TEST REPORT: No.45

Date: July 31st 2019

CHILLER EFFICIENCY PERFORMANCE WITH INTELLIGENT ADIABATIC CHILLER BOOSTER SYSTEM "SMART COOLING[™]" PRO 10

Participated in the test:

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Gerab energy engineer: Ali Soufan

Swiss Integrated Energy Technologies: Luca Gallarate

Project name: Double Tree by Hilton Dubai Al Barsha hotel, UAE

Object address: Al Sabbat Street, 49, Dubai 00000, United Arab Emirates

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Introduction:

Type of building: Hotel Hilton, Albarsha Dubai. Cooling units: air cooled water chiller Carrier 30XA 1002 total 2 units. Cooling capacity by manufacturer's data performance sheet: 1000 kw Energy consumption by manufacturer's data performance sheet: 344 kw Chiller booster: "Smart Cooling[™]" PRO 10, adiabatic technology with condenser protection.

3-unit chiller retrofits were made to reduce the energy consumption of chillers and to increase chiller COP efficiency. Chillers were equipped with intelligent adiabatic pre-cooling system "Smart Cooling[™]" PRO 10. Chiller booster PRO 10 is based on pre-cooling of air before it enters condensers by using water evaporation technology - spraying and vaporising a very fine water mist before entering the condenser (hot air comes into contact with the fine water mist, the temperature of the incoming air in the condenser is reduced).

Chiller booster components ensure 100% condenser protection from direct contact with water. The water must not reach the condenser.

Main components:

The protective membranes: the membranes are installed outside before the condenser, covering 100% of the condenser surface, thus preventing the water mist from coming into direct contact with the condenser. Water filtration, water purification, water sterilisation: the system provides water purification from minerals and water sterilization to avoid the risk of bacterial occurrence.

High pressure pump capable of providing water pressure up to 70 bar.

A water recirculation system that drains non-evaporated water into a water purification and pump system.

The control unit, which provides complete system control according to ambient air temperature and humidity, provides the complete operation of the system, analyses the parameters of the chiller, ambient air temperature and humidity, and provides the required amount of water in the adiabatic system according to data gathered.

A high-pressure nozzle panels that provide 5-40-micron droplet water spraying.

A set of fasteners and fixings ensuring the compatibility of the chiller booster system with the chiller.





Equipment tested: Air cooled water chillers, Carrier 30XA1002.





Chiller without "Smart Cooling[™]" system

Chiller with "Smart Cooling[™]" system

In Picture No.2 it can be seen that the chiller condensers are fitted with protective membranes that prevent the water from entering the chiller condenser. To the right there is the chiller booster pump station, which includes 70 bar water preparation, water sterilization, purification. The equipment is equipped with a programmable Siemens controller. The right side of the chiller shows the water drain line connected to the pump station. The water that enters the drain is re-filtered and reused.



(Picture No.2 Chiller equipped with "Smart Cooling[™]" system)

Temperature probe Nr.1



Entering air temperature in condenser after condenser protective membrane + 28°C and 46% humidity.

Temperature probe Nr.2



Ambient air temperature +43°C



Testing procedures test Nr.1:

Measuring instruments:

Ultrasonic water flow meter RIF600 was used to measure the effectiveness of the chiller.

The energy monitoring equipment Enicope Enicope analytics, (BEST) was used to measure energy consumption.

The formula for calculating the COP. $EI/kw \div cooling/kw = cop$

Step 1

A data logger was installed on the subject HVAC equipment to collect all applicable real-time energy consumption and unit performance information. Data was collected with Eniscope analytics, energy measurement.

The first 5 days (120 hours of use) of the test measured energy used by the condenser without the "Smart Cooling™" unit. During this period the chillers consumed 70 112 KW/h (Kilowatt hours) of electricity. Water consumption 0 m3.

The average temperature and relative humidity during the period was 36° C / 34 %RH.

Step 2

Switch ON the "Smart Cooling™" system.

Step 3

The next 5 days (120 hours of use) of the test measured energy used by the chiller with an Intelligent adiabatic system "Smart Cooling™". During this period the chiller consumed 53 386 KW/h (Kilowatt hours) of electricity. Water consumption 88 m3. The average temperature and relative humidity during the period was 36° C / 45 %RH. After data analysis monitoring numbers show: Difference / energy savings that provide "Smart Cooling™" system per 5 working days was 16 726 KW/h (Kilowatt hours) of electricity.

Tables below show all numbers, used energy consumption kw/h, before and after use adiabatic system, air temperature, working hours.

Compare total KWh consumed by rack «B» chiller system for 5 consecutive days with adiabatic pre-cooling system OFF – to 5 consecutive days with adiabatic system ON (with comparative temp. data).





Test Nr.1. 5 day electrical consumption comparison 17th - 21st June 'Smart

Conclusion 5 days off and 5 days on of 'Smart Cooling[™]' equipment:

Customer in 5 days saved 16 726 kw/h of electricity, electricity rate was 0.46 AED per kw/h, which brings 7 693 AED in savings.

To achieve this result 88 m3 of water were used with water costs 10.5 AED per m3. In total 924 AED were spent on water.

Summary Test Nr.1

Total savings after running costs were 6 769 AED per 5 days or 1353 AED per day or in average 3 345 kw/h per day with 2 operational chillers.

"Smart Cooling™" expected 17% savings for 14h in 24h operational period, which was evaluated as 755 kw/h savings in 24h from 1 chiller based on 10 degrees temperature drop. As we can see in provided results, performance is much higher as "Smart Cooling™" equipment is working more that 14h and actual temperature drop is in average 14 degrees Celsius in condenser coils after protecting the membrane.



Five day electrical consumption comparison 17th - 21st June 'Smart Cooling[™]' OFF with 3rd -7th June 'Smart Cooling[™]' ON

date	Total chiller consumption in KW/h "Smart Cooling" Off 17 th of June	Total chiller consumption kw/h "Smart Cooling" ON 3 th of June	Savings in kw/h	Savings in %	Hotel load "Smart Cooling" Off	Hotel Load "Smart Cooling" on	Temperature "Smart Cooling" Off 17 th of June	Temperature "Smart Cooling" on 3 th of June
17/06/2019								
00:00	528	292	236	45%			33.49	31.00
17/06/2019								
01:00	504	347	157	31%			33.24	30.44
17/06/2019								
02:00	496	302	193	39%			32.79	30.01
17/06/2019								
03:00	480	304	176	37%			32.59	29.87
17/06/2019								
04:00	480	368	112	23%		\frown	32.51	30.02
17/06/2019			100					
05:00	468	302	166	35%			32.26	29.87
17/06/2019	110	204	120	249/			24.24	20.70
17/06/2010	443	304	139	31%			31.21	29.79
07:00	412	336	76	18%			32.13	30.99
17/06/2019	412	330	10	1078			32.13	30.33
08:00	469	365	104	22%			34.63	34.04
17/06/2019					-		01.00	01.01
09:00	497	391	105	21%			36.81	34.78
17/06/2019					-			
10:00	499	394	104	21%			38.01	35.96
17/06/2019								
11:00	519	397	122	24%			41.79	38.24
17/06/2019 12:00	572	379	193	34%	84%	57%	42.82	38.82
17/06/2019					-			
13:00	581	400	182	31%			39.74	36.75
17/06/2019								
14:00	569	427	142	25%			38.05	36.26
17/06/2019								
15:00	564	506	59	10%			37.39	35.12
17/06/2019								
16:00	565	470	95	17%			36.11	34.56
17/06/2019 17:00	595	493	102	17%			35.42	34.00
17/06/2019								
18:00	606	483	123	20%			34.10	33.02
17/06/2019								
19:00	565	454	111	20%			33.54	32.48
17/06/2019								
20:00	543	440	103	19%			33.17	32.38
17/06/2019			455					
21:00	566	413	153	27%			32.79	32.29
17/06/2019	105	454	AE	00/			22.25	20.47
22:00	495	451	45	9%	-		32.25	32.17
23.00	467	391	76	16%			32.05	32.36
		001	,0	1070			02.00	02.00
Total of day	12483	9408	3075	25%				



date	Total chiller consumption in KW/h "Smart Cooling" Off 18 th of June	Total chiller consumption kw/h "Smart Cooling" ON 4 th of June	Savings in kw/h	savings in %	Hotel load "Smart Cooling" Off	Hotel Load "Smart Cooling" on	Temperature "Smart Cooling" Off 18 th of June	Temperature "Smart Cooling" on 4 th of June
18/06/2019								
00:00	526	429	97	18%			32.28	32.62
18/06/2019								
01:00	512	447	65	13%			32.13	31.53
18/06/2019								
02:00	508	394	113	22%			31.88	30.42
18/06/2019								
03:00	500	418	82	16%			31.40	30.72
18/06/2019								
04:00	491	456	35	7%			30.63	31.32
18/06/2019								
05:00	481	447	35	7%			30.00	31.04
18/06/2019								
06:00	486	450	36	7%		•	29.70	31.46
18/06/2019								
07:00	512	462	50	10%			30.87	32.40
18/06/2019								
08:00	516	470	46	9%			31.97	34.87
18/06/2019								
09:00	540	477	62	12%			33.81	37.52
18/06/2019								
10:00	587	466	121	21%			36.98	41.48
18/06/2019								
11:00	596	492	103	17%			39.52	46.57
18/06/2019	584	473	111	19%	86%	77%	42.07	45.03
12:00				1070				40.00
18/06/2019								
13:00	590	470	120	20%			39.12	40.57
18/06/2019								
14:00	610	475	135	22%	-		37.86	37.73
18/06/2019								
15:00	654	614	40	6%	-		36.57	37.77
18/06/2019								
16:00	655	614	41	6%			35.74	37.29
18/06/2019								
17:00	653	568	85	13%			35.22	36.56
18/06/2019								
18:00	636	539	97	15%			34.18	36.03
18/06/2019								
19:00	624	523	101	16%			33.73	36.63
18/06/2019								
20:00	632	524	108	17%			34.29	36.89
18/06/2019	0.0			10%			04.05	07.00
21:00	610	511	99	16%			34.25	37.63
18/06/2019		170	10	0%			00.00	07.00
22:00	521	479	42	8%	-		33.83	37.69
18/06/2019		475	<u>.</u>	70/			22.22	27.04
23:00	509	475	34	7%	-		33.60	37.61
Total of day	13533	11673	1860	14%				

NoteNo	date	Total chiller consumption in KWh "Smart Cooling" Off 19 th of June	Total chiller consumption kwh "Smart Cooling" ON 5 th of June	Savings in kw/h	savings in %	Hotel load "Smart Cooling" Off	Hotel Load "Smart Cooling" on	Temperature "Smart Cooling" Off 19 th of June	Temperature "Smart Cooling" on 5 th of June
Norm Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 1000000Norm 10000000Norm 1000000Norm 	19/06/2019								
Norm 1000Norm<	00:00	561	428	133	24%			33.86	37.42
NOME NOME<	19/06/2019								
1300019130<	01:00	586	425	161	27%			34.43	36.78
1000009 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000 10000091000009 100000910000009 10000091000009 1000009 </td <td>19/06/2019</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	19/06/2019								
10000 000<	02:00	558	427	131	24%			34.69	36.12
10002019 10002019101	19/06/2019								
Notion of the set of	03:00	528	434	95	18%			34.52	35.29
1000000000000000000000000000000000000	19/06/2019	510	469	40	90/			24.24	24.95
Name Note Note <t< td=""><td>10/06/2010</td><td>510</td><td>400</td><td>42</td><td>0%</td><td></td><td></td><td>34.24</td><td>34.65</td></t<>	10/06/2010	510	400	42	0%			34.24	34.65
10002019 1000000 10000000 100000000 $1000000000000000000000000000000000000$	05:00	500	446	54	11%			33.03	34 53
Note: Note: <t< td=""><td>19/06/2019</td><td></td><td></td><td></td><td>1170</td><td>-</td><td></td><td>00.00</td><td>04.00</td></t<>	19/06/2019				1170	-		00.00	04.00
1908/2019 100 42 2^{2} 3	06:00	500	448	52	10%			33.65	34.61
0.0000.100.4070.22%0.408<	19/06/2019								
19022019 375 472 104 485 19022019 368 474 $a3$ 158 19022019 568 474 $a3$ 158 19022019 577 467 106 198 19022019 577 487 116 198 19022019 577 482 115 198 19022019 567 396 423 396 19022019 568 427 396 423 19022019 568 74 220 386 19022019 568 776 72 396 19022019 568 776 72 396 19022019 528 107 176 19022019 536 528 107 176 19022019 536 528 107 176 19022019 536 577 72 126 19022019 586 577 72 126 19022019 </td <td>07:00</td> <td>519</td> <td>457</td> <td>62</td> <td>12%</td> <td></td> <td></td> <td>33.84</td> <td>35.68</td>	07:00	519	457	62	12%			33.84	35.68
0680 5/5 96.7	19/06/2019								
19902019 200 200 200 $30,7$ 467 100 105 19902019 377 467 100 105 200 100 105 19902019 307 462 115 195 195 100 105 19002019 307 462 115 195 195 420 395 19002019 305 388 247 395 420 395 19002019 305 395 315 420 395 420 395 19002019 305 395 315 315 420 315 19002019 305 390 74 125 305 300 305 19002019 305 393 112 195 105 300 305 19002019 305 393 112 195 105 300 305 19002019	08:00	575	472	104	18%			34.27	36.73
900 55 474 63 194 1962019 1 100 196 196 1962019 000 957 467 100 198 1962019 0597 422 195 196 1960019 0597 338 247 395 463 453 1960019 0597 338 247 395 459 463 459 1960019 0597 414 200 396 463 459 1960019 0597 040	19/06/2019								
19962019 100 1	09:00	558	474	83	15%	~		35.35	38.78
1000 97 467 100 198-0 190602019 057 422 115 194-0 190602019 057 388 247 39% 190602019 050 388 247 39% 190602019 054 398 39% 190602019 054 398 39% 190602019 054 398 39% 190602019 054 398 39% 190602019 054 398 39% 190602019 054 398 39% 190602019 054 363 198 190602019 053 193 198 190602019 053 117 17% 190602019 053 118 17% 190602019 053 128 29% 190602019 108 318 128 190602019 108 128 29% 190602019 108 318 318 190602019 104 370 128 190602019	19/06/2019								
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11:00697442011519%44.344.3190620190.353882473%8%44.34.43190620190.444142303%44.24.294.29190020190.444142303%4.294.294.03190020190.444.2919331%4.293.1% <td>19/06/2019</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	19/06/2019								
19062019 388 247 39% 55^{5} 85^{5}	11:00	597	482	115	19%			41.03	46.33
1200 1200 100 <t< td=""><td>19/06/2019</td><td>635</td><td>388</td><td>247</td><td>39%</td><td>85%</td><td>85%</td><td>42.99</td><td>45.59</td></t<>	19/06/2019	635	388	247	39%	85%	85%	42.99	45.59
11006/2019 0414 230 36% 40.3 1300 040 414 230 36% 1906/2019 2 193 31% 1906/2019 2 193 31% 1906/2019 2 193 31% 1906/2019 2 2 12% 1906/2019 2 2 12% 1906/2019 2 2 12% 1906/2019 2 2 18% 368 1906/2019 2 2 18% 368 1906/2019 2 353 106 17% 1906/2019 3 3 106 17% 1906/2019 3 3 106 17% 1906/2019 3 3 12% 3 1906/2019 3 3 12% 3 1906/2019 3 3 12% 3 1906/2019 3 3 3 3 1906/2019 3 3 3 3 1906/2019 3 <t< td=""><td>12:00</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	12:00								
13.00 0.44 14.00 220 3% 40.39 13.00 0.44 $$	19/06/2019								
Inducating Inducting	13:00	644	414	230	36%			40.22	40.39
14.00 16.01 14.23 16.93 3.1% 1906/2019 6.84 560 74 12% 1906/2019 6.00 6.85 528 107 17% 1906/2019 6.00 6.03 528 107 17% 1906/2019 752 112 18% 34.60 36.60 1906/2019 753 106 17% 35.65 36.60 1906/2019 753 106 17% 35.65 36.60 1906/2019 753 72 18% 34.51 36.60 1906/2019 76 72 18% 34.51 36.60 1906/2019 76 72 18% 34.51 36.60 1906/2019 74 72 12% 34.51 36.60 1906/2019 74 72 12% 12% 35.91 35.61 1906/2019 74 72 12% 2% 32.69 34.51 1906/2019 74 38.31 33% 35.91 35.61 35.69 1906/2019 </td <td>19/06/2019</td> <td>601</td> <td>420</td> <td>102</td> <td>210/</td> <td></td> <td></td> <td>27.00</td> <td>20.16</td>	19/06/2019	601	420	102	210/			27.00	20.16
13000 1300 74 12% 1500 636 560 74 12% 19062019 636 528 107 17% 19062019 752 112 18% 38.60 19062019 752 112 18% 34.65 36.05 19062019 76 753 106 17% 35.55 35.55 19062019 72 12% 35.9 35.55 35.55 35.55 19062019 76 451 128 22% 32.90 34.95 19062019 76 451 128 22% 32.90 34.95 19062019 76 36.3 19.9 33% 33.90 33.90 35.90 19062019 74 77 148 28.90 35.90 35.90 35.90 19062019 52 77 148 28.90 35.90 35.90 35.90 19062019 52 77 18.90 77 18.90 35.90 35.90 35.90 35.90 19062019	14.00	021	429	193	31%			37.59	39.10
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	15:00	634	560	74	12%			36.52	37,80
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19/06/2019 637 525 112 18% 19/06/2019 636 531 106 17% 19/06/2019 636 531 106 17% 19/06/2019 589 517 72 12% 19/06/2019 589 517 72 12% 19/06/2019 578 451 128 22% 19/06/2019 571 383 189 33% 19/06/2019 571 383 189 33% 19/06/2019 571 148 28% 28% 19/06/2019 574 377 148 28% 19/06/2019 524 377 189 38%	16:00	635	528	107	17%			35.46	36.60
17.00 687 525 112 $18%$ $1906/2019$ 686 531 106 $17%$ $1906/2019$ 686 531 106 $17%$ $1906/2019$ 589 517 72 $12%$ $1906/2019$ 589 517 72 $12%$ $1906/2019$ 78 72 $12%$ $82%$ $1906/2019$ 78 451 128 $22%$ $1906/2019$ 71 7333 89 $33%$ $1906/2019$ 71 77 128 $22%$ $1906/2019$ 71 77 189 $33%$ $1906/2019$ 71 77 148 $28%$ $1906/2019$ 71 77 148 $28%$ $1906/2019$ 71 77 189 $28%$ $1906/2019$ 89 89 89 89	19/06/2019					1			
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18:00 636 531 106 17% 19/06/2019 33.70 35.35 19/06/2019 72 12% 32.99 34.74 19/06/2019 72 12% 32.99 34.74 19/06/2019 72 12% 32.99 34.95 19/06/2019 736 451 128 22% 32.99 34.95 19/06/2019 736 189 33% 33% 35.60 35.60 19/06/2019 736 383 189 33% 32.89 35.60 19/06/2019 736 377 148 28% 32.61 35.69 19/06/2019 737 148 28% 32.51 35.69 19/06/2019 737 148 28% 32.51 35.69 19/06/2019 737 148 28% 32.51 35.43 19/06/2019 733 736 89 18% 32.51 35.43 19/06/2019 737 148 28% 32.25 35.43 19/06/2019	19/06/2019					1			
19/06/2019 589 517 72 12% 19/06/2019 78 451 128 22% 19/06/2019 78 451 128 22% 19/06/2019 737 128 22% 19/06/2019 72 12% 32.92 34.95 19/06/2019 71 383 189 33% 33% 32.89 35.40 19/06/2019 71 383 189 33% 33% 35.69 35.69 19/06/2019 72 72 148 28% 32.29 35.43 19/06/2019 72 73.00 493 405 89 18% 74	18:00	636	531	106	17%			33.70	35.35
19:00 589 517 72 12% 19:06/2019 19:06/2019 19:06 128 22% 19:06/2019 128 22% 33.92 34.95 19:06/2019 19:06 18 33% 33% 35.40 19:06/2019 19:06 383 189 33% 32.89 34.95 19:06/2019 19:06 377 148 28% 32.51 35.69 19:06/2019 19:06/2019 19:06 18 28% 35.69 35.69 19:06/2019 19:06 19:06 18 28% 35.69 35.69 19:06/2019 19:06 19:06 18 28% 35.69 35.69 19:06/2019 19:06 19:06 18 28% 35.69 35.69 19:06/2019 19:06	19/06/2019								
19/06/2019 578 451 128 22% 32.92 34.95 19/06/2019 383 189 33% 33% 32.92 34.95 19/06/2019 383 189 33% 32.92 34.95 19/06/2019 383 189 33% 32.92 35.40 19/06/2019 32.00 524 377 148 28% 32.51 35.69 19/06/2019 32.30 493 405 89 18% 32.00 32.25 35.43	19:00	589	517	72	12%			32.99	34.74
20:00 578 451 128 22% 33.92 34.95 19/06/2019	19/06/2019								
19/06/2019 571 383 189 33% 19/06/2019 32.00 524 377 148 28% 19/06/2019 524 377 148 28% 32.51 35.69 19/06/2019 524 377 148 28% 32.51 35.69 19/06/2019 23.00 493 405 89 18% 28% 32.25 35.43	20:00	578	451	128	22%			32.92	34.95
21.00 571 383 189 33% 19/06/2019	19/06/2019								
19/06/2019 524 377 148 28% 19/06/2019 32.51 35.69 19/06/2019 493 405 89 18% 23.00 493 405 89 18%	21:00	571	383	189	33%			32.89	35.40
22:00 524 3// 148 28% 19/06/2019 32:00 493 405 89 18% 18% 18% 18% 32:25 35:43	19/06/2019		0	4.0	00%			00.51	05.00
19/00/2019 493 405 89 18% 32.25 35.43	22:00	524	377	148	28%			32.51	35.69
	19/06/2019	402	405	80	18%			32.25	35.42
	20.00	485	400	60	1070			02.20	55.45

date	Total chiller consumption in KW/h "Smart Cooling" Off 20st June	Total chiller consumption kw/h "Smart Cooling" ON 6 th of June	Savings in kw/h	savings in %	Hotel load "Smart Cooling" Off	Hotel Load "Smart Cooling" on	Temperature "Smart Cooling" Off 20st June	Temperature "Smart Cooling" on 6 th of June
20/06/2019								
00:00	537	377	160	30%			32.44	35.13
20/06/2019								
01:00	527	353	173	33%			32.29	34.91
20/06/2019								
02:00	516	347	169	33%			32.04	34.61
20/06/2019								
03:00	504	337	167	33%		-	31.63	33.84
20/06/2019								
04:00	490	424	67	14%			30.97	33.77
20/06/2019	105	100	05	10%				00.70
05:00	495	400	95	19%	-		30.49	33.79
20/06/2019	407	200	09	20%		•	20.59	22.42
20/06:0010	497	399	90	20%			30.56	32.43
07:00	486	411	74	15%			31.85	33.89
20/06/2019				1070			01.00	
08:00	530	451	79	15%			33.56	35.83
20/06/2019								
09:00	613	516	97	16%			35.50	38.44
20/06/2019								
10:00	613	508	105	17%			38.41	41.69
20/06/2019								
11:00	647	507	141	22%			43.42	47.04
20/06/2019	740	500	000	00%	88%	79%	45.50	45.50
12:00	/12	509	203	29%			45.52	45.52
20/06/2019								
13:00	731	512	219	30%			43.53	39.53
20/06/2019								
14:00	709	501	209	29%	-		38.16	38.01
20/06/2019								
15:00	693	556	137	20%			36.75	36.37
20/06/2019		500	100	100/			25.00	05.00
16:00	090	568	122	18%			35.89	35.29
20/06/2019	686	554	130	10%			35.57	34.63
20/06/2019			102	1370			30.01	
18:00	674	527	148	22%			34.91	.33.86
20/06/2019					1			
19:00	691	510	181	26%			34.15	33.71
20/06/2019					1			
20:00	733	517	216	30%			33.65	33.71
20/06/2019					1			
21:00	728	475	253	35%			33.71	33.97
20/06/2019								
22:00	625	423	202	32%			33.65	34.26
20/06/2019								
23:00	580	410	170	29%			33.21	34.15
Total of day	14707	11091	3616	25%				

date	Total chiller consumption in KWh "Smart Cooling" Off 21st June	Total chiller consumption kwh "Smart Cooling" ON 7 th of June	Savings in kw/h	Savings in %	Hotel load "Smart Cooling" Off	Hotel Load "Smart Cooling" on	Temperature "Smart Cooling" Off 21st June	Temperature "Smart Cooling" on 7 th of June
21/06/2019								
00:00	658	433	224	34%	-		33.22	33.76
21/06/2019								
01:00	609	400	209	34%			33.27	33.29
02:00	607	405	201	33%			33.36	32.99
21/06/2019			201					02.00
03:00	602	351	251	42%			32.96	32.49
21/06/2019								
04:00	670	424	245	37%	-		33.03	32.77
21/06/2019								
05:00	599	380	218	36%	-		33.61	32.12
21/06/2019	500	201	179	210/			33.76	21.66
21/06/2019	500	391	176	51%			33.70	31.00
07:00	578	378	200	35%			34.51	33.10
21/06/2019								
08:00	601	449	152	25%			35.73	35.08
21/06/2019								
09:00	628	492	135	22%			37.63	38.14
21/06/2019								
10:00	729	423	307	42%			40.30	39.04
21/06/2019	722	464	258	36%	= 101		41 61	41 30
21/06/2019					74%	66%		
12:00	783	467	316	40%			41.64	41.52
21/06/2019								
13:00	780	459	321	41%			38.43	38.99
21/06/2019								
14:00	768	494	275	36%			36.87	38.35
21/06/2019	716	482	233	33%			35.55	36.88
21/06/2019								
16:00	758	475	283	37%			34.98	35.90
21/06/2019								
17:00	626	490	136	22%			34.57	35.29
21/06/2019								
18:00	632	444	188	30%	-		34.27	34.26
21/06/2019	635	432	203	32%			34.02	34 30
21/06/2019		102	200	0270	-		01.02	01.00
20:00	730	426	304	42%			34.05	35.04
21/06/2019								
21:00	620	419	201	32%			33.98	35.29
21/06/2019								
22:00	502	347	155	31%	-		33.81	35.01
21/06/2019	400	354	145	20%			33.60	34.80
20.00	455	10000	14J	2370			00.00	04.00
i otal of day	15619	10280	5339	34%				
TOTAL PER PERIOD	70112	53386	16726	24%				



Test No.2 was done for 30 days, from 31th May - 30th June, 2019 Chiller energy consumption calculations, "Smart Cooling[™]" ON

The average power consumption was calculated as follows:

The Carrier 30XA 1002 chillers worked with the "Smart Cooling[™]" unit ON for 20 days, where the total energy consumption of the chiller's MW / h was measured.

The results show: "Smart Cooling™" ON

"Smart Cooling[™]" equipment was ON for 20 days with an average hotel occupancy of 72%. In 20 days, the total chiller consumption was 221.41 MW / h, average 11.07 MW / h per day. Formula (221.41 MW / h, ÷ 20 days) = 11.07 MW / h. AVARAGE within 24 hours.

Chiller energy consumption calculations "Smart Cooling™" OFF The average energy consumption was calculated as follows:

The results show: "Smart Cooling™" OFF

"Smart Cooling[™]" equipment was OFF for 9 days with an average hotel occupancy of 82%. In 9 days, the total chiller consumption was 129.06 MW / h, average 14.34 MW / h per day. Formula (129.06 MW / h, ÷ 9 days) = 14.34 MW / h. AVARAGE within 24 hours.

Summary Test Nr.2:

After a 30-day test comparing the average power consumption of a Carrier 30 XA 1002 24hour chiller, we found that the average 24-hour saving was 2-3 Mw / h depending on the occupancy of the hotel. Total 30-day water consumption including 'Smart Cooling™' maintenance was 375 m3.



Test Nr.2 One month overview between 'Smart Cooling™' ON and OFF

		S	MARTCOO	LING WATE	R READ	ING, ELECTRICITY READING		
DATE	Previous	Present	Total Consumed	Total Mw/h consumed	осср %	Smart Cooling operational notes	Average ambient air Temperature	Max Ambient Temperature
31/05/2019	0	36	7918.56	8.77	47.08	On, last adjustments done	34	43
01/06/2019	36	50	3079.44	8.25	47.08	on	34	40
02/06/2019	50	60	2199.6	8.43	47.08	on	34	43
03/06/2019	60	78	3959.28	9.41	54.04	on	33	39
04/06/2019	78	95	3739.32	11.67	57.94	on	36	46
05/06/2019	95	112	3739.32	10.93	76.32	on	37	46
06/06/2019	112	130	3959.28	11.09	83.29	on	37	47
07/06/2019	130	148	3959.28	10.28	77.44	on	35	41
08/06/2019	148	162	3079.44	9.92	66.02	on	35	45
09/06/2019	162	175	2859.48	10.43	77.16	on	35	43
10/06/2019	175	184	1979.64	11.36	81.62	on, after 2pm one circuit is not operational for "Smart Cooling"	33	41
11/06/2019	184	197	2859.48	12.2	82.73	on, after 2pm one circuit is not operational for "Smart Cooling"	35	42
12/06/2019	197	212	3299.4	12.27	86.07	on	37	44
13/06/2019	212	228	3519.36	12.13	93.31	on	37	44
14/06/2019	228	241	2859.48	12.45	88.86	on	36	44
15/06/2019	241	254	2859.48	12.54	77.16	on	35	43
16/06/2019	254	265	2419.56	12.54	86.35	on	35	42
17/06/2019	265	274	1979.64	12.48	84.96	on/ 17:00 Smart Cooling turned off	34	43
18/06/2019	274	274	0	13.53	86.35	off	34	43
19/06/2019	274	274	0	13.77	85.24	off	35	43
20/06/2019	274	274	0	14.71	88.02	off	35	45
21/06/2019	274	274	0	15.62	74.37	off	35	42
22/06/2019	274	285	2419.56	16.01	74.09	Off (cleaning process)	37	44
23/06/2019	285	294	1979.64	15.36	78.55	Off (cleaning process)	37	43
24/06/2019	294	294	0	13.58	83.84	off	36	44
25/06/2019	294	294	0	12.96	83.29	off	35	43
26/06/2019	294	294	0	13.52	86.91	off	37	42
27/06/2019	294	309	3299.4	12.82	85.79	On after 15:00	37	44
28/06/2019	309	332	5059.08	12.88	79.67	on	37	44
29/06/2019	332	355	5059.08	12.03	71.03	on	38	48
30/06/2019	355	375	4399.2	11.83	76.32	on	37	47

ROI Summary:

Savings: Daily Power Savings = 2.5 Mw/h X 0.45 (Rate) = AED 1,125 electrical saving per day Monthly Saving = AED 1,125 X 30 days = AED 33,750

Operation cost: Monthly Water Consumption = 375 m3 X 10 (Rate) = AED 3,750 Monthly Biochemical and Maintenance costs= AED 600 Total Operation Costs = AED 4,350

Monthly Net Saving = AED 33,750 - AED 4,350 = AED 29,400

Costs of:

2 Nos "Smart Cooling™" Devices = AED 210,000 (Inc. VAT)

ROI:

2 Nos "Smart Cooling™" Devices= 210,000 / (29,400 X 8) = 10.7 Months

ROI Calculation Notes:

Number of operating months are 8, considering the hot season only, 4 months when there is a minimal saving, was neglected in this ROI calculation.

As per the above readings, saving range is from 2 to 3 MW/h per day, however, we have based the ROI calculation on an average saving of 2.5 MW/h.

ROI calculation is based on occupancy and OAT (Outside Air Temperature).

Ali Soufan

mallille

July 31st 2019

Annex



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RIF600 | Clamp-on Ultrasonic Meter Calibration Report

Pipe diameter	DN80			Date	15/12/2018
Ambient temperature	29°C				
Standard Device before test	Normal			Model:	RIF600W
Standard Devide After Test	Normal				
Test result	Qualified				
Measured Medium	Water				
Accuracy	1%				
Signal Strength	UP:	90			
	DOWN:	90			
Standard device name	Static volu	umetric me	ethod/standard Meter Method Water Flo	w/Standard Dev	vice
Standard device accuracy	0,20%				

Test	Standard flor	Standard Meter flow		Pressure	Tested Meter Flow		Basic Error		Repeatability	
Point	m3	/h	°C	Мра		m3/h			%	
Point 1	101,52		25,0	0,300	102,27		0,739			
	101,47	101,47	25,0	0,300	102,07	102,10	0,591		-0,147	
	101,42		25,0	0,300	101,97	Ī	0,542	Ī		
	71,27		25,0	0,300	71,75		0,673	0,759	-0,146	Ī
Point 2	71,19	71,27	25,0	0,300	71,65	71,75	0,646			0,147
	71,34	†	25,0	0,300	71,86	Ī	0,729			
Point 3	26,32		25,0	0,300	26,51		0,722	-		1
	26,36	26,36	25,0	0,300	26,56	26,55	0,759		-0,132	
	26.39	1	25.0	0.300	26.58	1	0 720	t		

Verification Based on JJG 1030-2007 < Ultrasonic flowmeter verification procedures >

Scale Factor=1

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RIF600 |Test Report misuratore di portata ad ultrasuoni clamp on

Diametro tubazione	DN80			Date	15/12/2018	
Temperatura ambiente	29°C					
Dispositivo standard prima del test	Normale			Model:	RIF600W	
Dispositivo standard dop il test	Normale					
Risultato del test	Qualified					
Liquido	Acqua					
Accuratezza	1%					
Potenza dei segnali	UP:	90				
	DOWN:	90				
Tipo di dispositivo standard	Metodo volu	imetrico st	atico/Misuratore di portata volumetrico	D		

Accuratezza del dispositivo standa 0,20%

Test	Misuratore	Misuratore standard T		Pressione	Misuratore testato		errore base		Ripetibilità	
Punti	m3/	/h	°C	Мра		m3/h	%		%	
Punto 1	101,52		25,0	0,300	102,27		0,739			
	101,47	101,47	25,0	0,300	102,07	102,10	0,591		-0,147	
	101,42		25,0	0,300	101,97		0,542			
	71,27	71,27	25,0	0,300	71,75		0,673	0,759	-0,146	0,147
Punto 2	71,19		25,0	0,300	71,65	71,75	0,646			
	71,34		25,0	0,300	71,86		0,729			
	26,32		25,0	0,300	26,51		0,722			
Punto 3	26,36	26,36	25,0	0,300	26,56	26,55	0,759	1	-0,132	
	26,39		25,0	0,300	26,58		0,720			

Verification Based on

JJG 1030-2007 < Ultrasonic flowmeter verification procedures >

Scale Factor=1

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