



SFIDE NELLA SCELTA DELLA SOLUZIONE IMPIANTISTICA PER APPLICAZIONI DATA CENTER

***Soluzioni di controllo di sistema HVAC
in applicazione data center***

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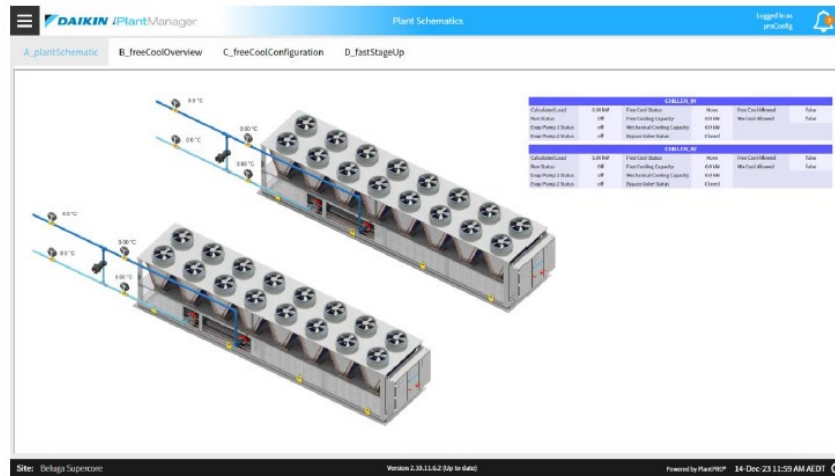
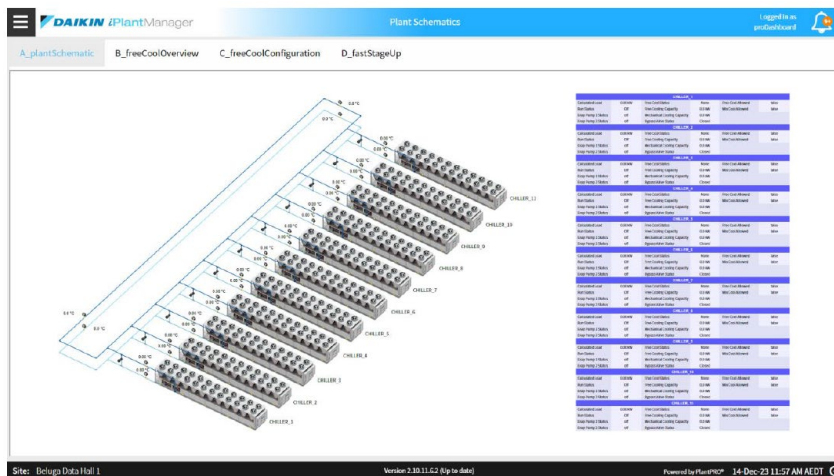


DAIKIN - intelligent DATA CENTRE Manager

- General Overview
- Advanced Energy optimization
- Option List & Documentation



General Overview – Daikin Control solution for Data Centre



What is intelligent DATA CENTRE MANAGER?

Daikin Control solution dedicated for DATA CENTRE APPLICATION based on Niagara framework, features:

- Sequencing and staging up to 20Chillers including free-cooling mode
- Complete control of primary loop, whole monitoring of the Units: power consumption, capacity and flow rate
- Optimization based on AI (artificial intelligence)
- BMS integration for high level monitoring
- Fully suitable for Tier III Loop
- Up to 8 filed sensor integrated (n.4 Temperature Sensor, n.2 Differential Pressure Sensor; n.2 Flow meter)

- Complete integration of primary loop control and chillers' control: using control function on the unit (performance monitoring ex.) we reduced the number of controlled field devices and increased the value of our proposition.

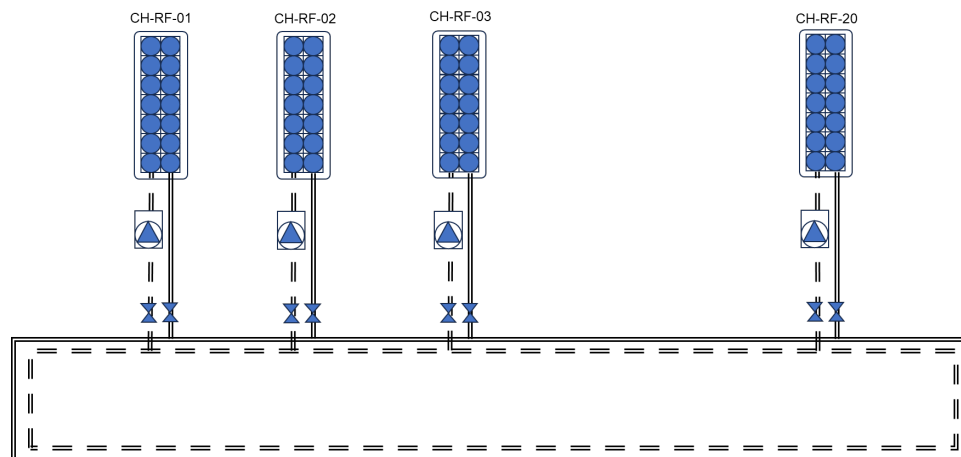
- Advanced Optimization: to reduce the PUE (performance indicator for Data Centre)

Key Factor

General Overview – Typical Sequence of operation

iDCM – “Intelligent DAT CENTRE Manager” is an external control panel (supplied loose) that can control up to 20 Chillers, including Primary Pump management and free-cooling mode.

Is fully suitable for TIER III DataCentre (N+1 System) as special execution also for TIER IV (2N System)
iPM as standard is provided with pump speed control (Delta T, Delta P or fixed speed mode).
Pumps are not managed directly by sequencer, **each unit's controller manages its pump accordingly to Unit status** (running, shut-off) **and speed setpoint defined by iPM**.
Antifreeze protection allowing water circulation is managed directly by internal antifreeze logic of the Unit.



Free cooling management

The iPlantManager chooses the operation mode considering:

- 1) **Free-cooling is started when the outside air temperature is lower than the entering water temperature by a predetermined free-cooling delta T** (adjustable). Once **free-cooling operation is confirmed feasible by chiller group controller, a free-cooling command is sent to all chillers simultaneously**. It is expected that the chiller unit will manage its own Free-Cool function (Full Free-Cooling or Mixed Mode) and therefore the **individual chiller Free-Cooling mode is not be controlled by group controller** (iPlantManager).
- 2) Free-Cooling mode changeover between Full Free-Cooling and Mix Mode operation: If the required conditions are met in terms of system capacity and LWT, chiller group controller (iPlantManager) determines if a unit is allowed to run in Free Cool Mixed Mode.
Once free-cooling mode changeover to free-cool mix mode is deemed required by chiller group controller (iPlantManager), a free-cooling mix mode command is sent to chiller unit allowing for maximum usage of Free-Cooling respecting the system capacity demand.
- 3) Chiller will work in **full compressor mode** when the **delta T between entering water and ambient air temperature is lower than 2°C** (adjustable).

Units' stage up stage down

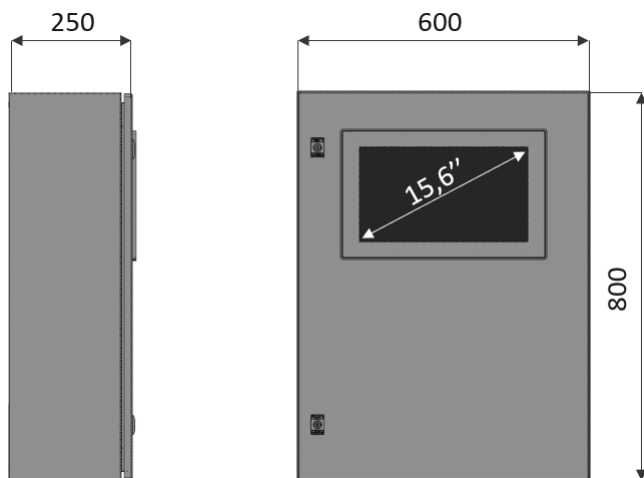
Chiller group controller (iPlantManager) activates or deactivates chillers depending on:

Supply and return water temperatures in both legs of the primary water loop so n.2 temperature sensor must be installed on the primary ring

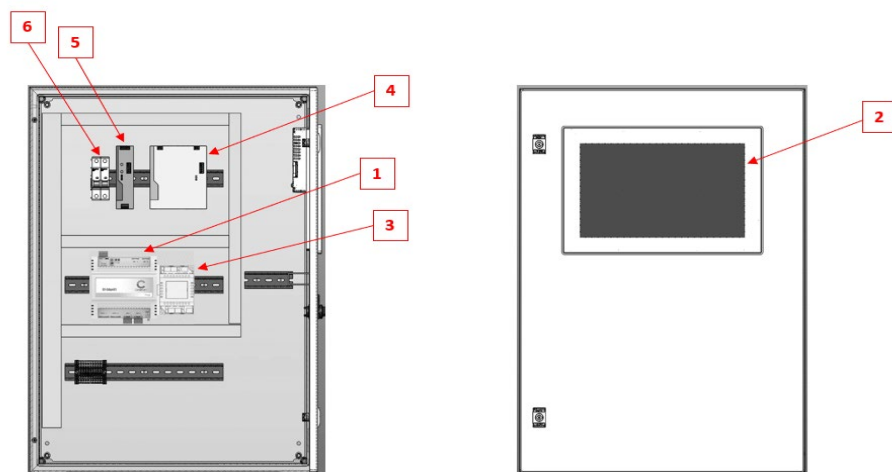
For Chiller group controller (iPlantManager) to activate more chillers (**Stage-Up**) the following conditions must be met: **Primary supply water temperature is above supply water temperature setpoint plus Stage up Offset (User-configurable)**.

For Chiller group controller (iPlantManager) to initiate a **STAGE-DOWN**: **Primary supply water temperature is below supply water temperature setpoint plus stage down offset (User-configurable)**

General Overview – Hardware specification (Typical)



Panel Layout



Component List

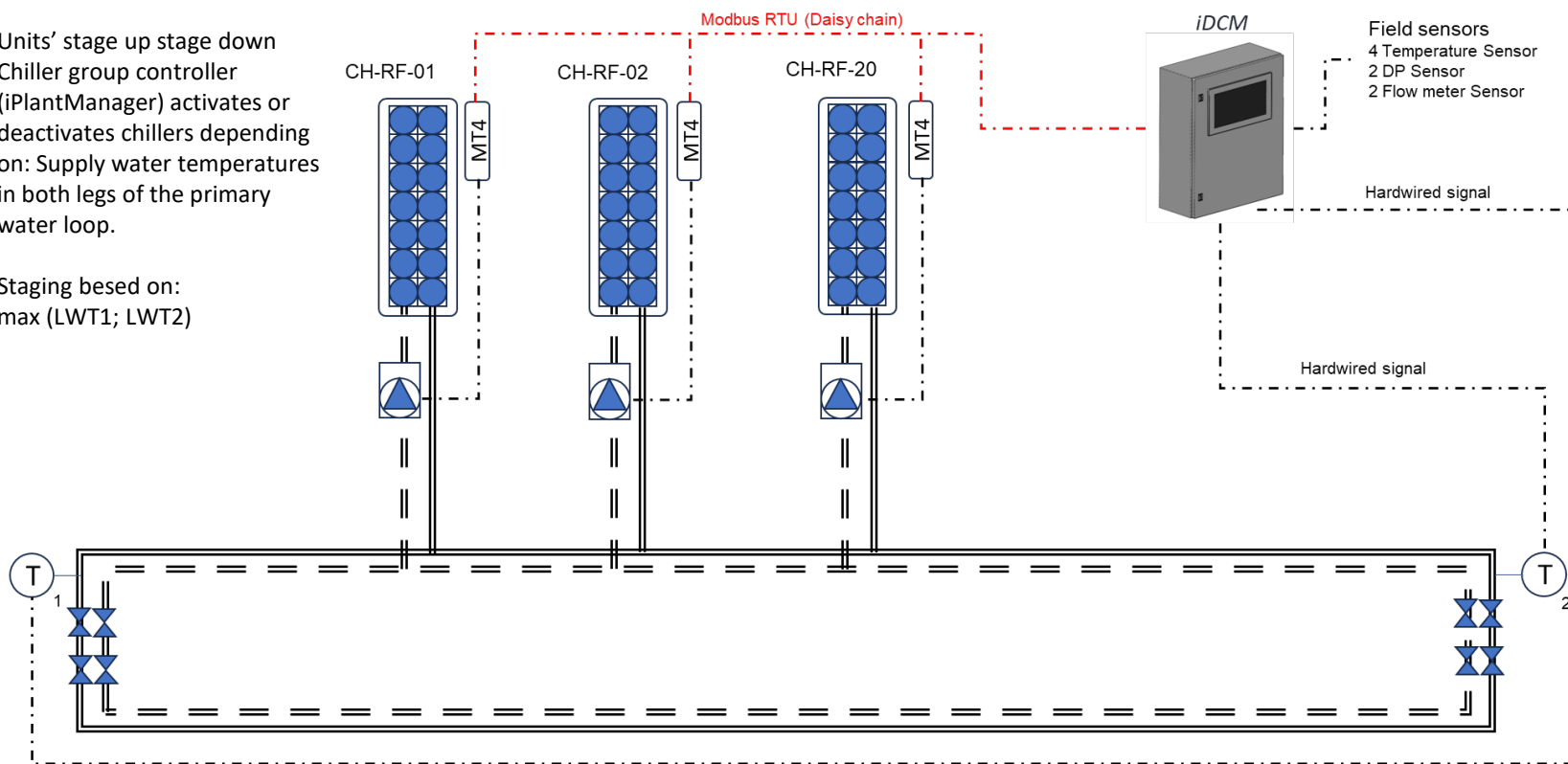
Technical Data	
Dimension (WxHxD)	600x800x250 mm
Weight	35/40 kg (approx.)

Component List	
Controller - EDGE - X1	1
HMI - Touch All-in-one, OTM156-RPC03-AIO-A7	2
Dual Mini Input Communication Module - Clx8UI	3
Capacity module - QUINT4-CAP/24DC/5/4KJ	4
Power supply unit - QUINT4-PS/1AC/24DC/5	5
Miniature circuit breaker - 5SY6216-7	6

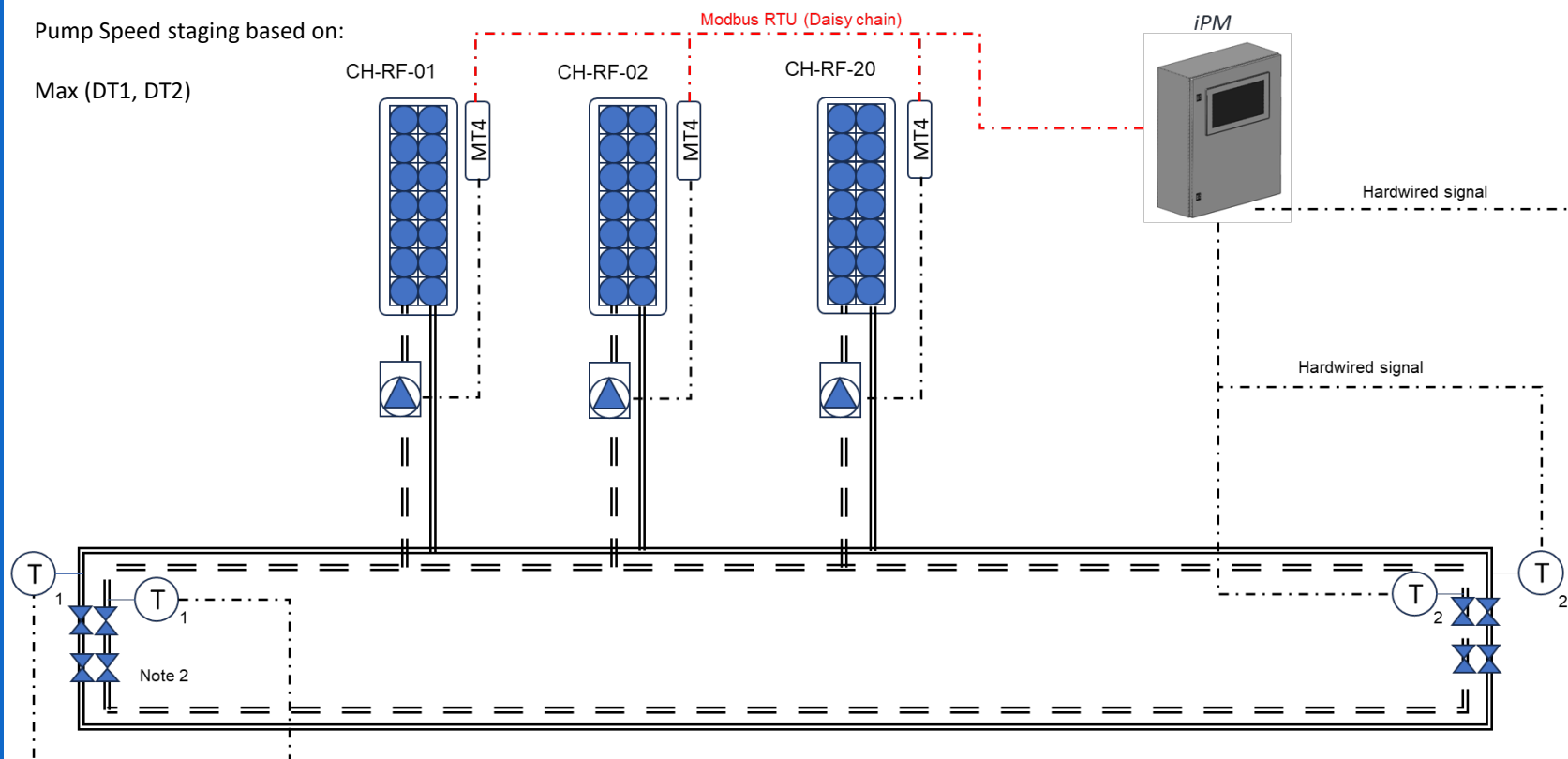
General Overview – Chiller sequencing and staging

Units' stage up stage down
Chiller group controller
(iPlantManager) activates or
deactivates chillers depending
on: Supply water temperatures
in both legs of the primary
water loop.

Staging based on:
max (LWT1; LWT2)



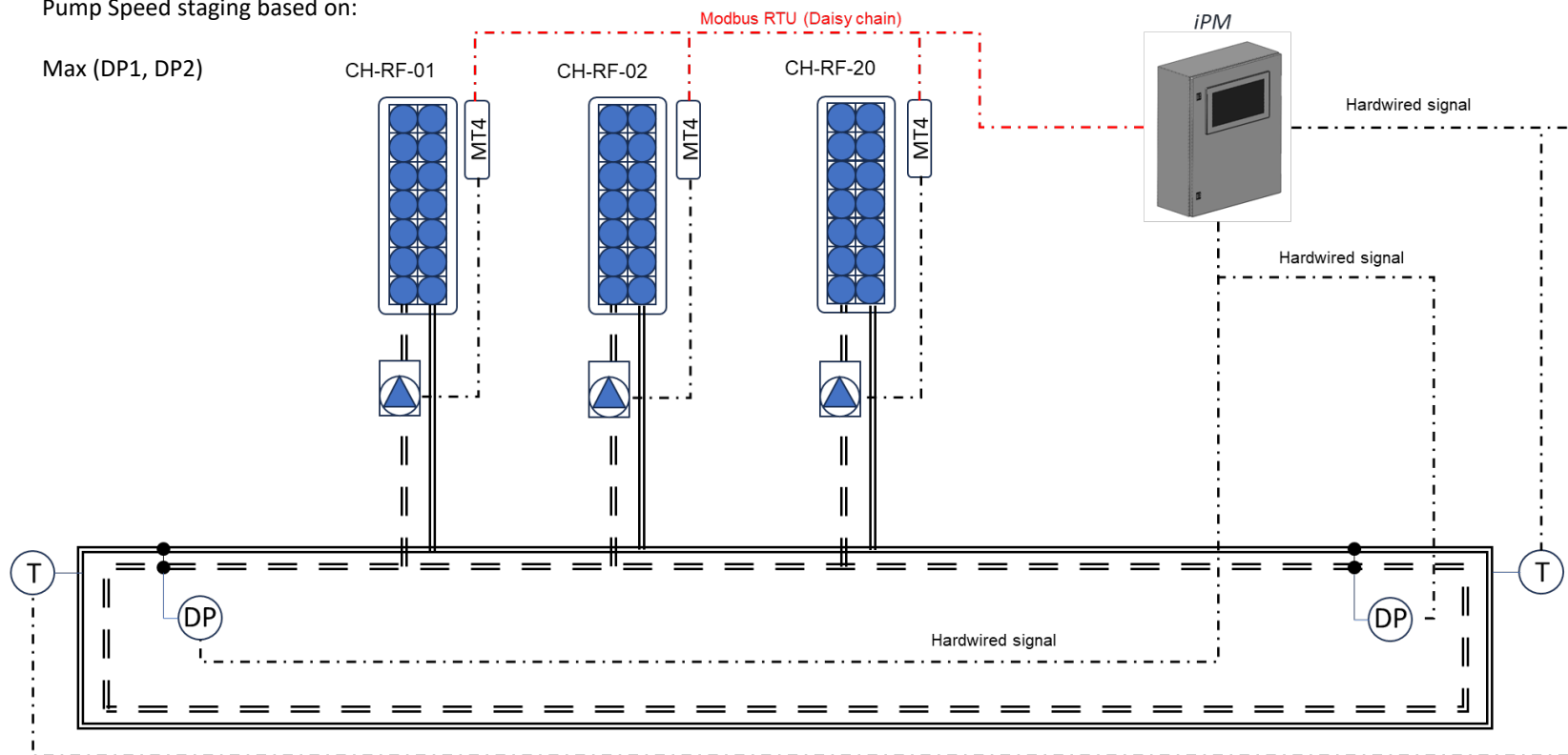
General Overview – Variable flow system DT



General Overview – Variable speed system DP

Pump Speed staging based on:

Max (DP1, DP2)



Advanced Energy Optimization

Smart Sequencing is an advanced controls & optimization feature that relies on Machine Learning models of the chillers, **to select the optimal combination of chillers that brings the lowest energy consumption.**

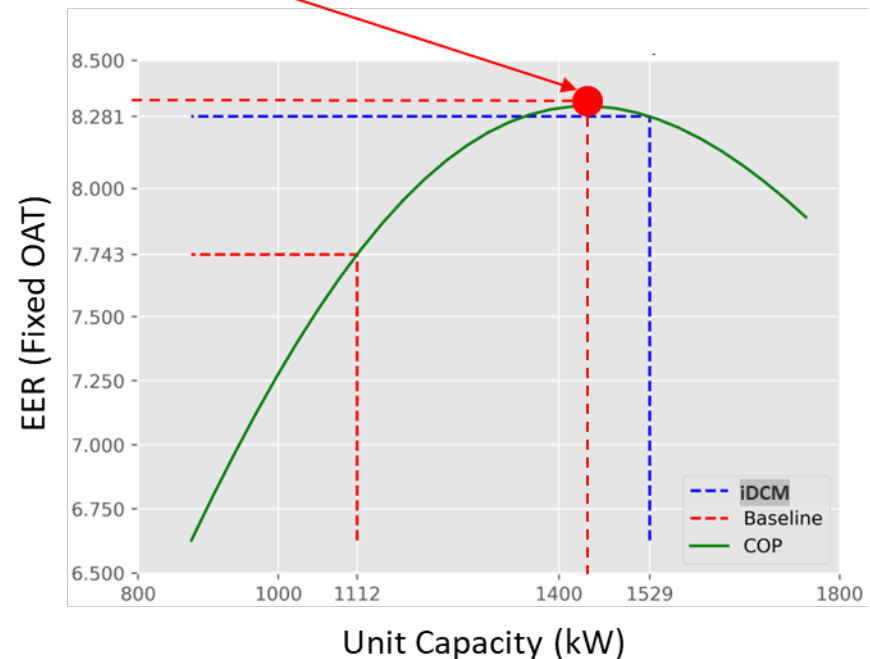
Machine Learning algorithm learn the **performance profile** of the chillers **based on manufacturer data and live data recorded** on site

Point of maximum efficiency

iDCM prioritizes first and foremost reliable operation and continuous stable water temperature setpoint delivery

It does not compromise reliability, and only focuses on increasing energy efficiency as a secondary goal

It minimizes the amount of switching on/off of units and mode changing (mechanical/free cooling), and changes the sequence only occasionally, and with specific transitional control logic to minimize disturbances



Advanced Energy Optimization - System Description

The Chilled Water Plant:

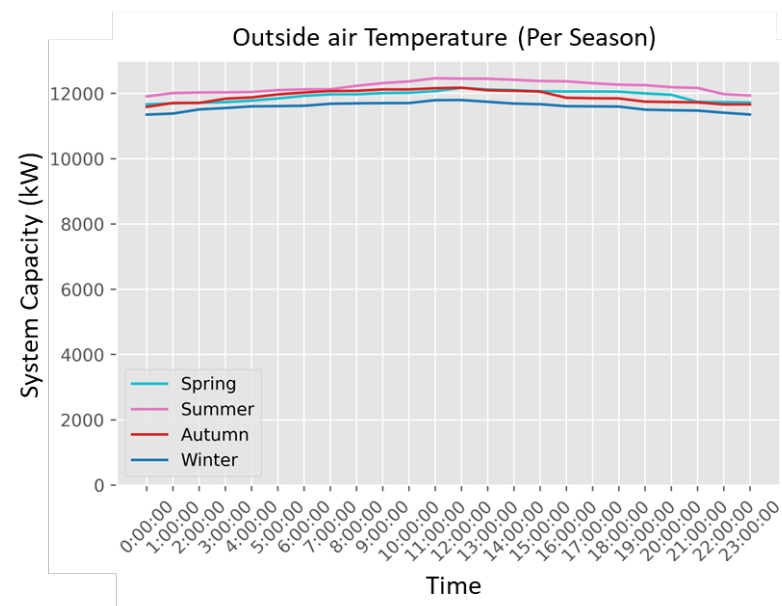
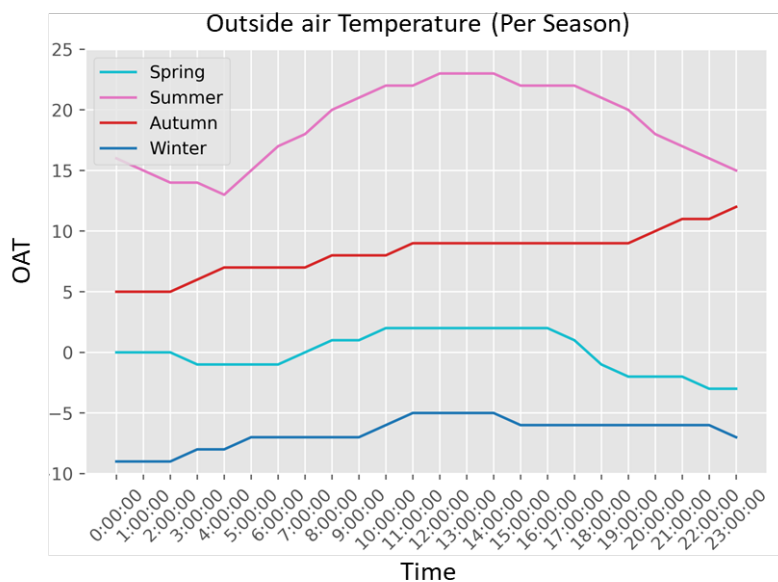
11 Free-cooling Air-cooled chillers EWFHH13 of 1,752 kW cooling capacity

Dedicated Primary Pumping

Cooling fluid:

40% Ethylene Glycol

Leaving Temperature setpoint: 18°C

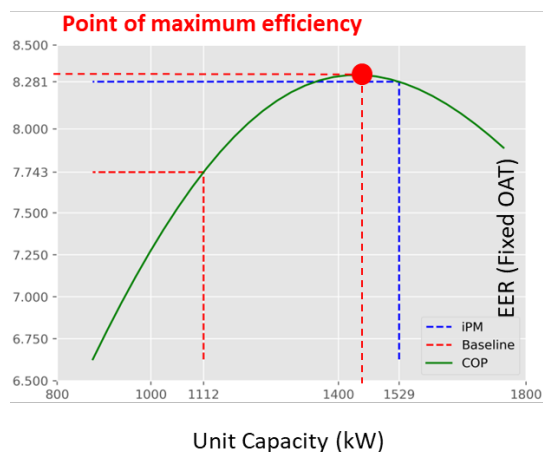




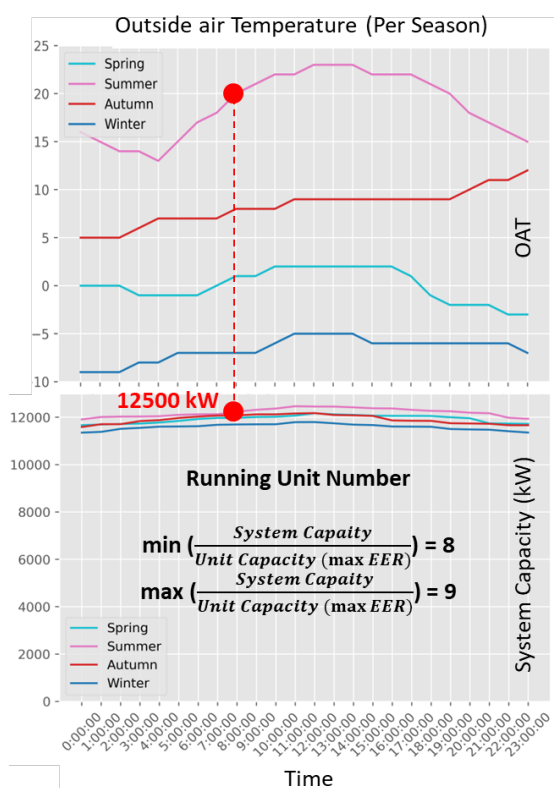
Advanced Energy Optimization - Logic description

Smart Sequencing selects the optimal combination of chillers in 3 steps:

1) Detecting the point of maximum efficiency on each single unit based on outside temperature and Leaving water temperature (example OAT=20°C, LWT 18°C)



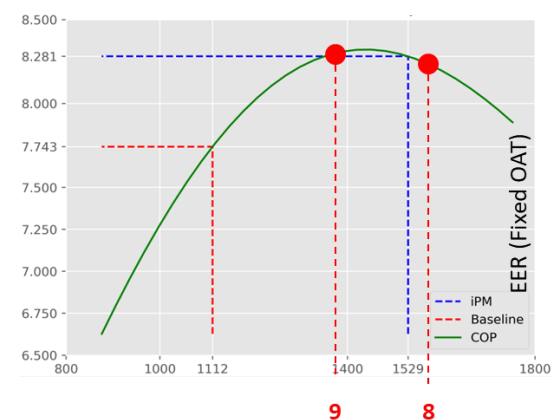
2) Detecting the Number of Running Unit (example OAT=20°C, LAT 18°C)



3) Defining the “real Unit Capacity”

$$\frac{\text{System Capacity (12500 kW)}}{\text{min Number of Running Unit (8)}} = 1562,5 \text{ kW}$$

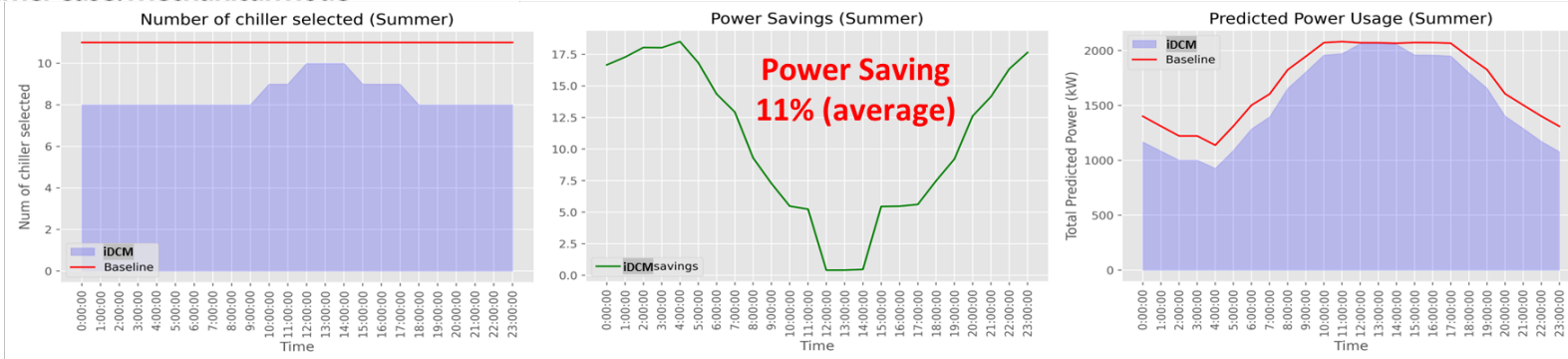
$$\frac{\text{System Capacity (12500 kW)}}{\text{max Number of Running Unit (9)}} = 1388,9 \text{ kW}$$



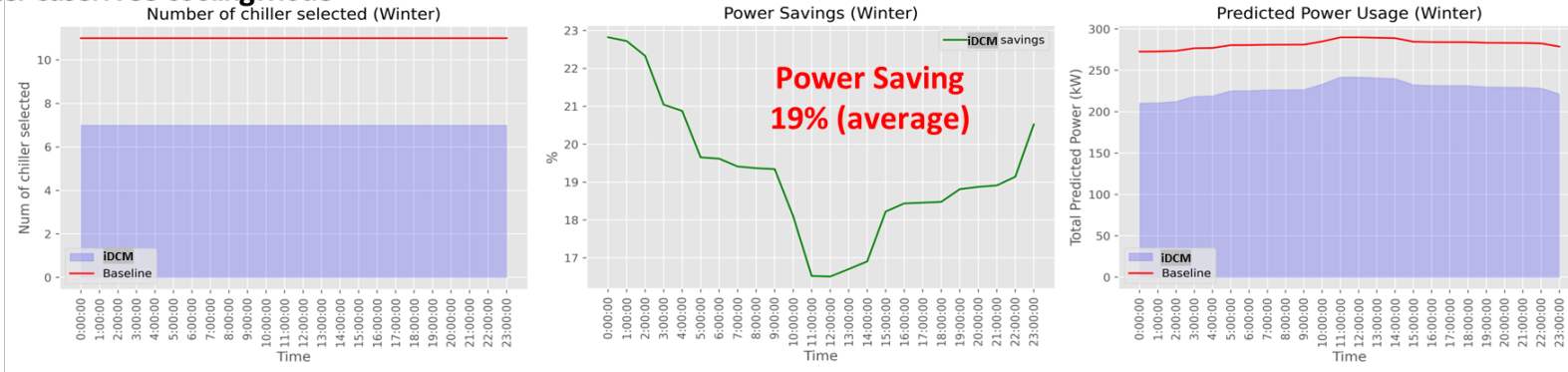


Advanced Energy Optimization – Energy efficiency compared to a Staging Logic based on fixed number of Running Unit

Summer Case: Mechanical Mode



Winter Case: Free-cooling Mode

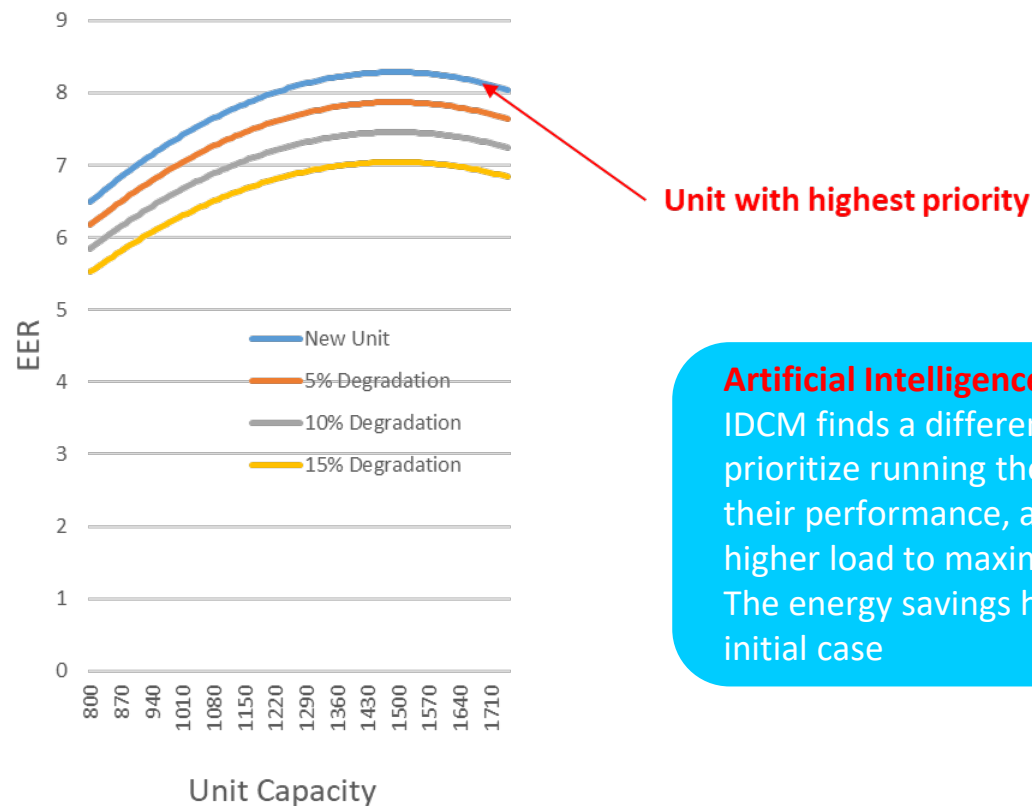




Advanced Energy Optimization – Energy Efficiency during Units Life cycle

One of iDCM's key benefits is that it continuously updates its Machine Learning model of the chillers in the plant based on recorded live site data. This allows iPlantManager to learn the performance over time and capture performance variation.

iDCM learns the new performance profile of the machines, and automatically adapts its control strategy as a result



Artificial Intelligence:

IDCM finds a different optimal number of chillers, to prioritize running the chillers which have maintained their performance, and to prioritize running them at a higher load to maximize the efficiency
The energy savings have increased compared to the initial case



Option List

	Type: intelligent DATA CENTRE Manager		Option incompatibility	IDCM004X-XXXX	IDCM008X-XXXX	IDCM012X-XXXX	IDCM016X-XXXX	IDCM020X-XXXX
	Refrigerant: N/A							
	Series: IDCM~B-SS							
	Sequenced Units		---	4	8	12	16	20
-	IDCM base							
	Option							
01	Integrated Touch Panel 15,6"			STD	STD	STD	STD	STD
02	IO Module (up to 8 fied device control)			STD	STD	STD	STD	STD
	Unit on board Pump - speed control (DeltaP,DeltaT, fixed speed)							
03				STD	STD	STD	STD	STD
01A	Additional Remote Touch Panel 15,6"	01		on request	on request	on request	on request	on request
	External Pump speed control (Manifolded type) - Up to 15 pumps	03-03B		on request	on request	on request	on request	on request
03B	External Pump speed control (Manifolded type) - Up to 24 pumps	03-03A		on request	on request	on request	on request	on request
04	Optimization module			on request	on request	on request	on request	on request
05	Redundant Configuration			Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory
06	UPS			on request	on request	on request	on request	on request
07	Tosibox			on request	on request	on request	on request	on request

Documentation

Available as standard documentation: Installation & operating Manual, Wiring diagram, Block Diagram



GRAZIE PER L'ATTENZIONE

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