14 October 2019

TEST REPORT

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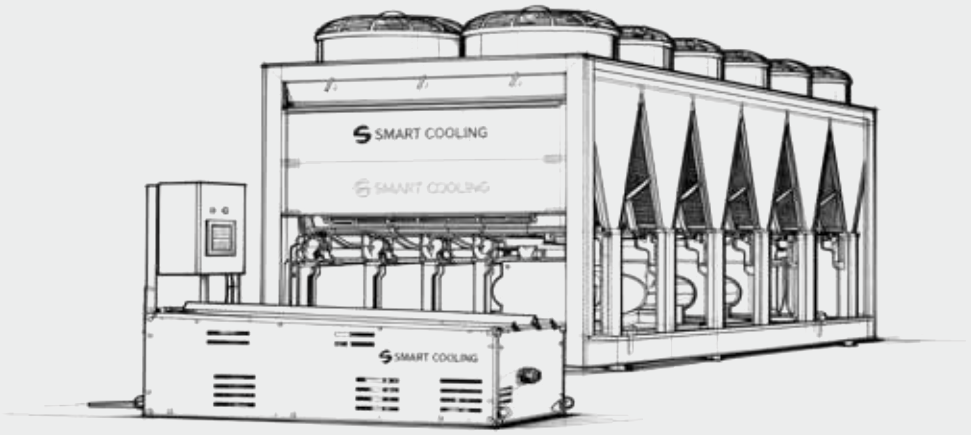


SMART COOLING™ PRO10 SYSTEM

RTA, Dubai

Test Participants:
Project name: **RTA, DUBAI** Location: **Dubai, UAE**
Customer: **RTA, Dubai**
Compiled by: **Smart4Power**

Table of Contents

Introduction:

Type of structure: RTA, Marina Plaza, Office 2602, Dubai, UAE.
Cooling units: Air cooled water chiller **Chiller No. 10.**
Chiller booster: *Smart Cooling™ PRO 10*, adiabatic technology with condenser protection.

Between *01/10/2019 (16:00) - 03/10/2019 (16:00)*, a full performance evaluation of the *Smart Cooling™* system (SCS) was conducted on *Chiller No.10* at the RTA facility.
The test compares chiller performance with the *Smart Cooling™* system OFF and ON over two consecutive 24-hour periods under nearly identical outdoor conditions (CDD variance only **1.4%**).

The *Smart Cooling™* system improves chiller efficiency through intelligent adiabatic pre-cooling and condenser air temperature reduction. This reduces compressor load and improves the system's kW/TR performance.

- **Its main functions include:**
- Controlled water atomization for optimal adiabatic efficiency.
- Complete water sanitation.
- Reduction of condenser inlet air temperature to improve EER / SEC.

Intelligent automation based on temperature and load conditions. Water recirculation for minimized consumption (3.5 m^3/day measured during test).

During the test period, *Smart Cooling™* system ON improved the chiller's efficiency by **20%**, reducing the average kW/TR from **1.58 to 1.26**.

- **Daily savings were measured at:**
- **649 kWh/day** electricity reduction
- **289 AED/day** monetary savings
- **3.5 m^3/day** water consumption

These results confirm measurable efficiency improvements even with naturally varying cooling demand.

Main components:

Smart Cooling™ comprises the following key components: protective membranes, water treatment and recirculation systems, high-pressure water pump, control unit, high-pressure nozzle panels, fasteners, and fixings.

- **Protective membranes** cover the condenser surface, preventing direct water contact.
- **Water system** purifies and sterilizes water to prevent mineral buildup and bacteria.
- **Pump** provides 70 bar pressure.
- **Control unit** regulates operation via real-time data (temperature, humidity, chiller parameters).
- **Nozzles** spray 5–40 µm droplets.
- A set of **fasteners and fixings** ensure the compatibility of the equipment with the chiller.

Measuring instruments:

All measurements were recorded using the existing monitoring infrastructure of the RTA facility. Smart4Power (S4P) collected electrical consumption, cooling output (TR), and outdoor conditions for both test periods.

Data sources included:

1. Chiller No.10 performance metrics *(kW, TR, SEC – kW/TR)*.
2. Outdoor air temperature readings.
3. Hourly electrical energy consumption.
4. 24-hour logging for *Smart Cooling*™ OFF *(1–2 October)* and ON *(2–3 October)*.

- **Formula:**
  COP = Cooling (kW) ÷ Electrical (kW)

BTU Reader

Temperature and Humidity Reader

Eniscope (Energy Reader)

Equipment tested: Air-cooled water chillers, **Chiller No. 10**.

- The chiller's condensers fully enveloped by *Smart Cooling's*™ protective membranes, which prevent water mist infiltration and damage.
- In the foreground is the *Smart Cooling*™ pump station, pumping meticulously treated water at 70-bar pressure.
- The system is equipped with an automated Siemens controller.
- The system also includes a water drain line to re-filter and safely reuse water.

Testing *Smart Cooling*™**:**

During the evaluation at RTA, the ***Smart Cooling***™ system demonstrated a significant improvement in chiller efficiency when activated.

Two full operational cycles were analyzed:

Period 1 — ***Smart Cooling***™ **OFF**

- Chiller No.10 operated under normal conditions without adiabatic pre-cooling.
- Average SEC recorded: **1.58 kW/TR**.
- Outdoor temperature averaged **34.67°C**.
- Total 24-hour energy consumption was higher compared to ***Smart Cooling***™ ON.

Period 2 — ***Smart Cooling***™ **ON**

- Improved efficiency: SEC reduced to **1.26 kW/TR** (≈ 20% improvement).
- Reduced electrical consumption: **649 kWh/day** saved.
- Moderate water usage: **3.5 m³/day**.
- Daily monetary savings: **289 AED/day**.
- Outdoor conditions remained comparable (CDD variance 1.4%).

Two-Sample T-Test results:

- T-value: 42.96
- P-value: <0.01%
- Significance: 99%

Even though cooling demand was naturally higher on ***3 October, Smart Cooling***™ still achieved large measurable savings.

Testing Data:

The test comparison was conducted from:

- **OFF** period: *01/10/2019 (16:00) - 02/10/2019 (16:00)*
- **ON** period: *02/10/2019 (16:00) - 03/10/2019 (16:00)*

Both periods showed nearly identical environmental conditions.

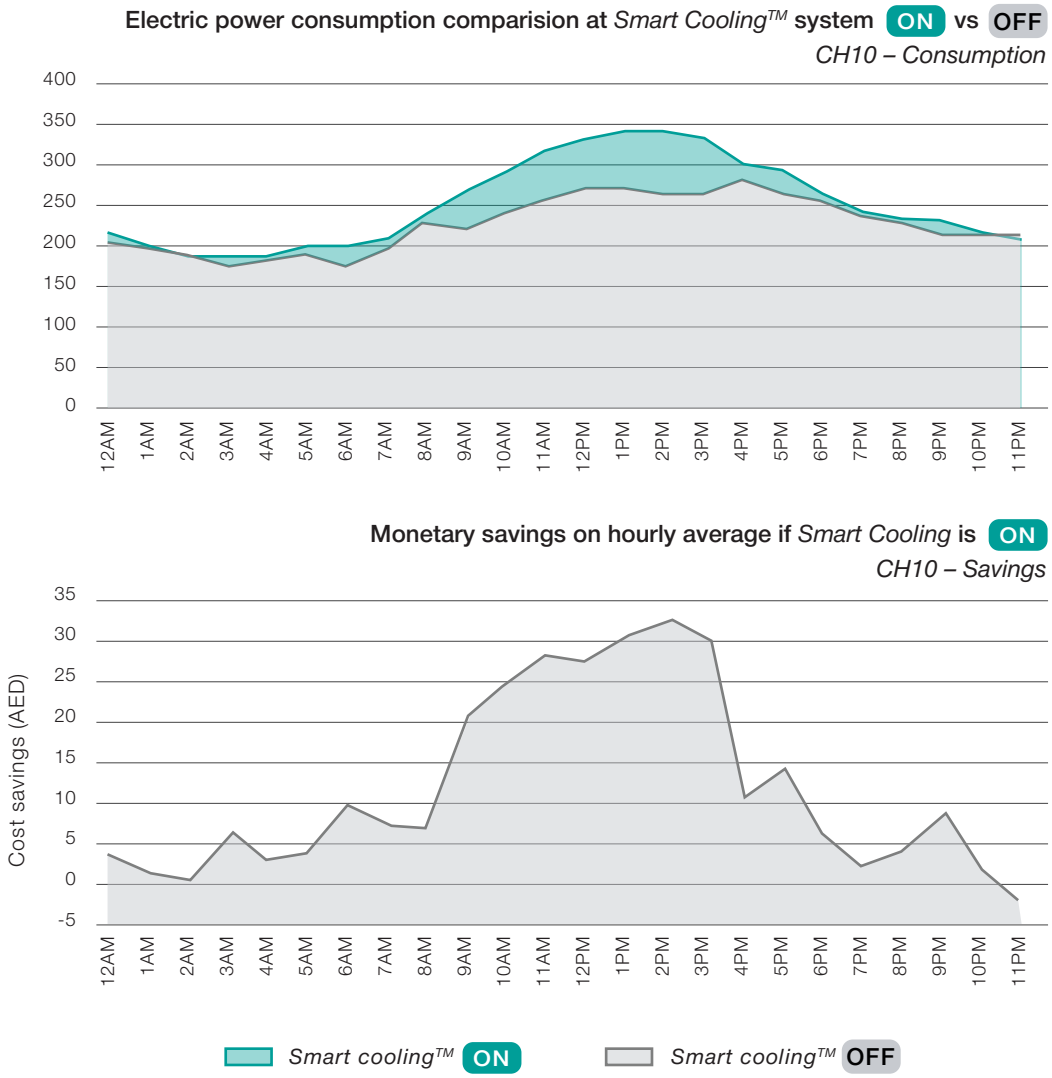
Key findings:

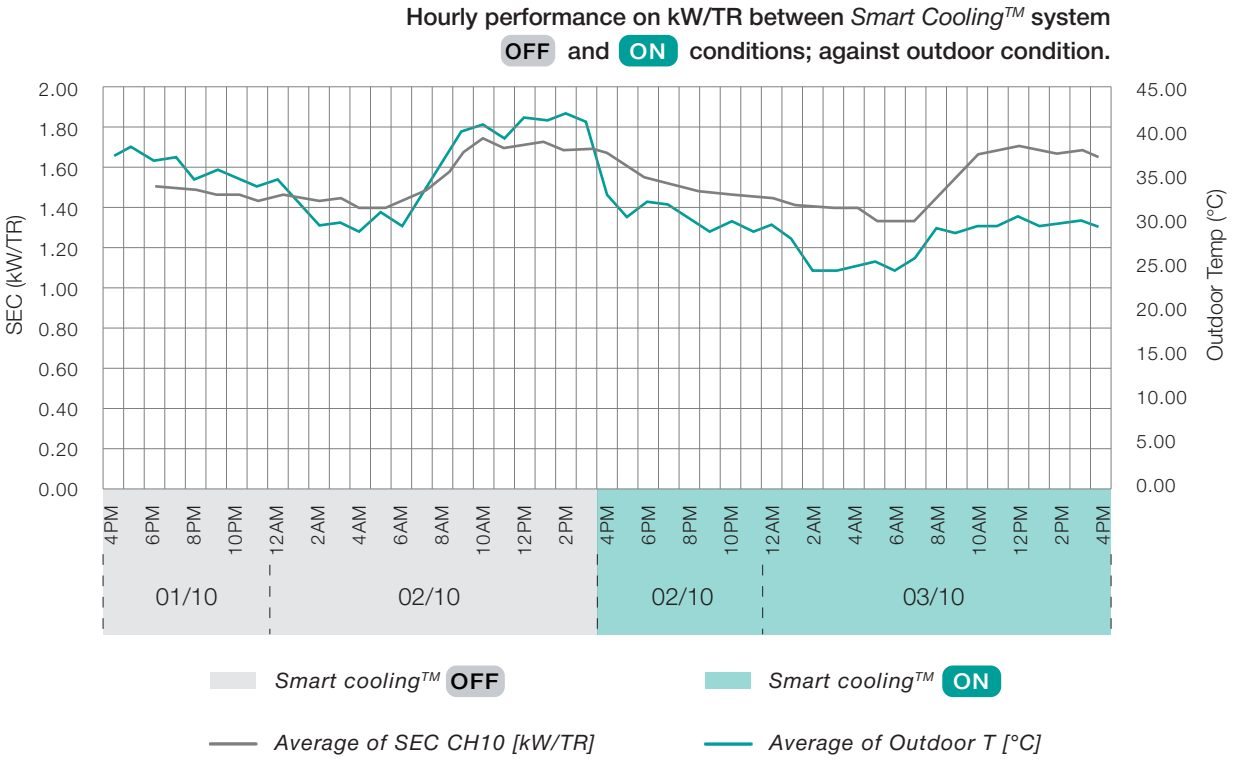
Average Outdoor Temperatures

OFF : **34.67°C**

ON : **34.18°C**

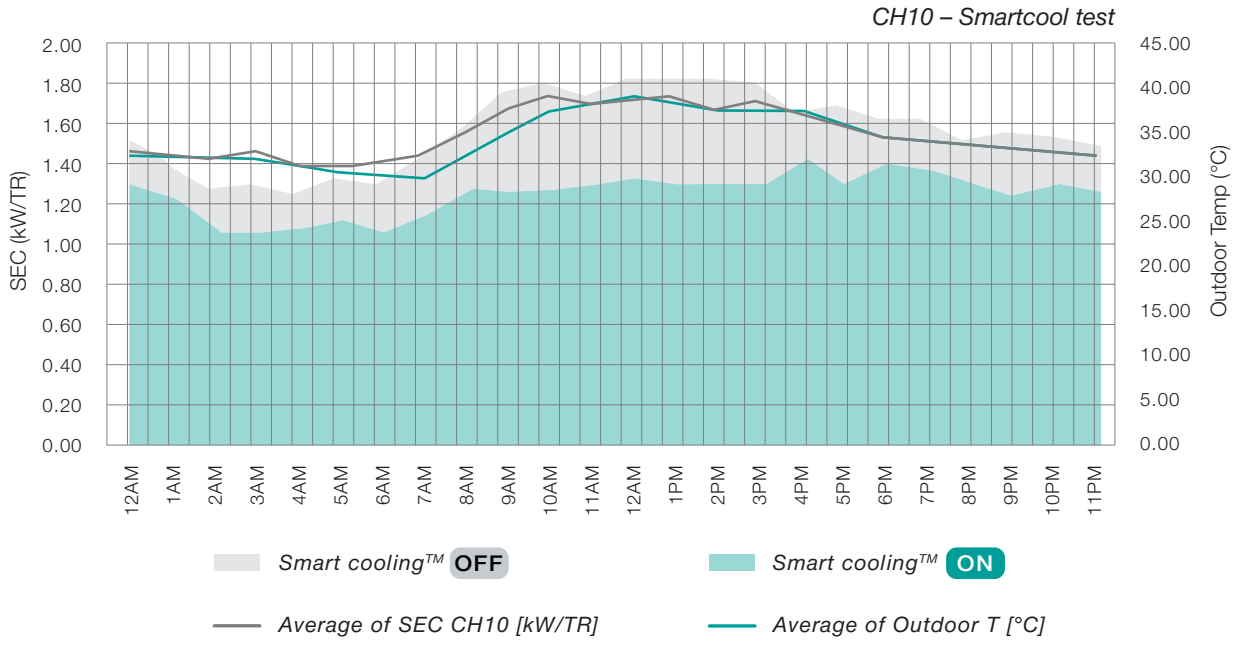
Difference: **0.49°C** (statistically minor — ensures test fairness)





NOTE: The periods of SCS OFF *and* ON *are on identical outdoor conditions. These two periods where measurements where done were identical, thus makes a fair comparison.*

SEC comparison			
Row Labels	**Average of SEC CH10 [kW/**	**StdDev of SEC CH10 [kW/**	**Count of SEC CH10 [kW/TR]**
Smartcool Off	1.58	0.23	1439
Smartcool On	1.26	0.16	1441
Grand Total	**1.42**	**0.26**	**2880**
Ho: $\mu_1=\mu_2$			
Ho: $\mu_1\neq\mu_2$			
Two sample T test		$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$	Two sample T test shows Smartcool changed the efficiency [SEC] of CH10 with a confidence level of 99%
T value	42.96		
deg freedom	1438		
p value	0.00%		
Comparison values			
Significance	99%		
T value	2.58		
p value	1.00%		
Improvement	**20.31%**		



Temperature comparison			
Row Labels	**Average of Outdoor T [C]**	**StdDev of Outdoor T [C]**	**Count of Outdoor T [C]**
Smartcool Off	34.67	2.80	1439
Smartcool On	34.18	2.82	1441
Grand Total	**34.41**	**2.82**	**2880**
Ho: $\mu_1=\mu_2$			
Ho: $\mu_1\neq\mu_2$			
Two sample T test		$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$	Two sample T test shows that with 95% confidence, day 1 was 0.49°C hotter than day 2
T value	4.71		
deg freedom	1438		
p value	0.00%		
Comparison values			
Significance	99%		
T value	2.58		
p value	1.00%		
Change (%)	**1.42%**		

Conclusion:

The increase in efficiency and energy savings has been calculated taking into account the outdoor temperature variance observed during the two test periods. The following results were obtained:

Supposing:

- 1 day of operation for each test period
- Comparable outdoor conditions (CDD variance: **1.4%**)
- Average outdoor temperature difference: **0.49 °C**
- Measured water consumption: **3.5 m³/day**

The following results:

- Measured electricity saving: **649 kWh/day**
- Monetary saving: **289 AED/day**
- Efficiency improvement: **20.31 % (SEC reduced from 1.58 to 1.26 kW/TR)**

Installing the *Smart Cooling*™ system on the chiller proved to be a valid solution.
The system, furthermore, increases the “life” of the compressors:

- by reducing the specific energy consumption under identical outdoor conditions,
- by stabilizing the condensation temperature even when the ambient temperature fluctuates,
- by maintaining cleaner condenser surfaces due to membrane protection.

Undoubtedly, installing the *SMART COOLING*™ system on a chiller serving a productive or technological process (working at around 80% of its capacity) would have given much higher results in terms of SAVING (the average **saving in our climate is around 39%–40%**), but even in this installation it is possible to foresee a ROI of 8 (eight) operational months.

Smart4Power
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