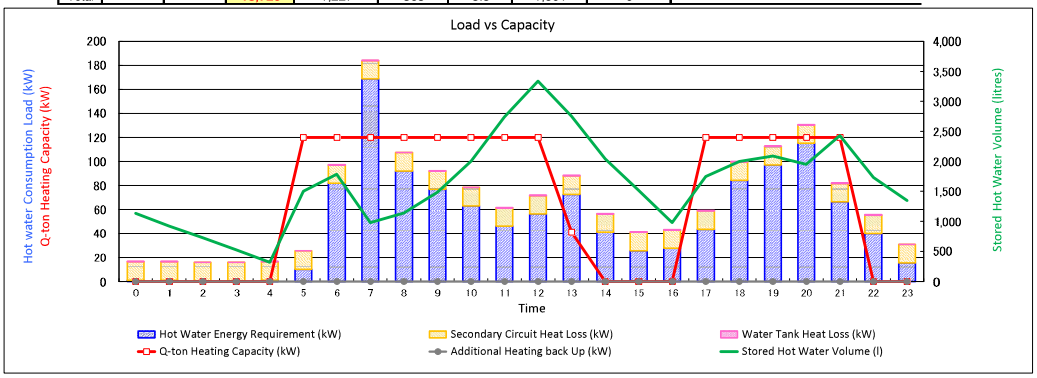
Winter condition

Maximum stored energy : 960 [MJ]
Required water storage capacity at 60℃ : 4,273 [L]

Water storage temperature : 75 [℃]
Required water storage capacity at 75℃ : 3,340 [L]

Hot water load margins(input) : 5%

Time	Outside temp [℃]	Feed water temp [℃]	Hot water usage @60℃ [L/h]	① Hot water consumption load [kW]	①' Secondary circuit heat loss [kW]	①" Water tank heat loss [kW]	② Q-ton heating capacity [kW]	②' Additional heating back up [kW]	③Hourly heating capacity differential [kW] (②+②'-①-①'-①")	④ Stored hot water volume@75℃ [litres]	Stored energy ratio [%]
Remains of stored heat volume at 0:00 (Initial stored heat volume)・・・input										1339	40%
0	4.0	6.3	16	1.0	15.3	0.19	0.0	0.0	-16.5	1,134	34%
1	4.0	6.3	16	1.0	15.3	0.17	0.0	0.0	-16.5	925	28%
2	4.0	6.3	8	0.5	15.3	0.14	0.0	0.0	-16.0	727	22%
3	4.0	6.3	8	0.5	15.3	0.12	0.0	0.0	-16.0	525	16%
4	4.0	6.3	16	1.0	15.3	0.09	0.0	0.0	-16.4	320	10%
5	4.0	6.3	156	10.2	15.3	0.06	120.0	0.0	94.4	1,503	45%
6	4.0	6.3	1,248	81.8	15.3	0.21	120.0	0.0	22.6	1,788	54%
7	4.0	6.3	2,574	168.7	15.3	0.25	120.0	0.0	-64.3	981	29%
8	4.0	6.3	1,404	92.0	15.3	0.15	120.0	0.0	12.5	1,138	34%
9	4.0	6.3	1,170	76.7	15.3	0.17	120.0	0.0	27.8	1,486	44%
10	4.0	6.3	959	62.9	15.3	0.21	120.0	0.0	41.6	2,007	60%
11	4.0	6.3	702	46.0	15.3	0.28	120.0	0.0	58.4	2,738	82%
12	4.0	6.3	858	56.2	15.3	0.37	120.0	0.0	48.1	3,340	100%
13	4.0	6.3	1,108	72.6	15.3	0.44	41.0	0.0	-47.4	2,748	82%
14	4.0	6.3	624	40.9	15.3	0.37	0.0	0.0	-56.6	2,039	61%
15	4.0	6.3	390	25.6	15.3	0.28	0.0	0.0	-41.2	1,520	46%
16	4.0	6.3	421	27.6	15.3	0.22	0.0	0.0	-43.2	981	29%
17	4.0	6.3	663	43.4	15.3	0.15	120.0	0.0	61.1	1,746	52%
18	4.0	6.3	1,287	84.3	15.3	0.24	120.0	0.0	20.1	2,000	60%
19	4.0	6.3	1,482	97.1	15.3	0.28	120.0	0.0	7.3	2,091	63%
20	4.0	6.3	1,755	115.0	15.3	0.29	120.0	0.0	-10.6	1,955	59%
21	4.0	6.3	1,014	66.4	15.3	0.27	120.0	0.0	38.0	2,432	73%
22	4.0	6.3	608	39.9	15.3	0.33	0.0	0.0	-55.6	1,736	52%
23	4.0	6.3	234	15.3	15.3	0.24	0.0	0.0	-30.9	1,350	40%
Total			18,720	1,227	368	5.5	1,601	0			



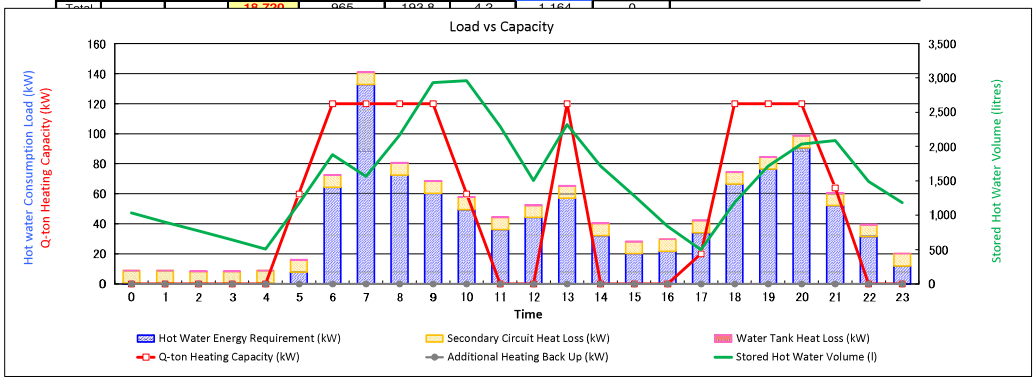
Summer condition

Maximum stored energy : 709 [MJ]
Required water storage capacity at 60℃ : 4,011 [L]

Water storage temperature : 75 [℃]
Required water storage capacity at 75℃ : 2,960 [L]

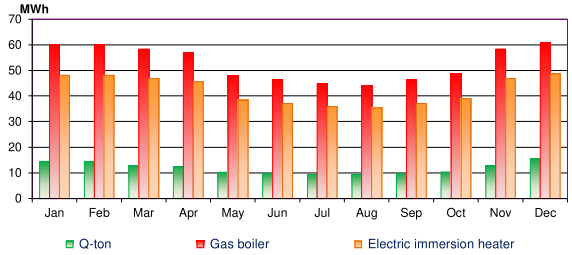
Hot water load margins(input) : 5%

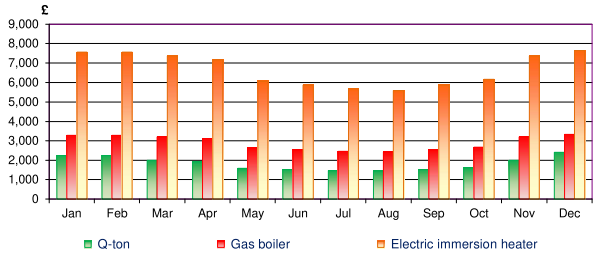
Time	Outside temp [℃]	Feed water temp [℃]	Hot water usage @60℃ [L/h]	① Hot water consumption load [kW]	①' Secondary circuit heat loss [kW]	①" Water tank heat loss [kW]	② Q-ton heating capacity [kW]	②' Additional heating back up [kW]	③Hourly heating capacity differential [kW] (②+②'-①-①'-①")	④ Stored hot water volume@75℃ [litres]	Stored energy ratio [%]
Remains of stored heat volume at 0:00 (Initial stored heat volume)・・・input										1173	40%
0	17.0	17.8	16	0.8	8.1	0.14	0.0	0.0	-9.0	1,035	35%
1	17.0	17.8	16	0.8	8.1	0.13	0.0	0.0	-9.0	902	30%
2	17.0	17.8	8	0.4	8.1	0.11	0.0	0.0	-8.6	772	26%
3	17.0	17.8	8	0.4	8.1	0.10	0.0	0.0	-8.6	643	22%
4	17.0	17.8	16	0.8	8.1	0.09	0.0	0.0	-9.0	509	17%
5	17.0	17.8	156	8	8.1	0.07	60.0	0.0	43.9	1,169	39%
6	17.0	17.8	1,248	64.3	8.1	0.14	120.0	0.0	47.5	1,883	64%
7	17.0	17.8	2,574	132.7	8.1	0.21	120.0	0.0	-21.0	1,566	53%
8	17.0	17.8	1,404	72.4	8.1	0.18	120.0	0.0	39.3	2,158	73%
9	17.0	17.8	1,170	60.3	8.1	0.24	120.0	0.0	51.4	2,931	99%
10	17.0	17.8	959	49.5	8.1	0.32	60.0	0.0	2.1	2,960	100%
11	17.0	17.8	702	36.2	8.1	0.32	0.0	0.0	-44.6	2,292	77%
12	17.0	17.8	858	44.2	8.1	0.25	0.0	0.0	-52.5	1,503	51%
13	17.0	17.8	1,108	57.1	8.1	0.17	120.0	0.0	54.7	2,321	78%
14	17.0	17.8	624	32.2	8.1	0.26	0.0	0.0	-40.5	1,716	58%
15	17.0	17.8	390	20.1	8.1	0.20	0.0	0.0	-28.4	1,286	43%
16	17.0	17.8	421	21.7	8.1	0.15	0.0	0.0	-29.9	839	28%
17	17.0	17.8	663	34.2	8.1	0.11	20.0	0.0	-22.4	501	17%
18	17.0	17.8	1,287	66.3	8.1	0.07	120.0	0.0	45.6	1,186	40%
19	17.0	17.8	1,482	76.4	8.1	0.14	120.0	0.0	35.4	1,716	58%
20	17.0	17.8	1,755	90.5	8.1	0.20	120.0	0.0	21.2	2,037	69%
21	17.0	17.8	1,014	52.3	8.1	0.23	64.0	0.0	3.4	2,087	71%
22	17.0	17.8	608	31.4	8.1	0.23	0.0	0.0	-39.7	1,490	50%
23	17.0	17.8	234	12.1	8.1	0.17	0.0	0.0	-20.3	1,186	40%
Total			18,720	965	193.8	4.2	1,164	0			



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IV) Your annual energy consumption, running cost saving and CO_2 emission





Energy Tariff (£/kWh)	Electricity:	0.1150	£ per kWh (0:00~7:00) *(Off peak tariff)*	0.1636	£ per kWh (7:00~24:00) *(Peak tariff)*	Gas:	0.0550 £ per kWh
CO_2 emission (kg/kWh)	Electricity:	0.4800	kg/kWh			Gas:	0.1980 kg/kWh

	Energy consumption		Running Cost (£)	Running Cost saving (£)	CO_2 emission (kg)	
Electric immersion heater efficiency :	100%					
Corresponding annual consumption :	506,994	kWh/year	79,949	57,954	243,357	72.23%
Gas oil boiler efficiency :	80%					
Corresponding annual consumption :	631,520	kWh/year	34,734	12,738	125,041	45.95%
Q-ton system				36.67% 72.49%		
Corresponding annual consumption : Q-ton :	140,798	kWh/year	21,995		67,583	
Boiler :	0	kWh/year				
Electric immersion heater :	0	kWh/year				

			Q-ton vs. Gas boiler	Q-ton vs. Electric Immersion heater
CRC - Carbon tax saving (if applicable) = Based on	0	pence per kg of CO2e	£0.00 per year	£0.00 per year
Existing Climate Change Levy tax = Based on	0	pence per kW of gas used	£0.00 per year	£0.00 per year
New Climate Change Levy tax = Based on	0	pence per kW of electricity used	£0.00 per year	£0.00 per year
Climate Change Levy tax saving =			£0.00 per year	£0.00 per year
RHI (Renewable Heat Incentive) *provisional Based on*	0	pence per kW output	£0.00 per year	£0.00 per year
Total cost saving compare to .... =			£12,738.44 per year	£57,954.31 per year

V) Mitsubishi Heavy Industries solution

Q-ton heating capacity : 120 kW
Maximum nessesary storage tank volume : 3,340 L (Water tank efficiency ratio 100%)

4	x Q-ton (x 30kW)	89,581
5	x 750 litres water tank storage	18,306
0	Water Treatment Device	0
1	Remote Monitoring System	5,127
	Installation cost (estimated)	0

VI) Investment cost comparison

	Gas heater	vs	Q-Ton System
Hot Water Device: Capital Cost	30,137		113,014
Installation Cost [estimated]	0		0
Total Installed Cost	30,137		113,014
Running Cost per year	34,734		21,995
Additional Investment [using Q-Ton]			82,877
Running Cost Saving [Compared to existing gas heater]			12,738
CRC + CCL + RHI Saving [Compared to existing gas heater system]			0
Running Cost Saving per year [using...]			12,738
Payback time period on additional cost compare to a gas boiler [years]			**6.5**
Payback time period on capital cost compare to a gas boiler [years]			**8.9**

	Electric heater	vs	Q-Ton System
Hot Water Device: Capital Cost	22,603		113,014
Installation Cost [estimated]	0		0
Total Installed Cost	22,603		113,014
Running Cost per year	79,949		21,995
Additional Investment [using Q-Ton]			90,411
Running Cost Saving [Compared to existing system]			57,954
CRC + CCL + RHI Saving [Compared to existing system]			0
Running Cost Saving per year [using...]			57,954
Payback time period on additional cost compare to an electric immersion heater [years]			**1.6**
Payback time period on capital cost compare to an electric immersion heater [years]			**2.0**

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VII) Payback Curve

Our energy use estimations are based 11.5 pence per kWh (Off peak tariff) and 16.36 pence per kWh (Peak tariff) for electricity and 5.50 pence per kWh for gas.

Based on the current hot water requirement we estimate that the current utility cost would be £ 34,734 per annum. Based on a 5% fuel increase, year on year, a 15 year estimated running cost would be in the region of £ 779,639 based on the use of a like for like gas boiler replacement.

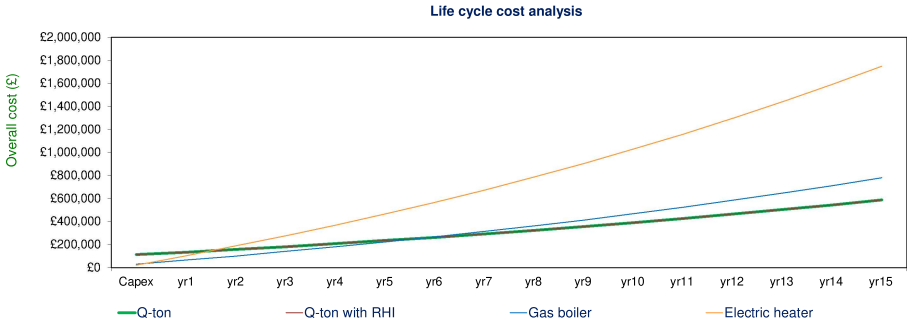
Based on these costs and the estimated running costs we estimate that the additional cost for the air source heat pumps would be paid back within less than 7 years based on current energy use.

The life cycle savings are based only on a 15 year payback period; however the heat pumps should have an operational life of 20 years and therefore would offer even greater savings.

Based on the 15 year operational life, we estimate the overall cost of operating the equipment over the period would be as follows.

15 year expenditure estimate (£)

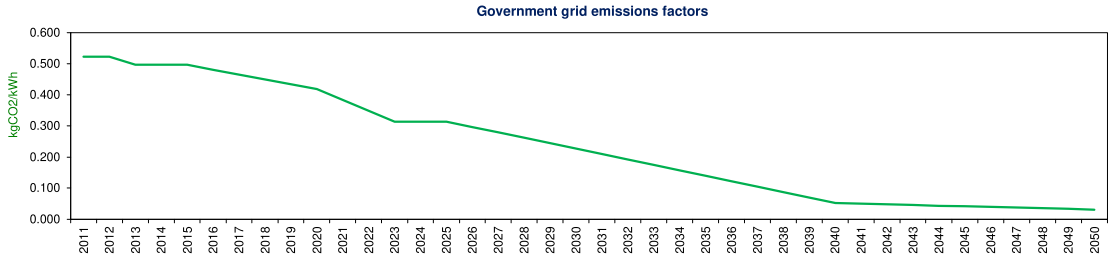
Electric heater	£1,747,797.69
Gas boiler	£779,638.59
Q-ton system	£587,638.21
Q-ton + RHI	£587,638.21



Q-ton heat pump option would offer a considerable saving when compared to the current heating set up; and would offer the greatest savings over the time period.

VIII) Future Use

The government is committed to reducing the carbon emissions for the UK and a key factor in achieving this is the decarbonisation of the electric grid.

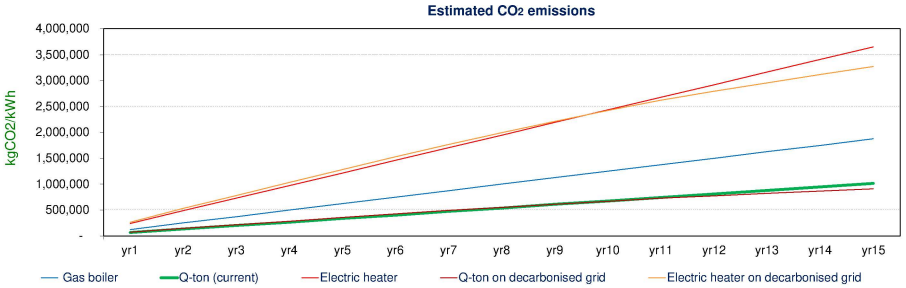


The graph above is based on the government's published targets. It shows the set targets and reductions and based on this the use of low energy electric heating system has been identified as one of the main factors to achieving the CO2 emission targets set by the European Union and UK Government.

We have shown the impact with the use of Q-ton on the current carbon emission and after the decarbonisation of the grid.

15 year CO_2 emission estimate (kg)

Electric Imer. heater	3,650,358
Elec + decarbonised grid	3,275,015
Gas boiler	1,875,615
Q-ton system	1,013,742
Q-ton + decarbonised grid	909,506



During our initial design we have accounted for these changes and is one of the reasons why we propose an electric heat pump system over the gas fired system. The current taxation on CO_2 emissions will only increase and thus it is imperative that we design our systems with as little CO_2 emissions as possible to not only protect the environment but also to reduce the impact on higher and higher fuel charges.

Therefore if an investment is made in electric heat pumps systems, the CO_2 emissions will fall year on year with the same operation, when used on the cleaner, decarbonised electric grid. As carbon will be taxed more in the future, future tax liability has to be considered.

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING EUROPE

Q-ton Air to Water

Project reference:	Echo St - IQ - Tower C - 234 Beds	**Prepared by :**	Craig Smith	**Mobile:**	0771 548 4827
Address:	Manchester	**Date :**	02.08.2023	**E-mail:**	support@mhitechnical.co.uk

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Note:

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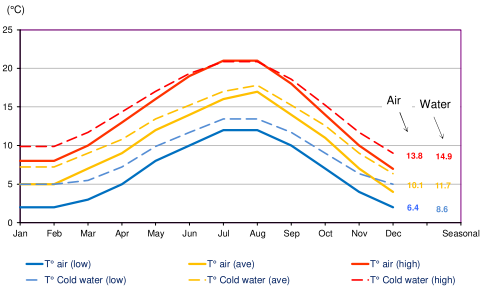
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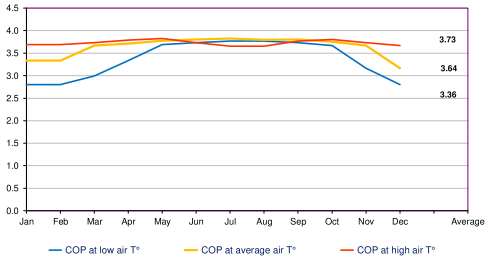
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I) Q-ton estimated COP

Ambient conditions in Manchester



Q-ton efficiency

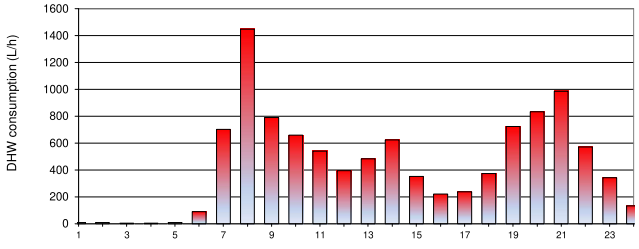


II) Hot water consumption profile

PERIOD	
0:00 to1:00	9
1:00 to 2:00	9
2:00 to 3:00	4
3:00 to 4:00	4
4:00 to 5:00	9
5:00 to 6:00	88
6:00 to 7:00	702
7:00 to 8:00	1448
8:00 to 9:00	790
9:00 to 10:00	658
10:00 to 11:00	540
11:00 to 12:00	395
12:00 to 13:00	483
13:00 to 14:00	623
14:00 to 15:00	351
15:00 to 16:00	219
16:00 to 17:00	237
17:00 to 18:00	373
18:00 to 19:00	724
19:00 to 20:00	834
20:00 to 21:00	987
21:00 to 22:00	570
22:00 to 23:00	342
23:00 to 24:00	132

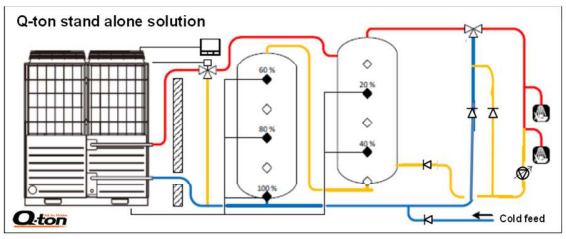
Total : **10530** litres per day

Daily consumption: **10530** litres



Consumption profil at 60°C

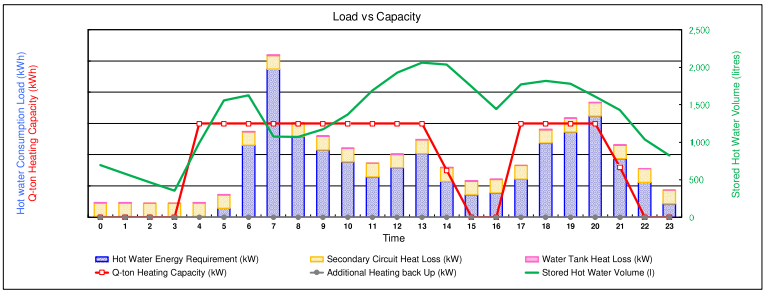
III) Basic installation water schematic



CALCULATION RESULTS

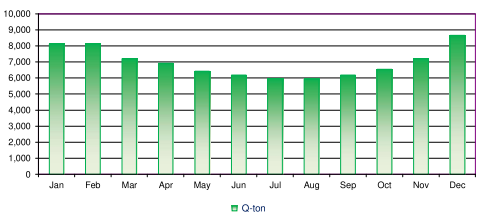
Energy output requirement	**60**	**kW**
Number of Q-ton required	**2**	
DHW storage volume required	**2,163**	**litres**

V) Typical one day operation patern (winter time)



IV) Your annual energy consumption and CO_2 emissions

Q-ton energy consumption (KW)



DHW storage temperature => **75 °C**

Seasonal air ambient temperature => **10.1 °C**

Estimated annual consumption
83,402 kW/yr

Estimated CO_2 emissions per year
40,033 kg

Q-ton - estimated annual COP => **3.64**

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AIR CONDITIONING EUROPE

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The most efficient way to produce your sanitary hot water!

MHI Specifications
561 Ipswich Road
Slough Trading Estate
Slough
Berkshire
SL1 4EP

Prepared for:	Mohammed Siddiqui - Watermans
Project reference:	Echo St - IQ - Tower C - 234 Beds
Address:	Manchester

Prepared by:	Craig Smith
Date:	02.08.2023
Mobile:	0771 548 4827
E-mail:	support@mhitechnical.co.uk

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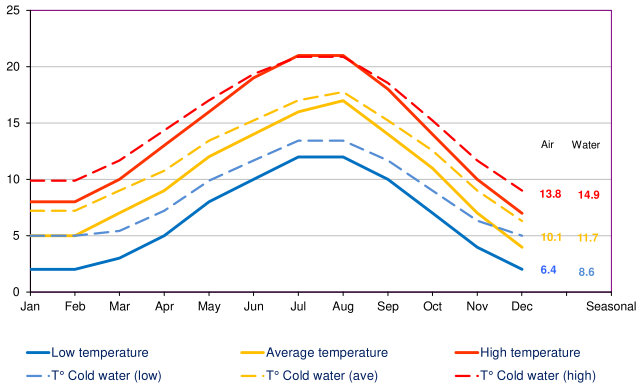
I) Your hot water consumption at 60°C (m³/year)

Type	Description	consumption in litres @ 60°C	Number of units	Number of days/year	Total (m³/yr)	
Rented Apartment	per person/day	45	234	365	3843	m³/year
		TOTAL :			3,843	m³/year
					10,530	litres/day

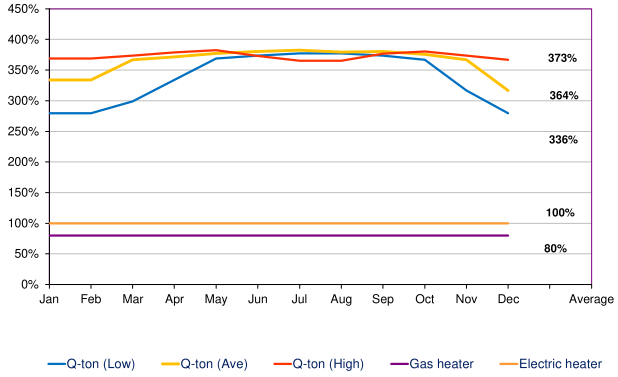
II) Ambient conditions and Efficiency

Plate heat exchanger usage? NO

Ambient conditions in Manchester



Efficiency comparison

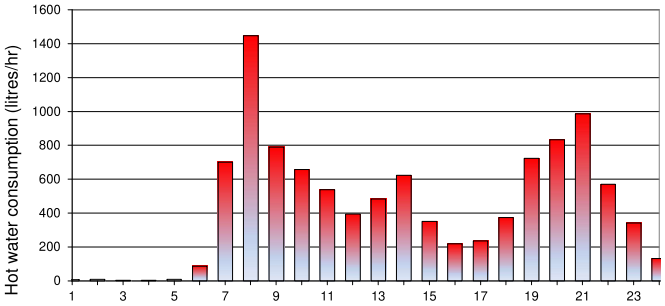


III) Energy load requirement and water storage capacity

PERIOD	
0:00 to1:00	9
1:00 to 2:00	9
2:00 to 3:00	4
3:00 to 4:00	4
4:00 to 5:00	9
5:00 to 6:00	88
6:00 to 7:00	702
7:00 to 8:00	1448
8:00 to 9:00	790
9:00 to 10:00	658
10:00 to 11:00	540
11:00 to 12:00	395
12:00 to 13:00	483
13:00 to 14:00	623
14:00 to 15:00	351
15:00 to 16:00	219
16:00 to 17:00	237
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20:00 to 21:00	987
21:00 to 22:00	570
22:00 to 23:00	342
23:00 to 24:00	132

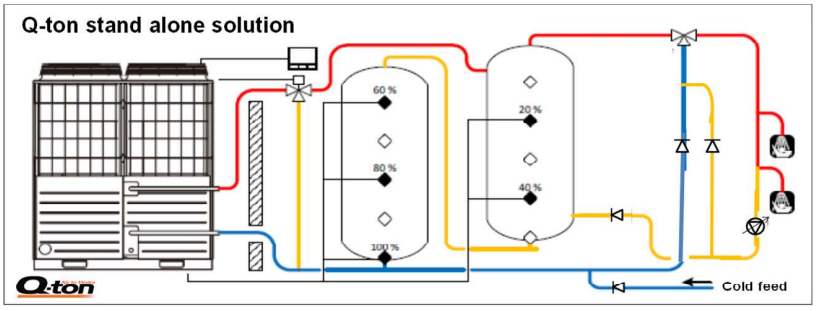
Total : 10530 litres per day

Daily consumption 10,530 litres/day



Hot water consumption profile at 60℃

Proposed schematic

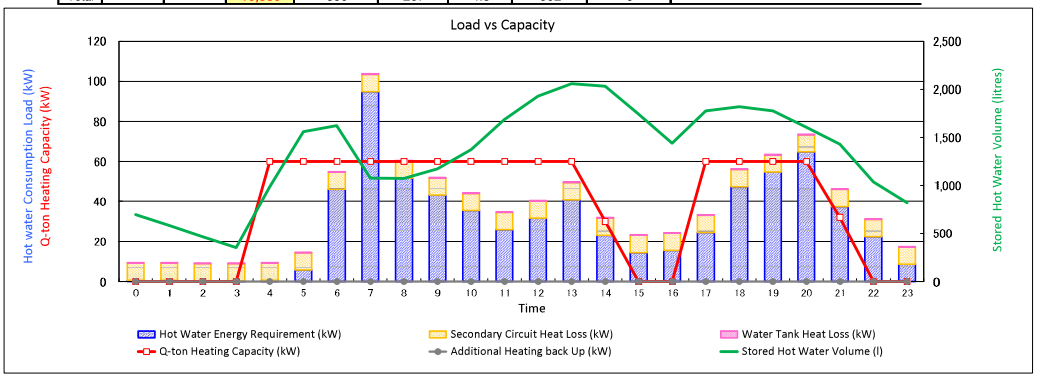


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Winter condition

Maximum stored energy : 592 [MJ]
Required water storage capacity at 60℃ : 2,635 [L]
Water storage temperature : 75 [℃]
Required water storage capacity at 75℃ : 2,060 [L]
Hot water load margins(input) : 5%

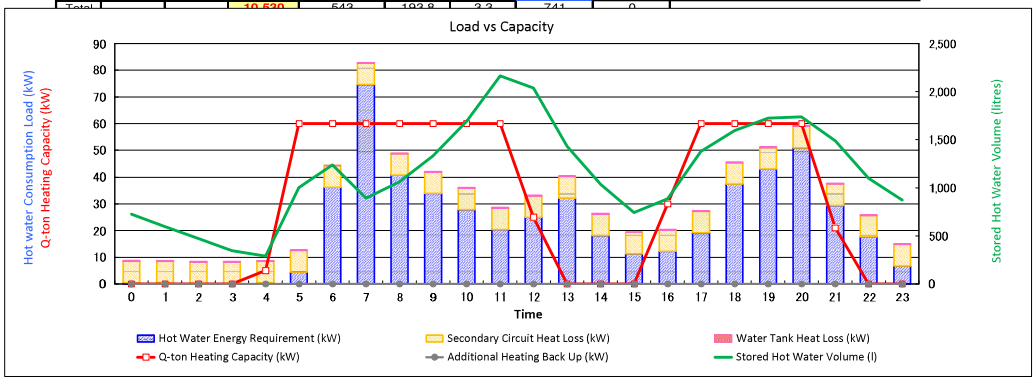
Time	Outside temp [℃]	Feed water temp [℃]	Hot water usage @60℃ [L/h]	① Hot water consumption load [kW]	①' Secondary circuit heat loss [kW]	①" Water tank heat loss [kW]	② Q-ton heating capacity [kW]	②' Additional heating back up [kW]	③Hourly heating capacity differential [kW] (②+②'-①-①'-①")	④ Stored hot water volume@75℃ [litres]	Stored energy ratio [%]
Remains of stored heat volume at 0:00 (Initial stored heat volume)･･･input										814	40%
0	4.0	6.3	9	0.6	8.6	0.13	0.0	0.0	-9.4	696	34%
1	4.0	6.3	9	0.6	8.6	0.11	0.0	0.0	-9.3	581	28%
2	4.0	6.3	4	0.3	8.6	0.10	0.0	0.0	-9.0	466	23%
3	4.0	6.3	4	0.3	8.6	0.08	0.0	0.0	-9.0	355	17%
4	4.0	6.3	9	0.6	8.6	0.07	60.0	0.0	50.7	988	48%
5	4.0	6.3	88	5.7	8.6	0.15	60.0	0.0	45.5	1,559	76%
6	4.0	6.3	702	46.0	8.6	0.22	60.0	0.0	5.2	1,625	79%
7	4.0	6.3	1,448	94.9	8.6	0.23	60.0	0.0	-43.8	1,075	52%
8	4.0	6.3	790	51.7	8.6	0.16	60.0	0.0	-0.5	1,072	52%
9	4.0	6.3	658	43.1	8.6	0.16	60.0	0.0	8.1	1,172	57%
10	4.0	6.3	540	35.4	8.6	0.17	60.0	0.0	15.8	1,371	67%
11	4.0	6.3	395	25.9	8.6	0.20	60.0	0.0	25.3	1,687	82%
12	4.0	6.3	483	31.6	8.6	0.24	60.0	0.0	19.5	1,931	94%
13	4.0	6.3	623	40.8	8.6	0.27	60.0	0.0	10.3	2,060	100%
14	4.0	6.3	351	23.0	8.6	0.28	30.0	0.0	-1.9	2,035	99%
15	4.0	6.3	219	14.4	8.6	0.28	0.0	0.0	-23.3	1,743	85%
16	4.0	6.3	237	15.5	8.6	0.24	0.0	0.0	-24.4	1,440	70%
17	4.0	6.3	373	24.4	8.6	0.21	60.0	0.0	26.8	1,774	86%
18	4.0	6.3	724	47.4	8.6	0.25	60.0	0.0	3.7	1,820	88%
19	4.0	6.3	834	54.6	8.6	0.25	60.0	0.0	-3.5	1,778	86%
20	4.0	6.3	987	64.7	8.6	0.25	60.0	0.0	-13.6	1,607	78%
21	4.0	6.3	570	37.4	8.6	0.23	32.0	0.0	-14.3	1,430	69%
22	4.0	6.3	342	22.4	8.6	0.20	0.0	0.0	-31.2	1,037	50%
23	4.0	6.3	132	8.6	8.6	0.15	0.0	0.0	-17.4	821	40%
Total			10,530	690	207	4.6	902	0			



Summer condition

Maximum stored energy : 518 [MJ]
Required water storage capacity at 60℃ : 2,931 [L]
Water storage temperature : 75 [℃]
Required water storage capacity at 75℃ : 2,163 [L]
Hot water load margins(input) : 5%

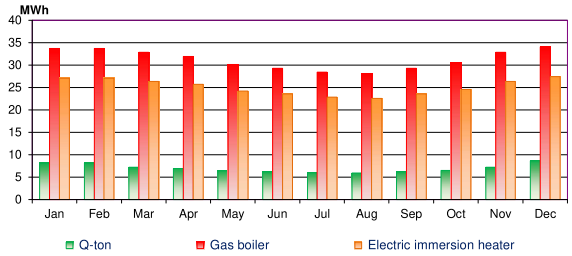
Time	Outside temp [℃]	Feed water temp [℃]	Hot water usage @60℃ [L/h]	① Hot water consumption load [kW]	①' Secondary circuit heat loss [kW]	①" Water tank heat loss [kW]	② Q-ton heating capacity [kW]	②' Additional heating back up [kW]	③Hourly heating capacity differential [kW] (②+②'-①-①'-①")	④ Stored hot water volume@75℃ [litres]	Stored energy ratio [%]
Remains of stored heat volume at 0:00 (Initial stored heat volume)･･･input										856	40%
0	17.0	17.8	9	0.5	8.1	0.11	0.0	0.0	-8.7	726	34%
1	17.0	17.8	9	0.5	8.1	0.09	0.0	0.0	-8.7	597	28%
2	17.0	17.8	4	0.2	8.1	0.08	0.0	0.0	-8.4	472	22%
3	17.0	17.8	4	0.2	8.1	0.07	0.0	0.0	-8.3	347	16%
4	17.0	17.8	9	0.5	8.1	0.06	5.0	0.0	-3.6	292	14%
5	17.0	17.8	88	4.5	8.1	0.05	60.0	0.0	47.4	1,002	46%
6	17.0	17.8	702	36.2	8.1	0.12	60.0	0.0	15.6	1,236	57%
7	17.0	17.8	1,448	74.6	8.1	0.15	60.0	0.0	-22.8	893	41%
8	17.0	17.8	790	40.7	8.1	0.11	60.0	0.0	11.1	1,060	49%
9	17.0	17.8	658	33.9	8.1	0.13	60.0	0.0	17.9	1,332	62%
10	17.0	17.8	540	27.8	8.1	0.16	60.0	0.0	24.0	1,691	78%
11	17.0	17.8	395	20.4	8.1	0.19	60.0	0.0	31.3	2,163	100%
12	17.0	17.8	483	24.9	8.1	0.24	25.0	0.0	-8.2	2,037	94%
13	17.0	17.8	623	32.1	8.1	0.23	0.0	0.0	-40.4	1,432	66%
14	17.0	17.8	351	18.1	8.1	0.17	0.0	0.0	-26.3	1,035	48%
15	17.0	17.8	219	11.3	8.1	0.13	0.0	0.0	-19.5	743	34%
16	17.0	17.8	237	12.2	8.1	0.10	30.0	0.0	9.6	885	41%
17	17.0	17.8	373	19.2	8.1	0.11	60.0	0.0	32.6	1,378	64%
18	17.0	17.8	724	37.3	8.1	0.16	60.0	0.0	14.5	1,595	74%
19	17.0	17.8	834	43	8.1	0.18	60.0	0.0	8.7	1,724	80%
20	17.0	17.8	987	50.9	8.1	0.20	60.0	0.0	0.8	1,737	80%
21	17.0	17.8	570	29.4	8.1	0.20	21.0	0.0	-16.7	1,486	69%
22	17.0	17.8	342	17.6	8.1	0.17	0.0	0.0	-25.8	1,098	51%
23	17.0	17.8	132	6.8	8.1	0.13	0.0	0.0	-15.0	873	40%
Total			10,530	543	193.8	3.3	741	0			

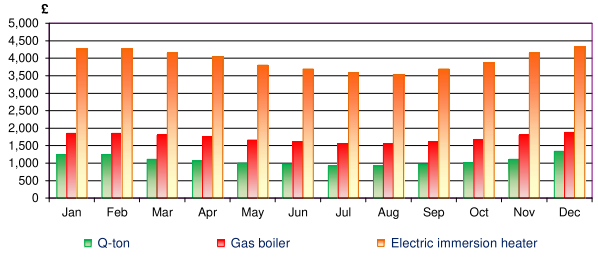


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IV) Your annual energy consumption, running cost saving and CO_2 emission





Energy Tariff (£/kWh)	Electricity:	0.1150	£ per kWh (0:00~7:00) *(Off peak tariff)*	0.1636	£ per kWh (7:00~24:00) *(Peak tariff)*	Gas:	0.0550 £ per kWh
CO_2 emission (kg/kWh)	Electricity:	0.4800	kg/kWh			Gas:	0.1980 kg/kWh

	Energy consumption		Running Cost (£)	Running Cost saving (£)	CO_2 emission (kg)	
Electric immersion heater efficiency :	100%					
Corresponding annual consumption :	301,098	kWh/year	47,344	34,453	144,527	72.30%
Gas oil boiler efficiency :	80%					
Corresponding annual consumption :	374,559	kWh/year	20,601	7,709	74,163	46.02%
Q-ton system				37.42% 72.77%		
Corresponding annual consumption : Q-ton :	83,402	kWh/year	12,892		40,033	
Boiler :	0	kWh/year				
Electric immersion heater :	0	kWh/year				

			Q-ton vs. Gas boiler	Q-ton vs. Electric Immersion heater
CRC - Carbon tax saving (if applicable) = Based on	0	pence per kg of CO2e	£0.00 per year	£0.00 per year
Existing Climate Change Levy tax = Based on	0	pence per kW of gas used	£0.00 per year	£0.00 per year
New Climate Change Levy tax = Based on	0	pence per kW of electricity used	£0.00 per year	£0.00 per year
Climate Change Levy tax saving =			£0.00 per year	£0.00 per year
RHI (Renewable Heat Incentive) *provisional Based on*	0	pence per kW output	£0.00 per year	£0.00 per year
Total cost saving compare to .... =			£7,709.23 per year	£34,452.80 per year

V) Mitsubishi Heavy Industries solution

Q-ton heating capacity : 60 kW
Maximum nessesary storage tank volume : 2,163 L (Water tank efficiency ratio 100%)

2	x Q-ton (x 30kW)	45,146
3	x 750 litres water tank storage	10,983
0	Water Treatment Device	0
1	Remote Monitoring System	5,127
	Installation cost (estimated)	0

VI) Investment cost comparison

	Gas heater	vs	Q-Ton System
Hot Water Device: Capital Cost	16,335		61,256
Installation Cost [estimated]	0		0
Total Installed Cost	16,335		61,256
Running Cost per year	20,601		12,892
Additional Investment [using Q-Ton]			44,921
Running Cost Saving [Compared to existing gas heater]			7,709
CRC + CCL + RHI Saving [Compared to existing gas heater system]			0
Running Cost Saving per year [using...]			7,709
Payback time period on additional cost compare to a gas boiler [years]			**5.8**
Payback time period on capital cost compare to a gas boiler [years]			**7.9**

	Electric heater	vs	Q-Ton System
Hot Water Device: Capital Cost	12,251		61,256
Installation Cost [estimated]	0		0
Total Installed Cost	12,251		61,256
Running Cost per year	47,344		12,892
Additional Investment [using Q-Ton]			49,005
Running Cost Saving [Compared to existing system]			34,453
CRC + CCL + RHI Saving [Compared to existing system]			0
Running Cost Saving per year [using...]			34,453
Payback time period on additional cost compare to an electric immersion heater [years]			**1.4**
Payback time period on capital cost compare to an electric immersion heater [years]			**1.8**

THIS IS AN ESTIMATION ONLY
PLEASE CHECK AND CONFIRM WITH MHIAE YOUR DAILY HOT WATER CONSUMPTION FOR AN ACCURATE RUNNING COST AND CARBON EMISSION SAVING.

MITSUBISHI HEAVY INDUSTRIES, LTD. Our Technologies, Your Tomorrow

VII) Payback Curve

Our energy use estimations are based 11.5 pence per kWh (Off peak tariff) and 16.36 pence per kWh (Peak tariff) for electricity and 5.50 pence per kWh for gas.

Based on the current hot water requirement we estimate that the current utility cost would be £ 20,601 per annum. Based on a 5% fuel increase, year on year, a 15 year estimated running cost would be in the region of £ 460,870 based on the use of a like for like gas boiler replacement.

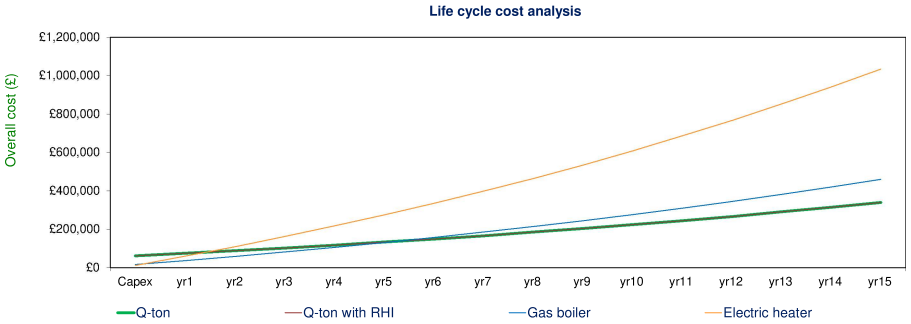
Based on these costs and the estimated running costs we estimate that the additional cost for the air source heat pumps would be paid back within less than 6 years based on current energy use.

The life cycle savings are based only on a 15 year payback period; however the heat pumps should have an operational life of 20 years and therefore would offer even greater savings.

Based on the 15 year operational life, we estimate the overall cost of operating the equipment over the period would be as follows.

15 year expenditure estimate (£)

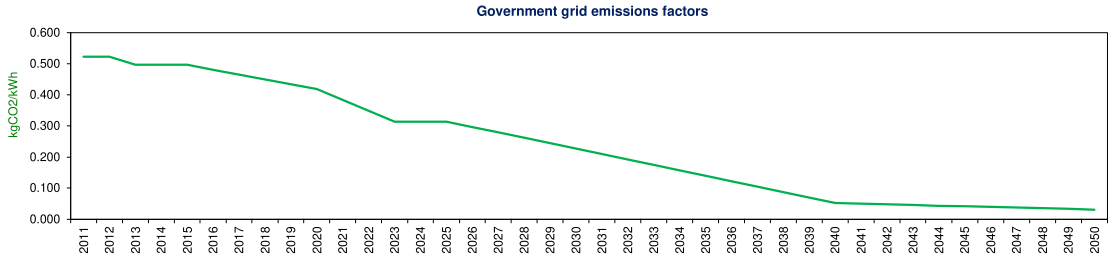
Electric heater	£1,033,874.06
Gas boiler	£460,869.98
Q-ton system	£339,436.92
Q-ton + RHI	£339,436.92



Q-ton heat pump option would offer a considerable saving when compared to the current heating set up; and would offer the greatest savings over the time period.

VIII) Future Use

The government is committed to reducing the carbon emissions for the UK and a key factor in achieving this is the decarbonisation of the electric grid.

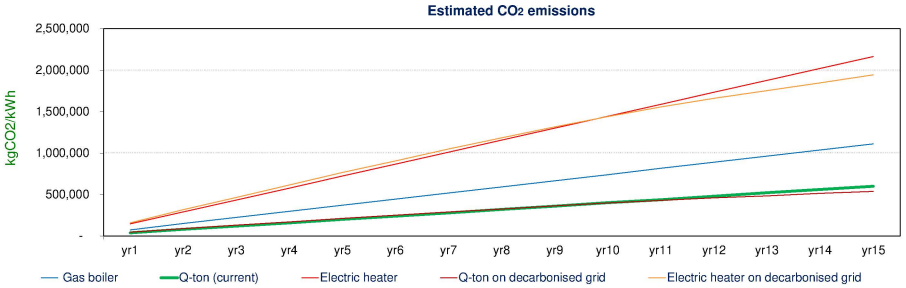


The graph above is based on the government's published targets. It shows the set targets and reductions and based on this the use of low energy electric heating system has been identified as one of the main factors to achieving the CO2 emission targets set by the European Union and UK Government.

We have shown the impact with the use of Q-ton on the current carbon emission and after the decarbonisation of the grid.

15 year CO_2 emission estimate (kg)

Electric Imer. heater	2,167,905
Elec + decarbonised grid	1,944,993
Gas boiler	1,112,442
Q-ton system	600,495
Q-ton + decarbonised grid	538,750



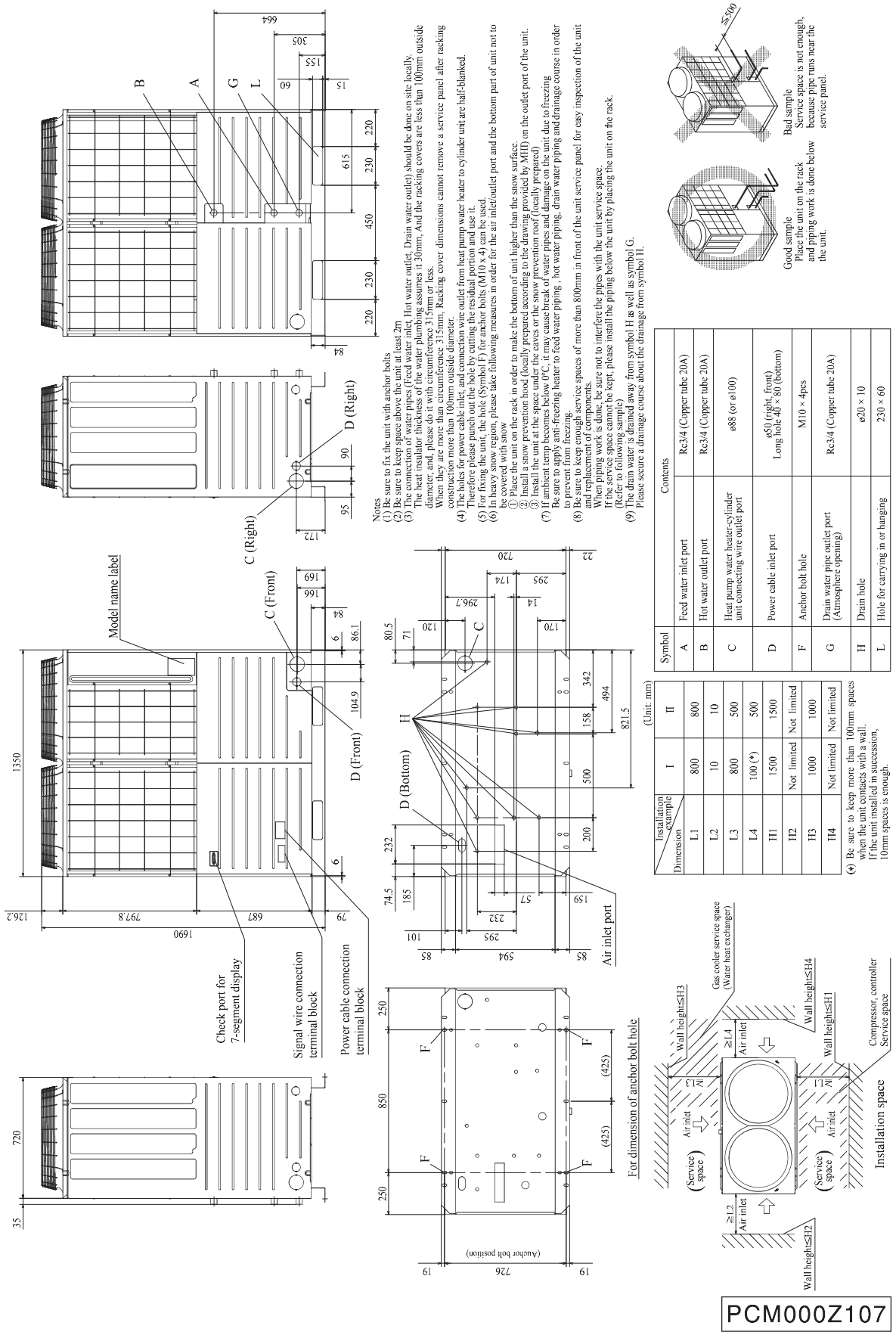
During our initial design we have accounted for these changes and is one of the reasons why we propose an electric heat pump system over the gas fired system. The current taxation on CO_2 emissions will only increase and thus it is imperative that we design our systems with as little CO_2 emissions as possible to not only protect the environment but also to reduce the impact on higher and higher fuel charges.

Therefore if an investment is made in electric heat pumps systems, the CO_2 emissions will fall year on year with the same operation, when used on the cleaner, decarbonised electric grid. As carbon will be taxed more in the future, future tax liability has to be considered.

2.2 Exterior dimensions

(1) Heat pump water heater

Model : ESA30E



Notes
(1) Be sure to fix the unit with anchor bolts
(2) Be sure to keep space above the unit at least 2m
(3) The connection of water pipes (Feed water inlet, Hot water outlet, Drain water outlet) should be done on site locally.
The heat insulator thickness of the water plumbing assumes it 30mm, And the racking covers are less than 100mm outside diameter, and, please do it with circumference 315mm or less.
When they are more than circumference 315mm, Racking cover dimensions cannot remove a service panel after racking construction more than 100mm outside diameter.
(4) The holes for power cable inlet, and connection wire outlet from heat pump water heater to cylinder unit are half-blanked.
Therefore please punch out the hole by cutting the residual portion and use it.
(5) For fixing the unit, the hole (Symbol F) for anchor bolts (M10 x 4) can be used.
(6) In heavy snow region, please take following measures in order for the air inlet/outlet port and the bottom part of unit not to be covered with snow.
① Place the unit on the rack in order to make the bottom of unit higher than the snow surface.
② Install a snow prevention hood (locally prepared according to the drawing provided by MII) on the outlet port of the unit.
③ Install the unit at the space under the eaves or the snow prevention roof (locally prepared)
(7) If ambient temp becomes below 0°C, it may cause break of water pipes and damage on the unit due to freezing.
Be sure to apply anti-freezing heater to feed water piping, hot water piping, drain water piping and drainage course in order to prevent from freezing.
(8) Be sure to keep enough service spaces of more than 800mm in front of the unit service panel for easy inspection of the unit and replacement of components
When piping work is done, be sure not to interfere the pipes with the unit service space.
If the service space cannot be kept, please install the piping below the unit by placing the unit on the rack.
(Refer to following sample)
(9) The drain water is drained away from symbol H as well as symbol G.
Please secure a drainage course about the drainage from symbol H.

(Unit: mm)

Installation example / Dimension	I	II
L1	800	800
L2	10	10
L3	800	500
L4	100 (*)	500
H1	1500	1500
H2	Not limited	Not limited
H3	1000	1000
H4	Not limited	Not limited

(*) Be sure to keep more than 100mm spaces when the unit contacts with a wall.
If the unit installed in succession, 10mm spaces is enough.

Symbol	Contents	
A	Feed water inlet port	Rc3/4 (Copper tube 20A)
B	Hot water outlet port	Rc3/4 (Copper tube 20A)
C	Heat pump water heater-cylinder unit connecting wire outlet port	ø88 (or ø100)
D	Power cable inlet port	ø50 (right, front) Long hole 40 × 80 (bottom)
F	Anchor bolt hole	M10 × 4pcs
G	Drain water pipe outlet port (Atmosphere opening)	Rc3/4 (Copper tube 20A)
H	Drain hole	ø20 × 10
L	Hole for carrying in or hanging	230 × 60

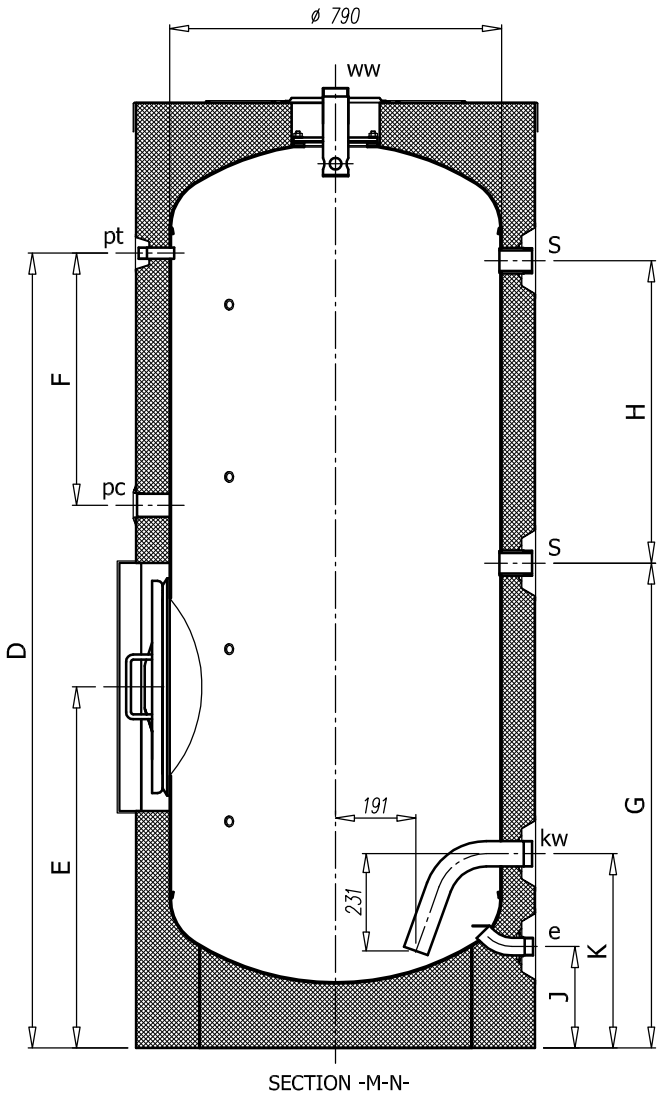
PCM000Z107

lapesa

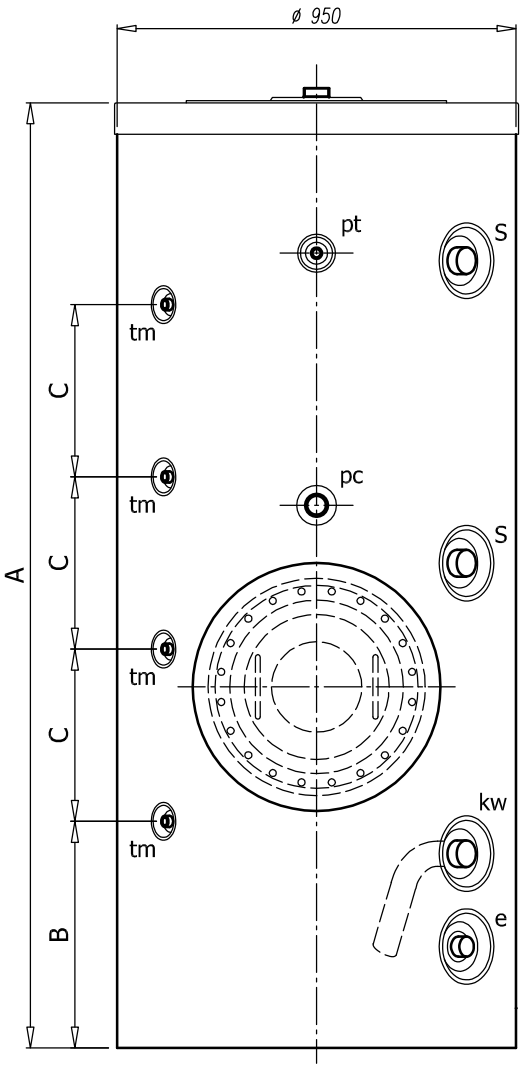
D.H.W. VITRIFIED TANK
Model CVM-RB-750/1000/PSS2

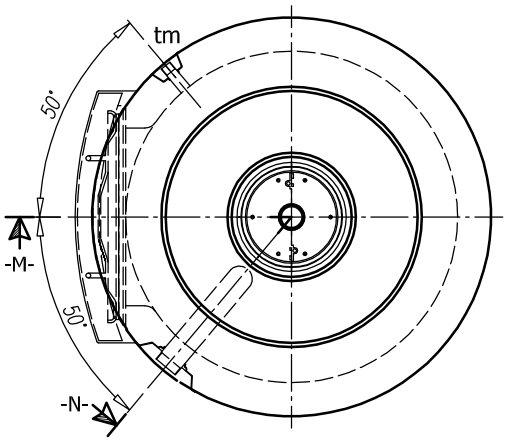
Ficha Técnica

Ref.: FP20_329-01
Fecha: 21/02/2019
Cliente: MITSUBISHI HEAVY INDUSTRIES



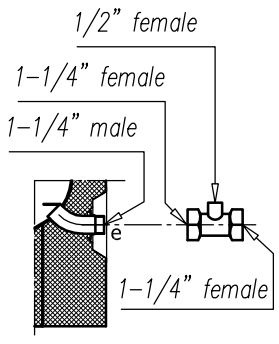
SECTION -M-N-





Mod.	A	B	C	D	E	F	G	H	J	K
CVM-RB-750	1840	498	320	1550	818	300	963	570	200	420
CVM-RB-1000	2250	538	410	1890	858	600	1152	720	240	460

kw	Water inlet	2"	male
e	Drain	1-1/4"	male
ww	Water outlet	2"	male
pt	Pressure and temperature	3/4"	male
tm	Water sensor	3/4"	male
pc	Cathodic protection connection	1-1/2"	female
S	Side connection	2"	male



Drain connection detail

TECHNICALS CHARACTERISTICS

D.H.W. tank :
* Material: S 275 JR
  Vitrified according to DIN 4753
* Max. working pressure : 8 bar
* Max. working temperature : 90 °C

Thermally insulated :
* Polyurethane foam
* C.F.C free
* Density 45 Kg/m3
* Thickness : 80 mm

DN 400 removable manhole
External jackets with accesories

Conforme O.T.	Conforme Cliente		Correspondiente a
			Código

* ALL DIMENSIONS AND WEIGHTS ARE SUBJECT TO NORMAL MANUFACTURING TOLERANCES *

MITSUBISHI
HEAVY INDUSTRIES

AIR CONDITIONING
& WATER HEATING

QRMS
QTON REMOTE MONITORING SYSTEM

QRMS: QTON REMOTE MONITORING SYSTEM

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING & WATER HEATING
SPECIFICATIONS

MAXIMISE EFFICIENCY

1. Efficient & Effective Usage of the Qton System

- QRMS can generate a full & informative 3 month operation report.
- Analysis of the report can optimise the operation of the Qton and increase cost savings for the user.
- Operational data can be stored for up to 5 years on the server to see the full hot water trend of the system.

24 / 7

2. 24/7 Monitoring

- QRMS can provide external monitoring for multiple properties at the same time.
- Regular reports on the Qton system allow for regular maintenance guidance and monitoring.
- Operational alerts and warnings can be received by e-mail .
- Alerts and warnings can be designated to different email addresses dependent on required actions (User, maintenance company etc...)
- A huge advantage of QRMS is that, in hard-water areas, regular maintenance of key components can reduce the possible build up of calcium and lime scale ensuring an efficient system.

3. Quick Service

- Visualisation of the Qton and errors can be checked online before site-visit for rapid diagnosis.
- Problem can be understood remotely so time at site is reduced.
- Qton down-time can be reduced as maintenance provider is prepared before repair/solution provided.



USER FRIENDLY OVERVIEW OF THE SYSTEM OPERATION

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING & WATER HEATING
SPECIFICATIONS

Quarterly report information

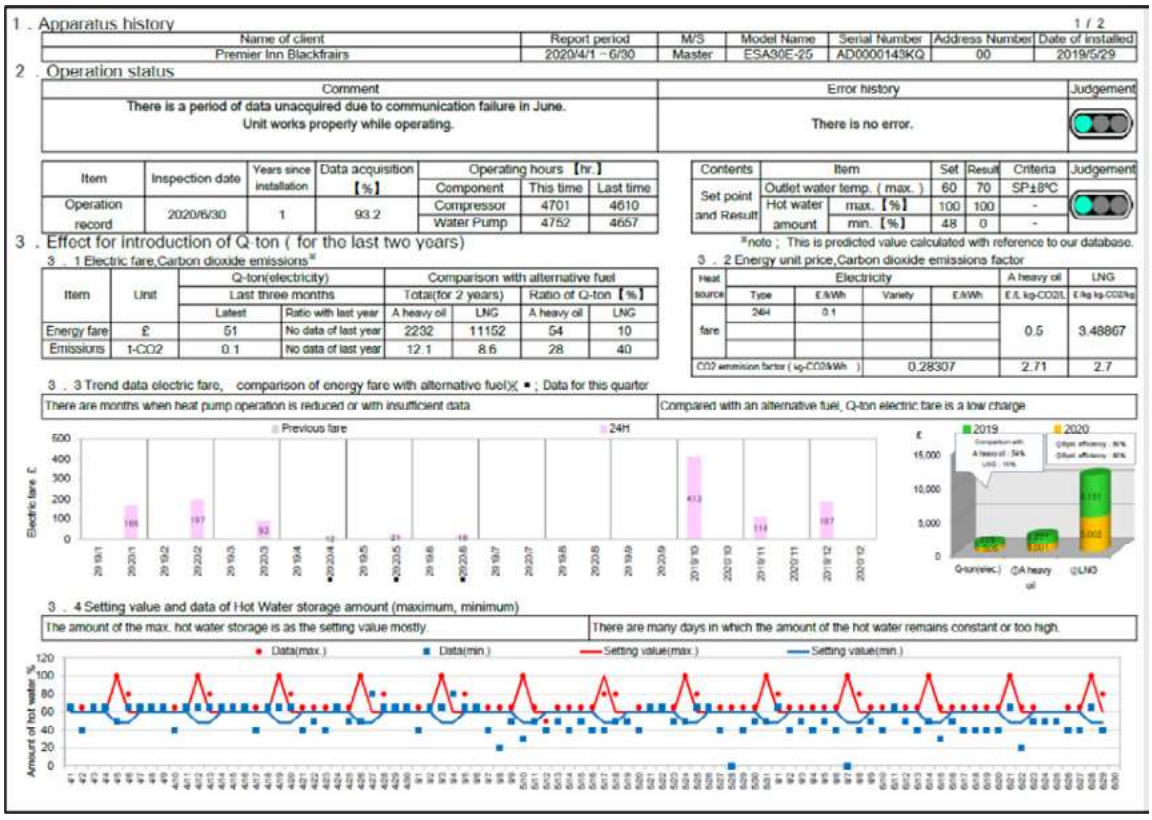
- Site name & report dates
- Qton product number (serial no)
- Operational status and quarterly trends
- Cost saving analysis versus traditional systems
- Hot water storage usage & effectiveness
- Any errors or problems with the site during the quarter
- Traffic light status indication:

  Green = Normal Operation

  Amber = Caution, Qton needs possible maintenance for full efficiency

  Red = Anomaly detected, Qton needs assistance

(Fig 1) Example of user friendly 3-month report



EASY SITE RECOGNITION & SYSTEM OVERVIEW

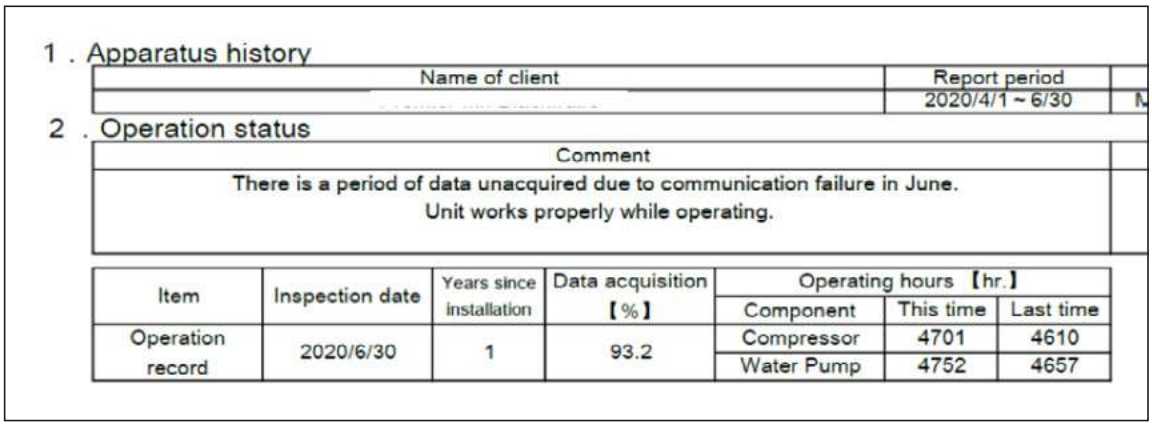
MITSUBISHI HEAVY INDUSTRIES AIR CONDITIONING & WATER HEATING
SPECIFICATIONS

The report provides an easy to read general comment on the operation of the site during the 3 month period.

Report overview data;

- Data collection % for the period (for full analysis)
- Operational hours of the installed Qton
- Compressor running time (hrs) for the quarter
- Water pump running time (hrs) for the quarter

(Fig 2) Site name, report date and operational hours can be easily seen



1 . Apparatus history

Name of client	Report period
	2020/4/1 ~ 6/30

2 . Operation status

Comment
There is a period of data unacquired due to communication failure in June. Unit works properly while operating.

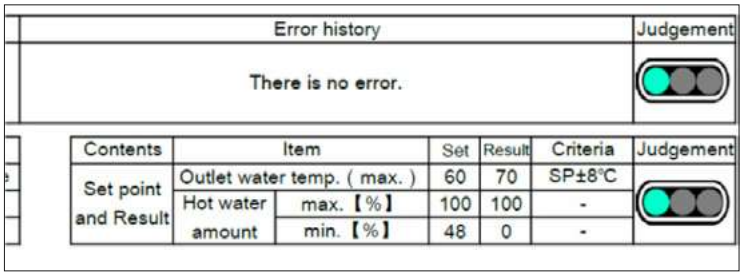
Item	Inspection date	Years since installation	Data acquisition【%】	Operating hours【hr.】		
				Component	This time	Last time
Operation record	2020/6/30	1	93.2	Compressor	4701	4610
				Water Pump	4752	4657

Example: Sample data from site, including comment that data sent to QRMS server was 93.2%. Possible modem problem or power outage when data collection was made.

Overview of system health & efficiency

Comments on error history (if any) and the efficiency of the Qton are also reported based on the criteria set for the system. An easy traffic light judgement system illustrates the operational state of the system over the reported period.

(Fig 3) Error history comment and % effectiveness of the Qton.



Error history	Judgement
There is no error.	

Contents	Item		Set	Result	Criteria	Judgement
Set point and Result	Outlet water temp. (max.)		60	70	SP±8℃	
	Hot water amount	max.【%】	100	100	-	
		min.【%】	48	0	-	

OPTIMISATION

The QRMS report can also display the weekly trends of the Qton's electricity and hot water usage for the quarter. This is a real advantage for the user as the Qton can be optimised for peak demands and programmed accordingly based on received accurate data. This can provide true savings as well as optimised Qton running.

(Fig 4) Weekly analysis of electrical consumption and hot water provision by Qton.



Reduced Energy Wastage

Analysis of hot water provision and storage can also be monitored. This tool is useful to display the Qtons operational hours but also the utilisation and waste of heat energy stored in the tank. Alteration and correct scheduling based on data can save costs and Qton running time.

(Fig 5) Graph illustrates that the Qton is providing too much hot water based on programmed settings.



24/7 MONITORING & MAINTENANCE

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING & WATER HEATING
SPECIFICATIONS

The QRMS system can also provide information on errors related to the Qton system. Error messages can be sent to both the end user and/or service/maintenance provider dependent on site requirements.

Errors are sent via email to the intended recipients when the error occurs, highlighting the specific problem.

Examples of error messages reported;

- Unit stopped
- Hot water temperature is excessive / not met
- Compressor anomaly
- Water pump anomaly

(Fig 6) Examples of error email messages

Email to service/maintenance provider (detailed)

CUSTOMER: XXXXX
KEITO:XXXXX
ADDRESS:XXXXXX
TEL: 00-XXXXX-XXXXX
UNIT No: 00
TIME: 2018/11/30 13:37:41
WARNING CODE: W01 Comp stop factor

MEMO
<Details (Date and time, No, Freq)>

2018/11/30 13:37:41	55,1	(Once)
2018/11/30 13:48:06	55,2	(Twice)
2018/11/30 13:58:02	84,1	
2018/11/30 14:04:14	84,2	
2018/11/30 14:11:04	84,3	
2018/11/30 14:17:44	84,4	
2018/11/30 14:24:45	84,5	
2018/11/30 14:31:35	84,6	
2018/11/30 14:38:16	84,7	
2018/11/30 14:45:06	84,8	(8 Times)

<Summary>
55, HP1 Anomaly / System anomaly
84, Anomaly of cut off the water supply / Water circuit anomaly

Email to user (alert)

Customer name: XXXXXXXX
System No.: XXXXXXXX
Customer address: XXXXXXXXX
Urgent Contact: XXXXXXXX 00-XXXXX-XXXX
Malfunction Unit No.: 01
Alarmed time: 2018-12-04 04:27:14

Alarm No.: E40
Compressor running time: 5693 hours
Water pump running time: 6021 hours

Quick Response & Diagnosis

The 24/7 monitoring can allow the service / maintenance contactor to understand the issue before visiting the site. Connection to QRMS provides detailed analysis of the system for the previous day / week / quarter so diagnosis can be made and rectified.

MITSUBISHI HEAVY

QRMS QTON REMOTE MONITORING SYSTEM

MHI Specifications

01753 376 422
sales@MHIspecifications.co.uk

MHI Post Sales Technical Support

0330 123 5598
info@MHItechnical.co.uk

Training Courses

MHItraining@MHItechnical.co.uk

MITSUBISHI HEAVY INDUSTRIES
AIR CONDITIONING & WATER HEATING

UK: Please contact your local Dean & Wood, HRP, RW branch
Ireland: Please contact your local DWG branch