



Desafios do Liquid Cooling

Novas Tecnologias de Arrefecimento por Líquido

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Acacio.alves@se.com

Property of Schneider Electric

Life Is On

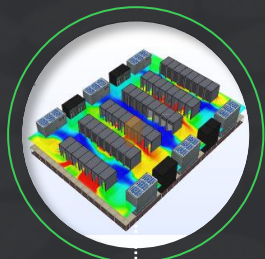
Schneider
Electric

End to End Physical and Digital AI-Ready Infrastructure



<https://youtu.be/Mde1wT8JLFg>

Remover o Calor Usando o Ar Está a Atingir o Limite



ROOM
COOLING AND
FAN WALLS

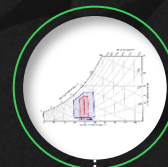
< 30-40kW / rack



InRow
Cooling and
RDHX

INROW and
CONTAINMENT

< 35-45kW / rack

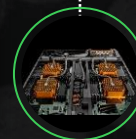


DEAD END
OF ANY
AIR
COOLING

50kW / rack



IMMERSIVE



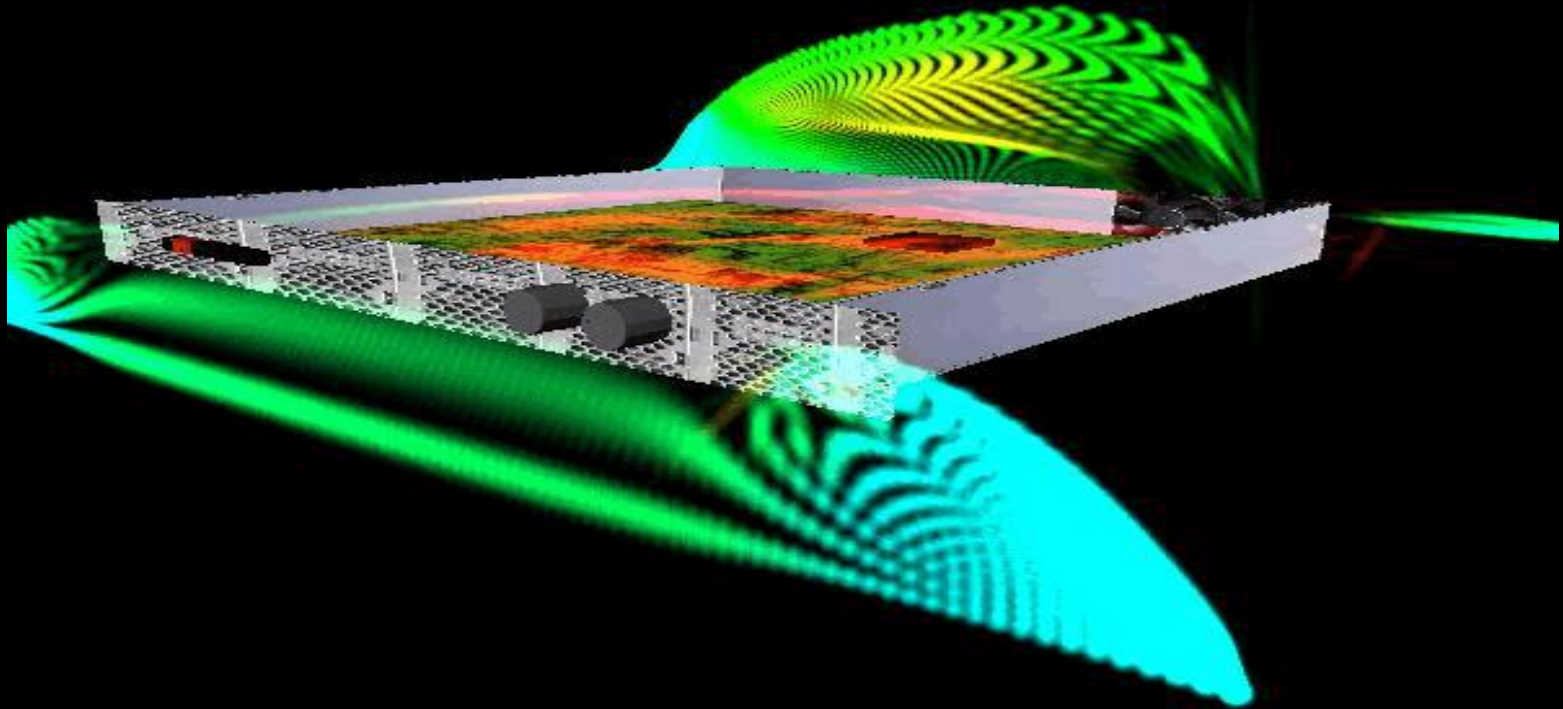
100kW / rack

DIRECT
TO CHIP /
COLD
PLATE



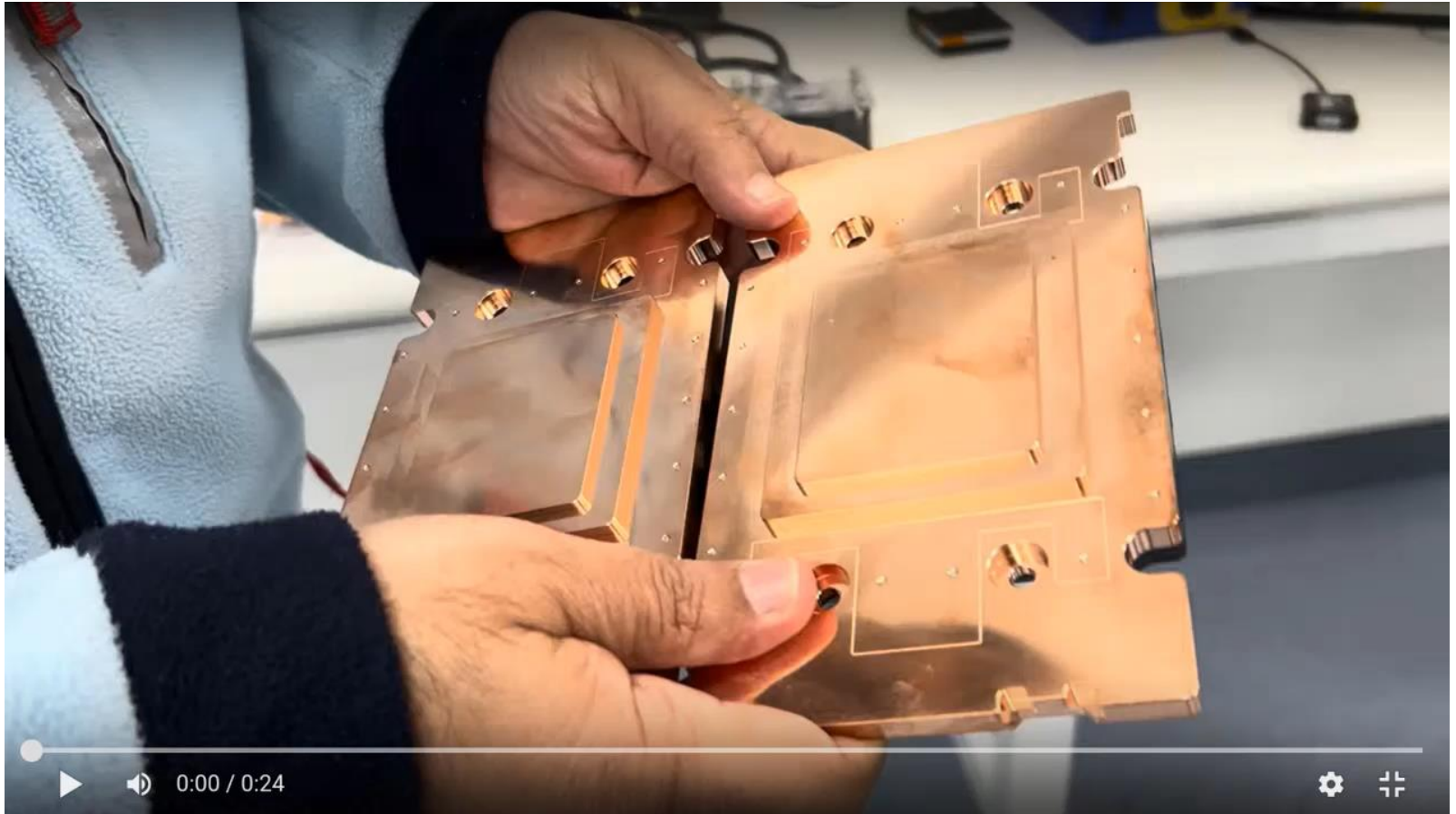
Aproximação dos Sistemas de Arrefecimento ao IT: Estratégia para Eficiência e Escalabilidade

Cooling the Server – all about Airflow

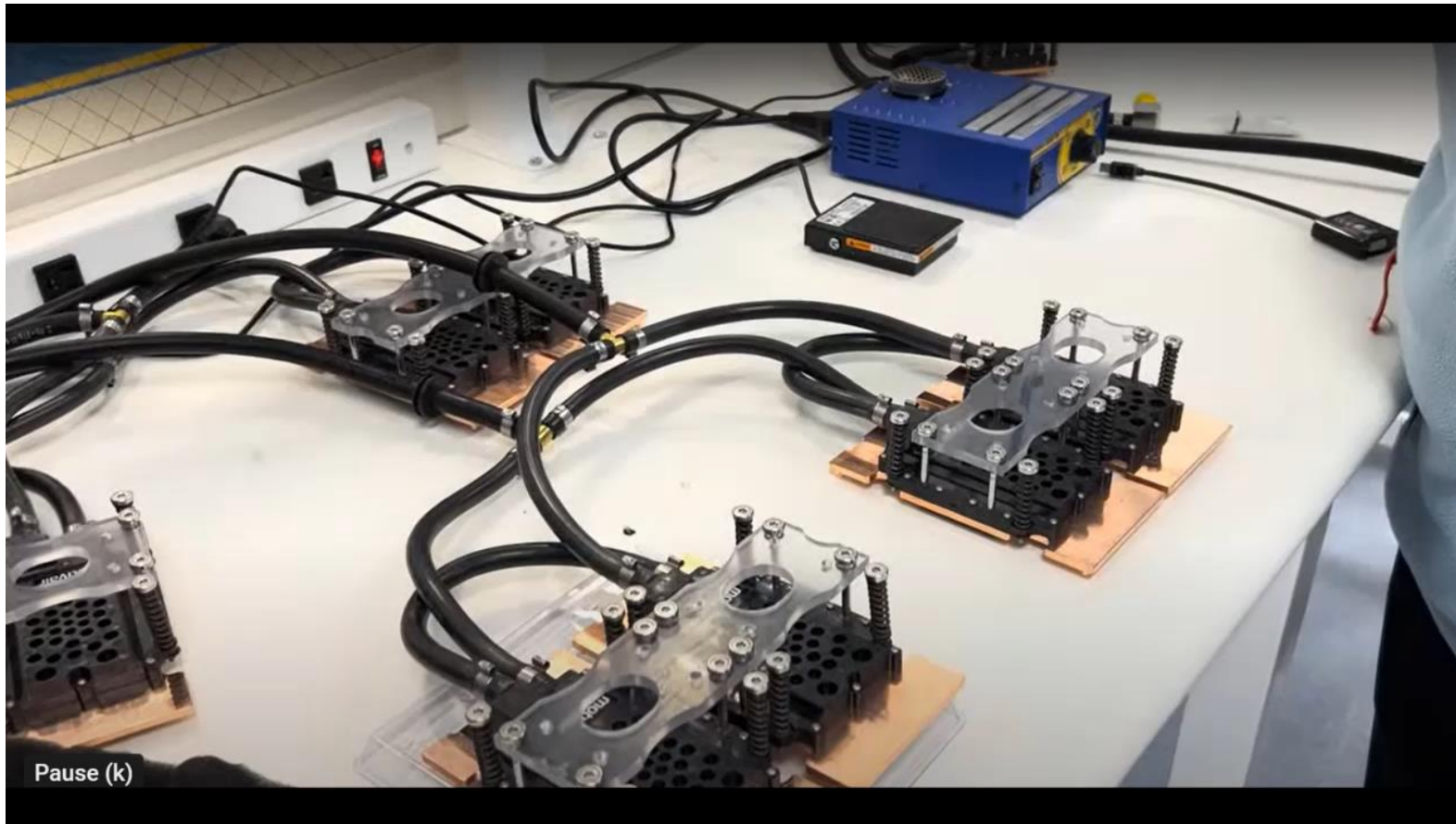


E agora... o GPU...

Close up view of a cold plate



Cold plate – connection to chip & liquid cooling connections



Instalação dos Cold Plates nos GPUs



Servidor AI



Ligação do Servidor AI Server ao Coletor



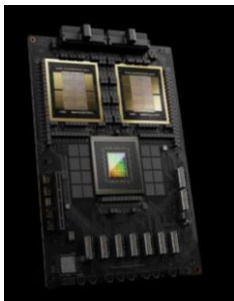
AI State of the art IT platform

Mais de 100 kW/rack – Liquid Cooled – Direct to Chip – Cold Plate



NVIDIA
GB200

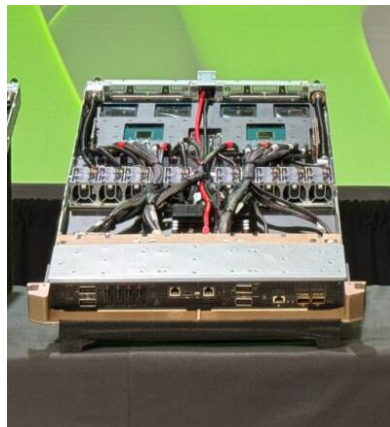
3000W



2x per
server

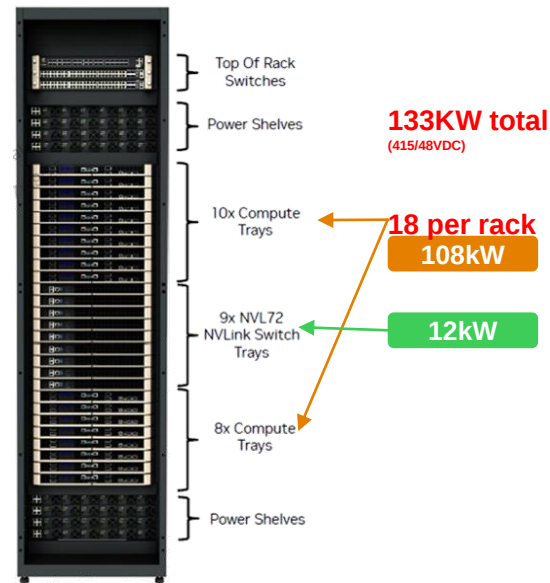
NVIDIA DGX
GB200

6000W



NVIDIA DGX GB200
NVL72

120kW@liquid - 13kW@air



Life Is On

Schneider
Electric

Sustainable IT cooling

CORRIDA ZERO CARBONO

01

Minimize
energy use
and move
to re-use



UNI EN ISO 14025



02

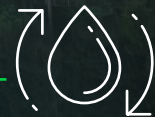
Reduce
Greenhouse
gas emissions

F-Gas
Regulation



03

No water
dependency
and limit
waste



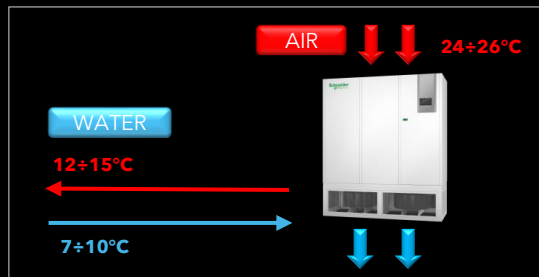
04

Get a
holistic
view

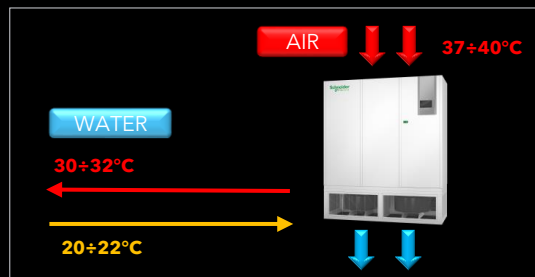


Maior Potência & Altas Temperaturas

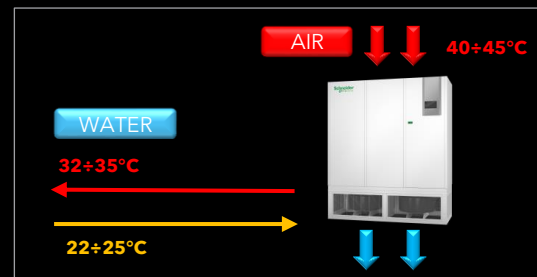
DC Tradicional



DC Moderno



DC Liquid-cooled



Up to 40°C
chiller water
setpoint!

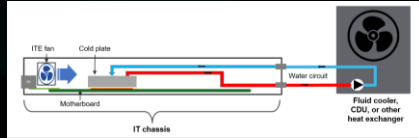


- + FREE COOLING
- + EFFICIENCY
- + SUSTAINABILITY

Como Arrefecer Servidores Com Líquido



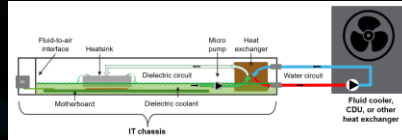
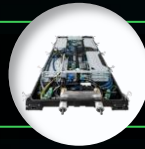
DIRECT TO CHIP



- **LEADING** architecture for liquid cooling
- Water is pumped to cold plates directly mounted on CPUs, GPUs and sometimes memory
- **Water can be pumped at positive or negative pressure**
- **Leaks are a concern**



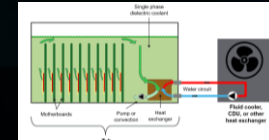
CHASSIS IMMERSION



- Only pilot deployments
- Dielectric pumped within chassis and exchanged to a separate water loop
- High cost and rack type are concerns



TANK IMMERSION



- Some HPC and crypto deployments
- Dielectric oil flows across servers to remove heat
- Leaks will not harm servers, but GWP, PFAS a concern



O mercado está a caminhar para a tecnologia Direct-to-Chip (DTC), devido à densificação e ao design híbrido.



DIRECT TO CHIP TECHNOLOGY...



... **Arrefece onde e como for necessário** - A placa fria arrefece exatamente onde é necessária a dissipação de calor, ou seja, no chip. Integra-se perfeitamente com servidores de densificação e AI.



... **Não obriga a decidir já se deve usar líquido.** - É possível um design híbrido, com refrigeração a ar e a líquido. Os servidores existentes com refrigeração a ar podem ser adaptados para refrigeração a líquido..



... **simples**— Não requer modificação do servidor, as placas frias já estão disponíveis integradas nos servidores.



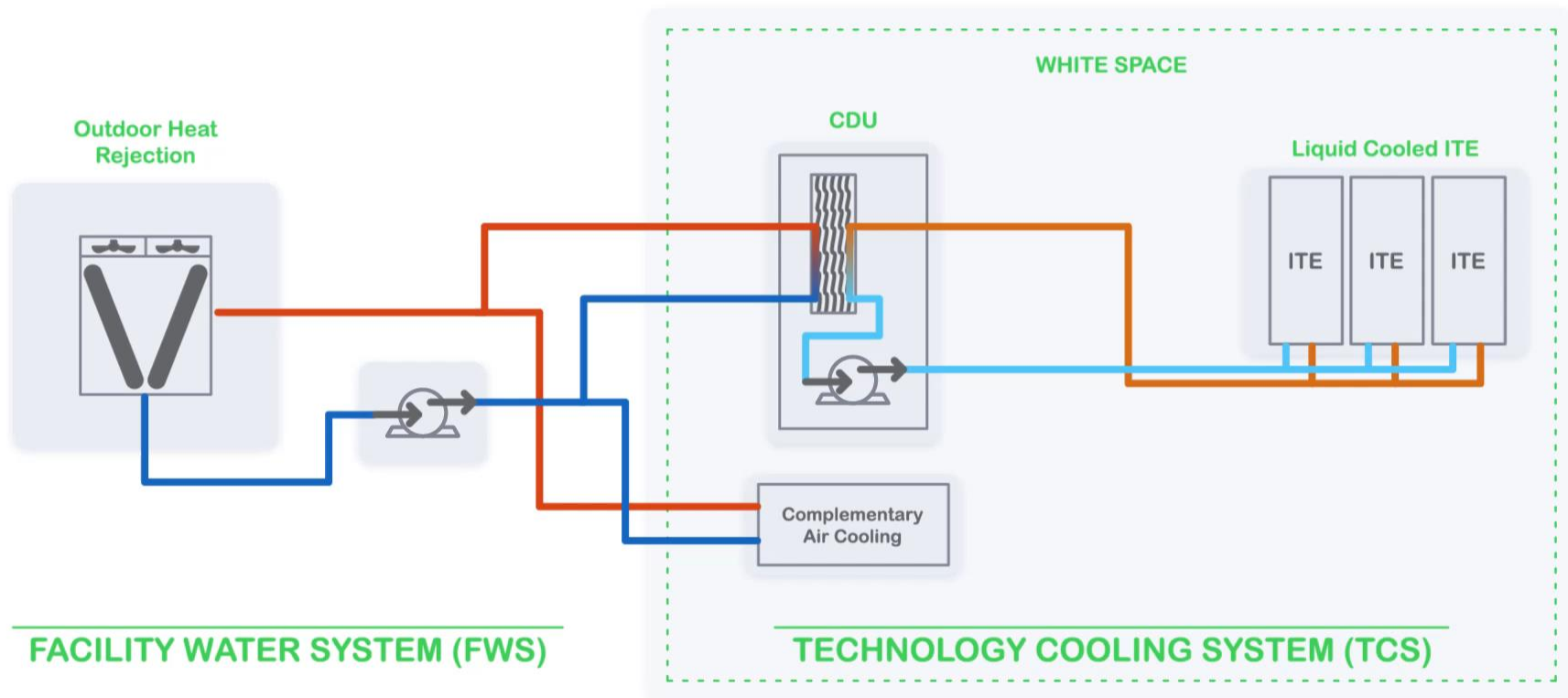
... **permite flexibilidade** — A tecnologia DtC mantém o mesmo layout no data center. Os utilizadores não têm de decidir se e quantos servidores com refrigeração líquida serão utilizados.



... **utilização de ar eficiente** - DtC Necessita ainda de refrigeração a ar, no entanto é mais eficiente do que nos centros de dados tradicionais.



Liquid Cooling Architecture



Challenges



NEW EQUIPMENT

CDU is needed
additional complexity to
add to the system

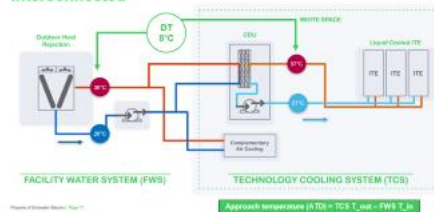


TEMPERATURES

Water **set point** and
enhanced **efficiency**



Heat rejection and CDU temperatures are strongly
interconnected

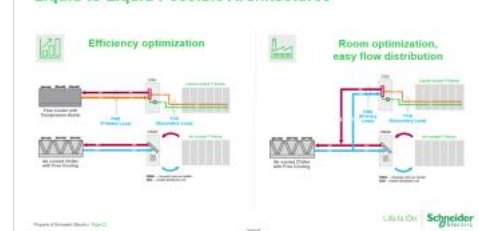


ARCHITECTURE

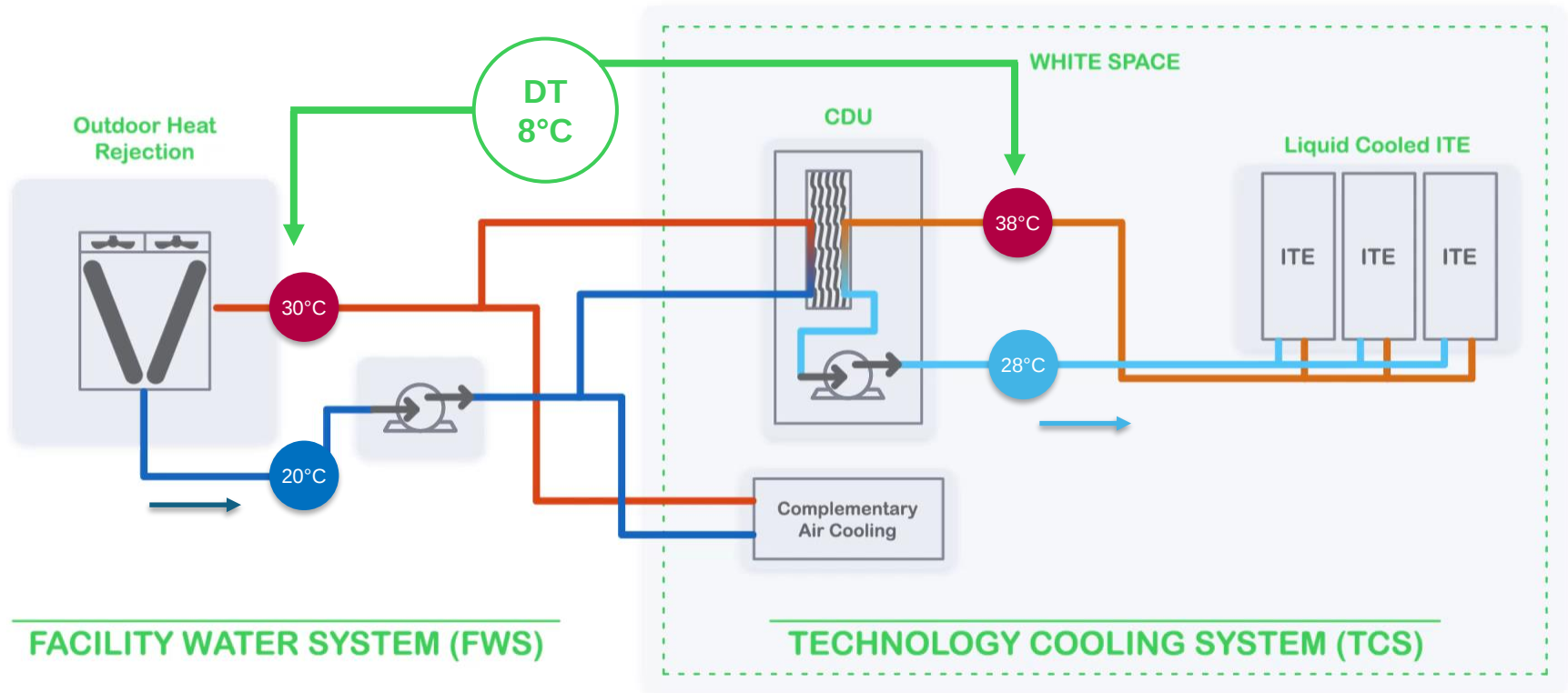
How many loops?
How to manage air and
liquid cooling?



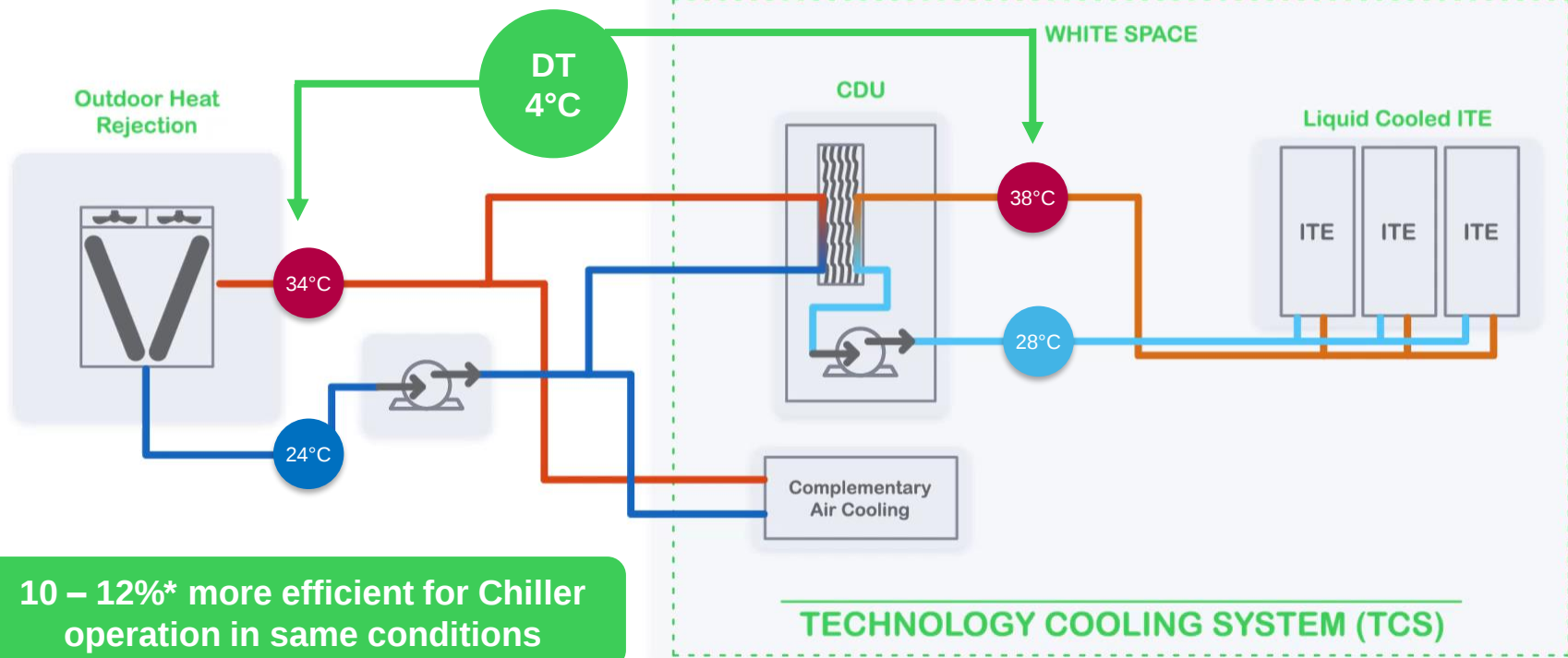
Liquid to Liquid Possible Architectures



Heat rejection and CDU temperatures are strongly interconnected



A minimum approach, for example, allows double digit efficiency improvement!



10 – 12%* more efficient for Chiller operation in same conditions

Let's face high temperature!



Chip Density

Dry Coolers

Up to **1200kW**

Adiabatic Solution

No Compressors

Screw Chillers XRAC/XRAF EHT

From **20°C up to
40°C** water setpoint

Flexibility

7 GWP

Turbocore Chillers XCA/XCF

Up to **2.4 MW**

30°C water setpoint

+25% efficiency vs
traditional technologies

7 GWP

Screw Chillers XRAC/XRAF

Up to **2.2 MW**

25°C water setpoint

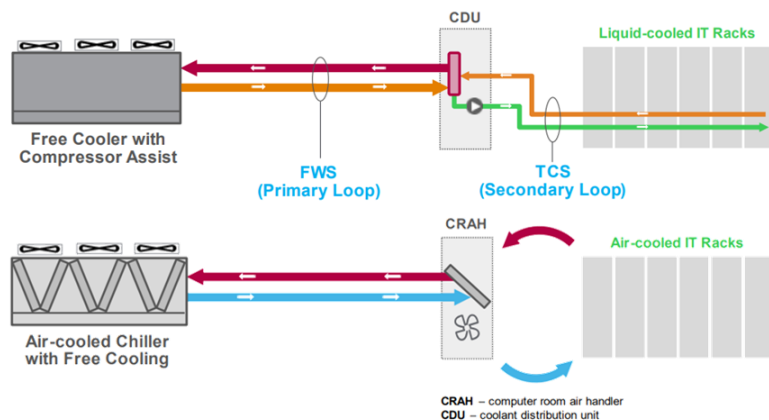
55°C outdoor
temperature

<7 GWP with R1234ze
and R1234yf

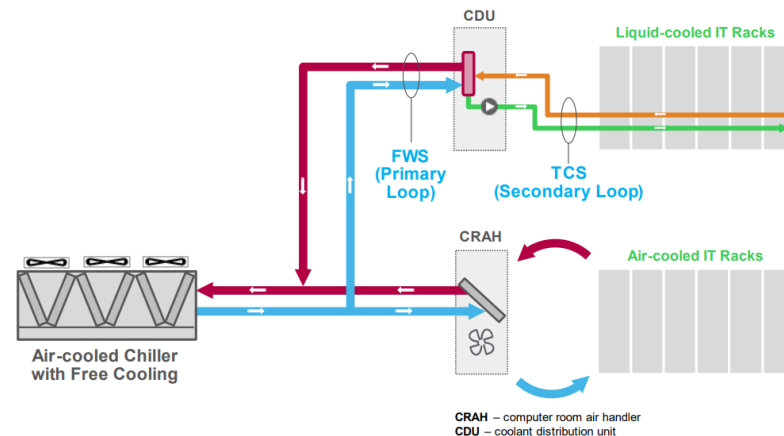
Liquid to Liquid Possible Architectures



Efficiency optimization



Room optimization, easy flow distribution



A full End-to-End Cooling Portfolio

UNIFLAIR™ 2010

PRECISION COOLING



Up to **250kW** Mid/Large air Cooling (CRAC/H)



Up to **500kW** Frontal discharge chilled water

APC 2007

INROW/RACK COOLING



Chilled water and Direct Expansion



Chilled Doors



Air distribution

motivaire 2025

LIQUID COOLING



Up to **2MW** Liquid to Liquid Coolant Distribution Unit



Manifolds and Distribution

UNIFLAIR™ 2010

HEAT REJECTION UNITS FOR AIR AND LIQUID COOLED SERVERS



Up to **2MW** Air Cooled chillers



Up to **2MW** Free-cooling / economizers



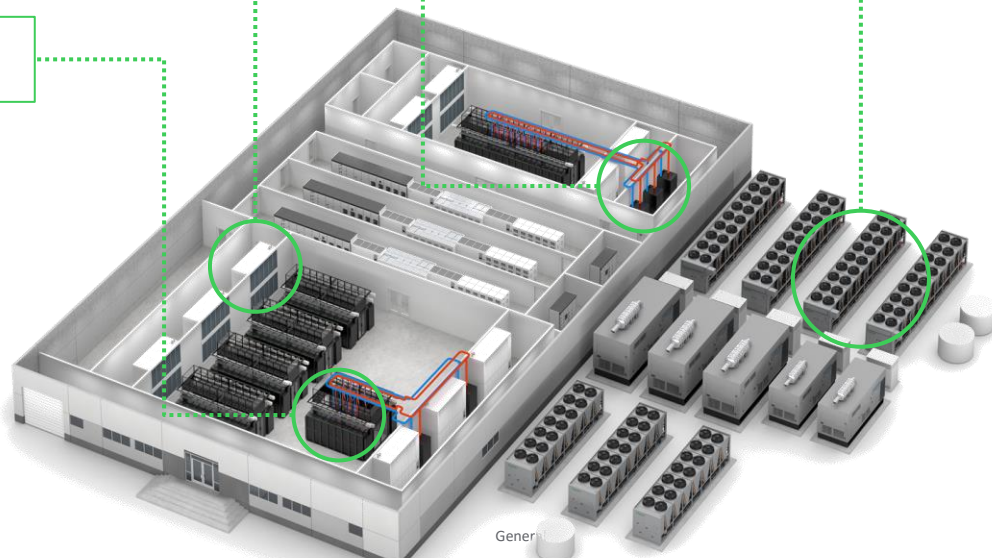
Up to **1.5MW** Free-cooler, compressor assisted



Up to **2.5MW** Water cooled chillers



Up to **1.5MW** Dry-cooler, Adiabatic coolers



General

End-to-end Cooling Portfolio

Life Is On

Schneider
Electric

- Legacy expertise in air cooling solutions
- Wider sales and service network



motivairTM

by **Schneider** Electric

- 10+ years of experience in liquid cooling and high-density applications
- Deep knowledge of the “silicon” sector



Liquid Cooling Portfolio

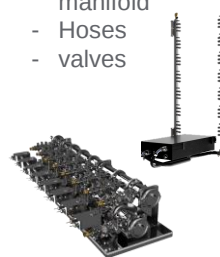
*Primary Supply @32°C
Secondary Supply/Return 25% PG @45°/65°C

Liquid Cooling

CDU

CDUs and HDUs dedicated manifold kit:

- In rack manifold (no OCP)
- Underfloor manifold
- Hoses
- valves



MCDU-4U
102kW

MCDU-10
210kW
[also OCP version]

Floor Mount*



MCDU-25
625kW

MCDU-40
1.2MW

MCDU-60
2.3 MW

HDU

In-Rack



MHDU10
10KW

Floor Mount



MHDU-5900
87 kW

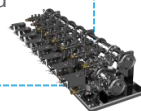
MHDU-5901
107 kW

MHDU-5910
144 kW

Chilled Door

Chilled Door dedicated manifold kit

- Underfloor manifold
- hoses



From 12 kW up to 75 kW
[M4-M8-M12-M12/F-M14-M14/6-M15-M15/E-M16]

Coolant Distribution Units

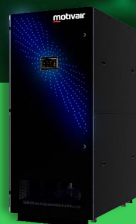
Floor-Mounted

Rack-Mounted

MCDU-60
2.3 MW



MCDU-50
1.7 MW



MCDU-40
1.2MW



MCDU-30
850KW



MCDU-25
625KW



NEW MCDU-10
210KW



MCDU-4U
102KW



- Seven Standard Models (Floor Mount & In-Rack)
- Built in redundancy and resiliency features
- Exascale Ready
- UL/CSA/CE certified

MCDU40 & MCDU50 – Key Features

- 1 Mid prevalence (30psi) **VFD pumps**
- 2 Fully accessible **inverters**
- 3 **Touch screen** display interface
- 4 4°C ATD plate **heat exchanger**
- 5 Embedded **25 microns filter** on TCS



- 6 Regulation **2-way valve** on FWS
- 7 **TOP or BOTTOM** connection
- 8 **Automatic refill system**
- 9 **Sanitary clamps connections** on TCS
- 10 **Expansion tank, pressure relief valve & air vent**

InRack CDU

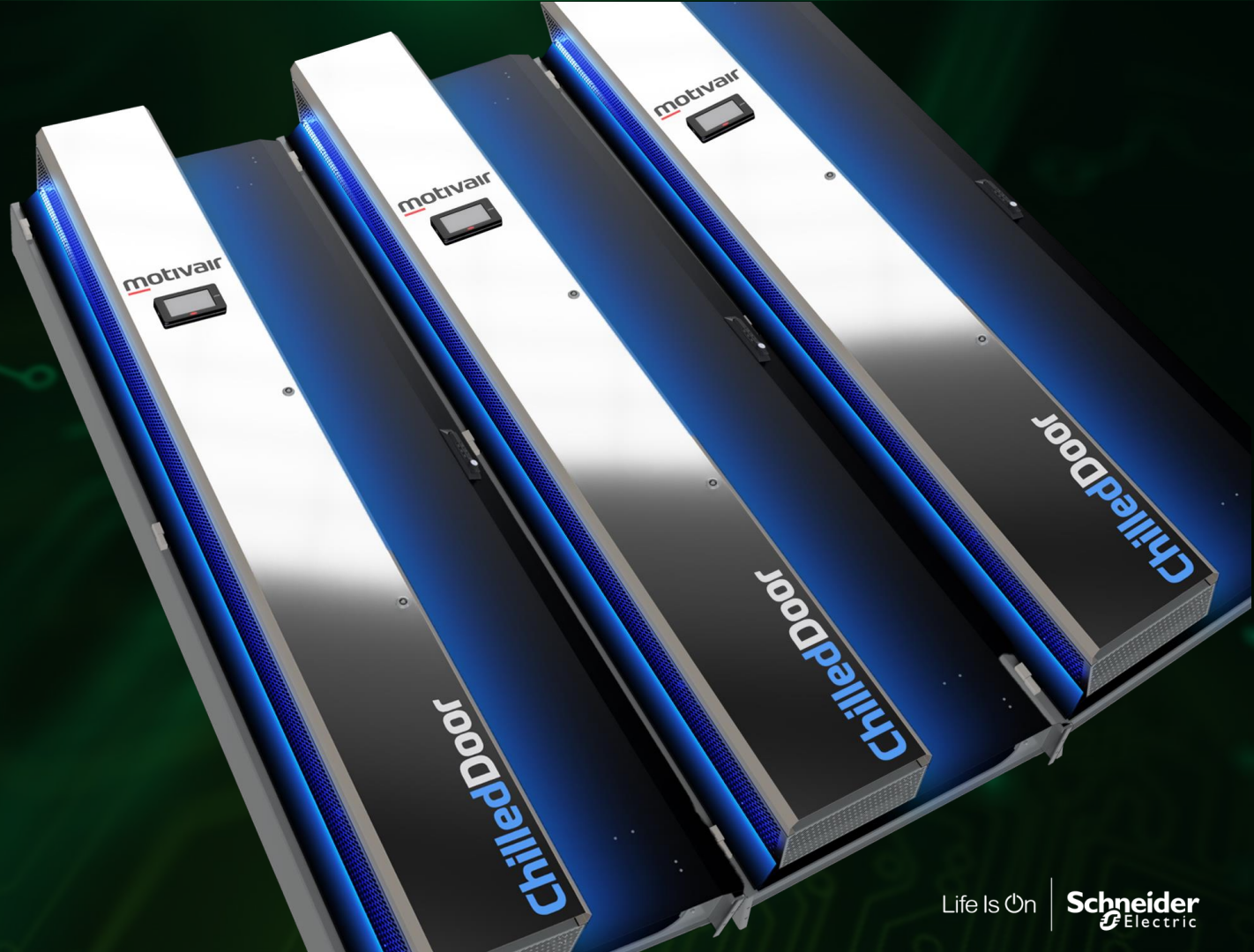
From 102kW up to 210kW



Life Is On

Schneider
Electric

The Chilled Door



The Chilled Door

- 0-75kW cooling capacity with 100% Heat Removal
- Designed to fit any industry-standard server rack
- High-powered adjustable Carel PLC control system for active cooling of server racks



**M4
12kW**



**M8
30kW**



**M12
45kW**



**M12-F
55kW**



**M14
65kW**



**M14-6
70kW**



**M15
70kW**



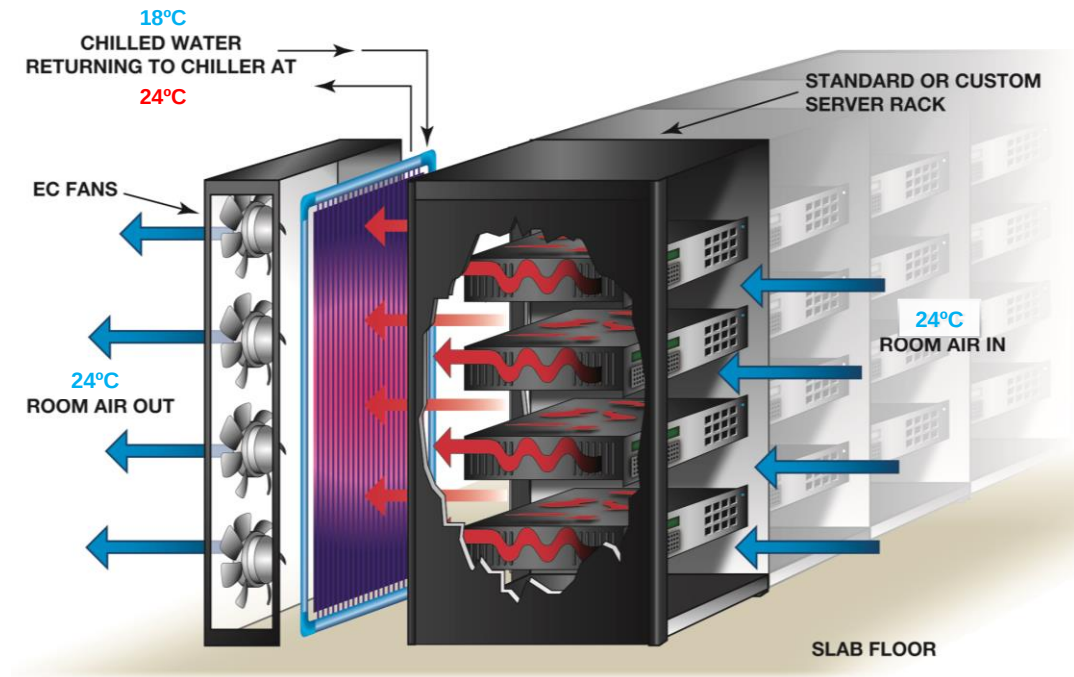
**M15-E
70kW**



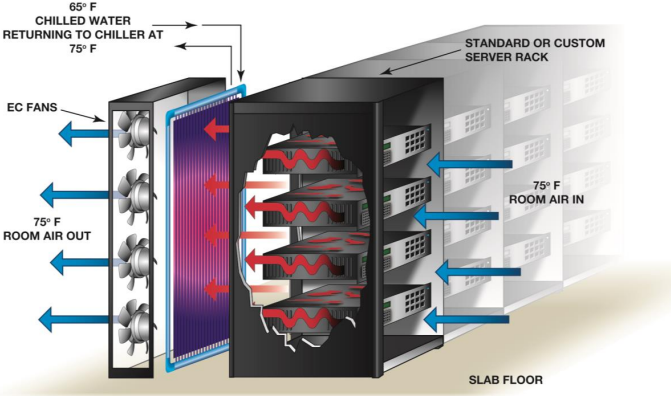
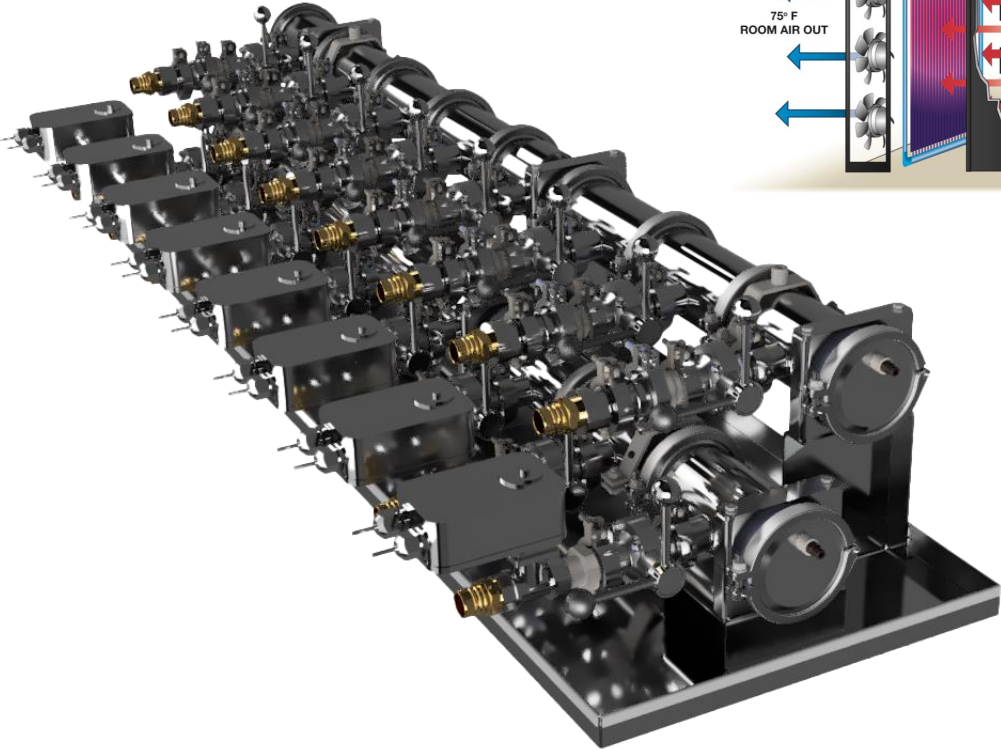
**M16
75kW**



The ChilledDoor®



Manifolds



Manifolds

- 304 Stainless Steel
- Variable Size Options
42U/48U/50U/Custom
- Universal Top/Bottom Design



Heat Dissipation Units(HDU™)

- Rejects the server heat from the server rack to the white space where building air conditioning would then remove that heat.
- Three different floor mount models.
 - Cools capacities up to 144 kW.
- The in-rack comes in two different models.
 - Cools capacities up to 15kW



Schneider Electric Reference Design Portal

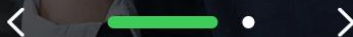
<https://www.se.com/ww/en/work/solutions/for-business/data-centers-and-networks/reference-designs/>



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Data center design done right

Simplify and accelerate your next data center design project using EcoStruxure™ Reference Designs.



Feedback

 Overview

Discover our Reference Designs

Software, services, and products

R >

General

Schneider Electric Reference Designs

To help in the initial stage of design and preliminary study



#99

Design Overview

Data Center IT Capacity

3818 kW
Adaptable from 1808 kW to 3818 kW

Target Availability

Tier III

Annualized PUE at 100% Load

Paris: 1.15 – 1.16
Singapore: 1.25 – 1.26
(Scenario dependent)

Racks and Density

Total Racks: 128 / 144 (Scenario dependent)

Rack Density:

Max air-cooled: 40 kW
Max liquid-cooled: 73 kW

- 1st reference design released
- Up to **73 kW/rack** max density
- Several scenarios
 - retrofit
 - green field
- Based on actual Nvidia IT equipment requirements
- Based on actual cooling units: fan walls, CDU, chillers

EcoStruxure
Innovation At Every Level

[EcoStruxure™ Reference Design 99]

3818 kW, Tier III, IEC, Chilled Water,
Liquid-Cooled & Air-Cooled AI Clusters

#108

Design Overview

Data Center IT Capacity

7392 kW

Target Availability

Tier III

Annualized PUE at 100% Load

San Francisco, CA: 1.14
Dallas, TX: 1.17

Racks and Density

Total Racks: 96

Rack Power Density:

Networking racks up to 22 kW/rack
AI racks up to 132 kW/rack

- 2nd reference design released
- Up to **132 kW/rack** max density
- Several scenarios
 - retrofit
 - green field
- Based on actual Nvidia IT equipment requirements
- Based on actual cooling units: fan walls, CDU, chillers

EcoStruxure
Innovation At Every Level

[EcoStruxure™ Reference Design 108]

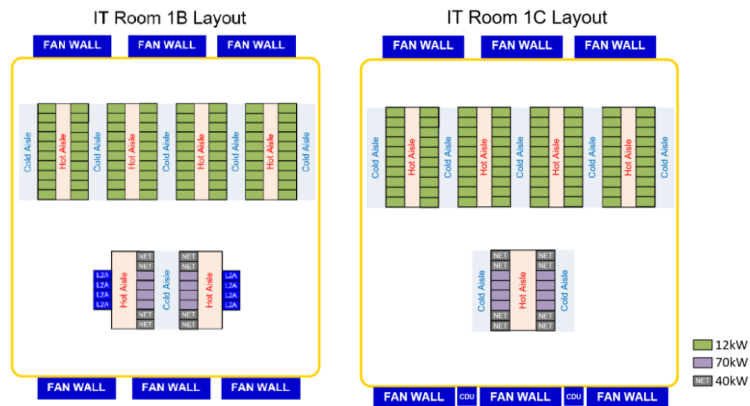
7392 kW, Tier III, NAM, Chilled Water,
Liquid-Cooled AI Clusters

Schneider Electric Reference Designs

To help in the initial stage of design and preliminary study



#99

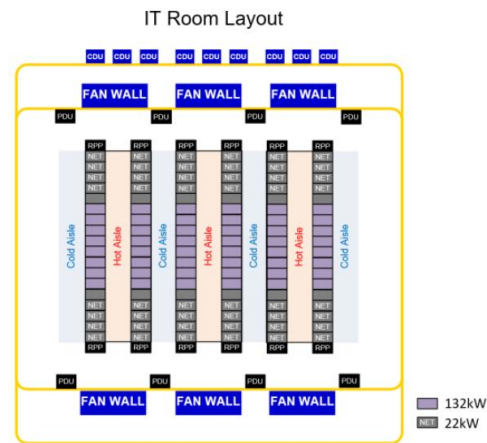


EcoStruxure™
Innovation At Every Level

[EcoStruxure™ Reference Design 99]

3818 kW, Tier III, IEC, Chilled Water,
Liquid-Cooled & Air-Cooled AI Clusters

#108



EcoStruxure™
Innovation At Every Level

[EcoStruxure™ Reference Design 109]

7392 kW, Tier III, NAM, Chilled Water,
Liquid-Cooled AI Clusters

Real Case: Cooling End-to-End Solution

REQUEST

Geography: Nordics

Load: 3MW DC Liquid cooled

Technology: Direct to chip
(GB200, 90kW/rack)

SOLUTION

- | | |
|-----|---|
| 3+1 | MCDU50 <ul style="list-style-type: none">• Tech. corridor• 1 TCS loop each 2 CDUs |
| 6 | HXCV6800 <ul style="list-style-type: none">• Underfloor distribution• Humidity monitoring |
| 3+1 | XCAF1212 (1/1.2MW) <ul style="list-style-type: none">• Free cooling turbocore• 4 FWS loops |



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Electric

se.com

<https://youtu.be/Mde1wT8JLFg>

