submer

Datacenters that make sense

Immersion Cooling at Scale

Unlock the Potential of Every Square Meter in Your Datacenter

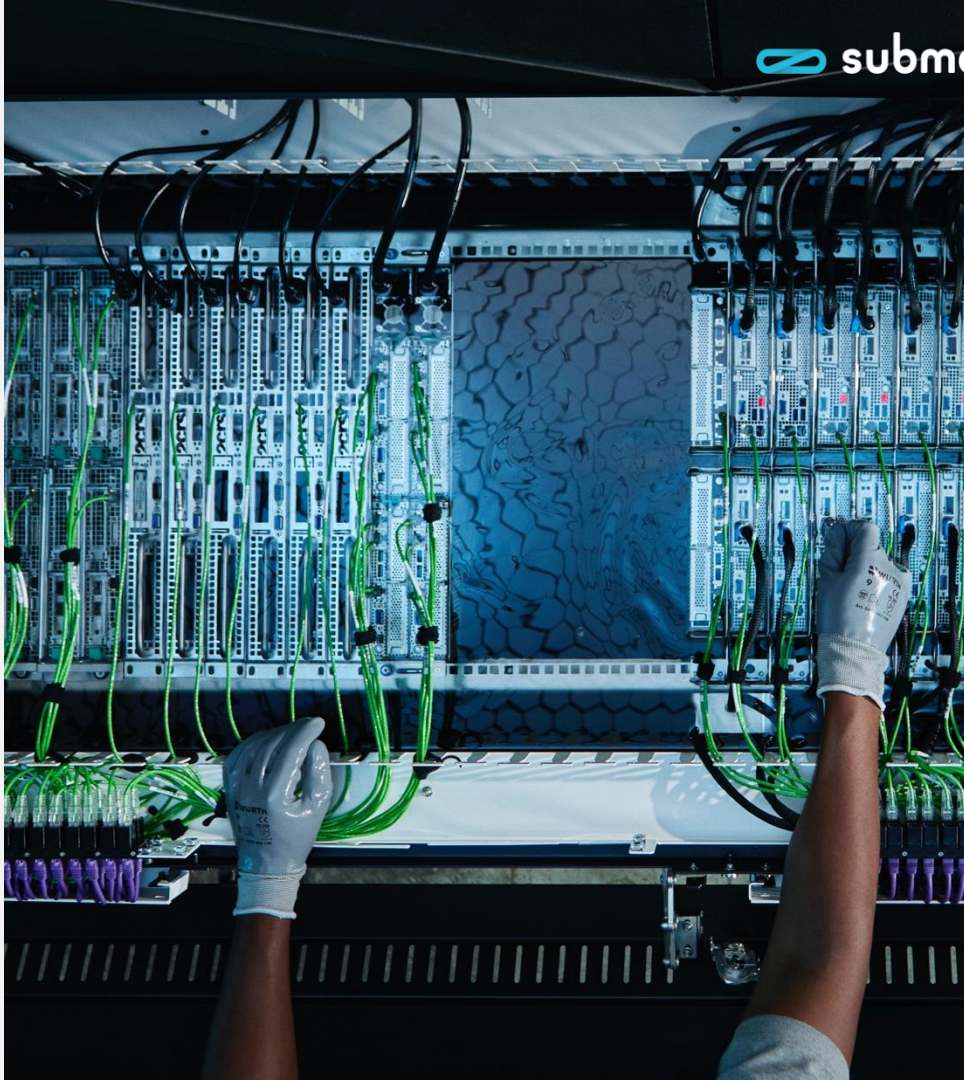
submertech submer

Index

01.

Introduction

Industry Landscape & Challenges



Sustainability

submer

+50%

CO2 Emissions

Digital pollution generates 50% more emissions than the global air transport industry

And this could double in the next 2 years

45%

IT Sector Emissions

Datacenters represent 45% of the IT Sector's greenhouse gases

6.6M

Gallons of Water

Equivalent to 25 million liters of water. This is the yearly consumption of a small 1MW datacenter

98%

Energy Loss

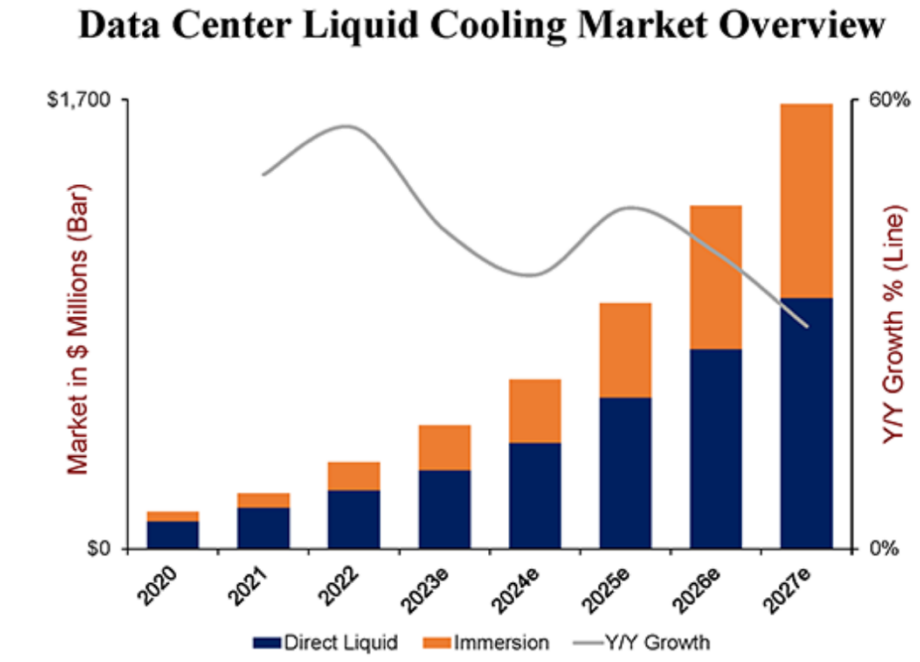
98% of energy consumed by datacenters is rejected as heat into the atmosphere

SOURCES:

The Shift Project
Statista
Smart Water Magazine
Nature
Diva Portal

Liquid Cooling Market Forecast

submer



Source: Dell'Oro Group January 2023 5-Year Forecast

Dell'Oro Group

- The liquid cooling market is forecast to grow significantly
- Immersion adoption will accelerate to account for ~45% of the total liquid cooling market by 2027

Industry Challenges

submer

Business

Complexity of Cooling Options

What's the most compelling from a TCO perspective?

Market is flooded with liquid cooling providers (vendor lock-in)

Consider location, equipment, IT layout, etc.

Power & Space Constraints

Power limitations and rising electricity costs

Expected exponential growth, so a reduced footprint is essential

Performance

Density

Have we exceeded Moore's Law?

CPUs at 200-400W and GPUs moving to 1000-1200W

Air cooling is no longer adequate

ASHRAE

Flexibility

Increasingly hot components

General compute & distributed heat flux workloads

Increasingly hot DIMMs, FPGAs, & many other components

Sustainability

Climate Resiliency

Global warming has exceeded 1ºC since pre-industrial times

Temperatures are rising and water resources are shrinking, leading to increasingly restricted site selection Ipcc.ch

Regulations

Net-zero carbon emissions by 2050

The Paris Agreement United Nations

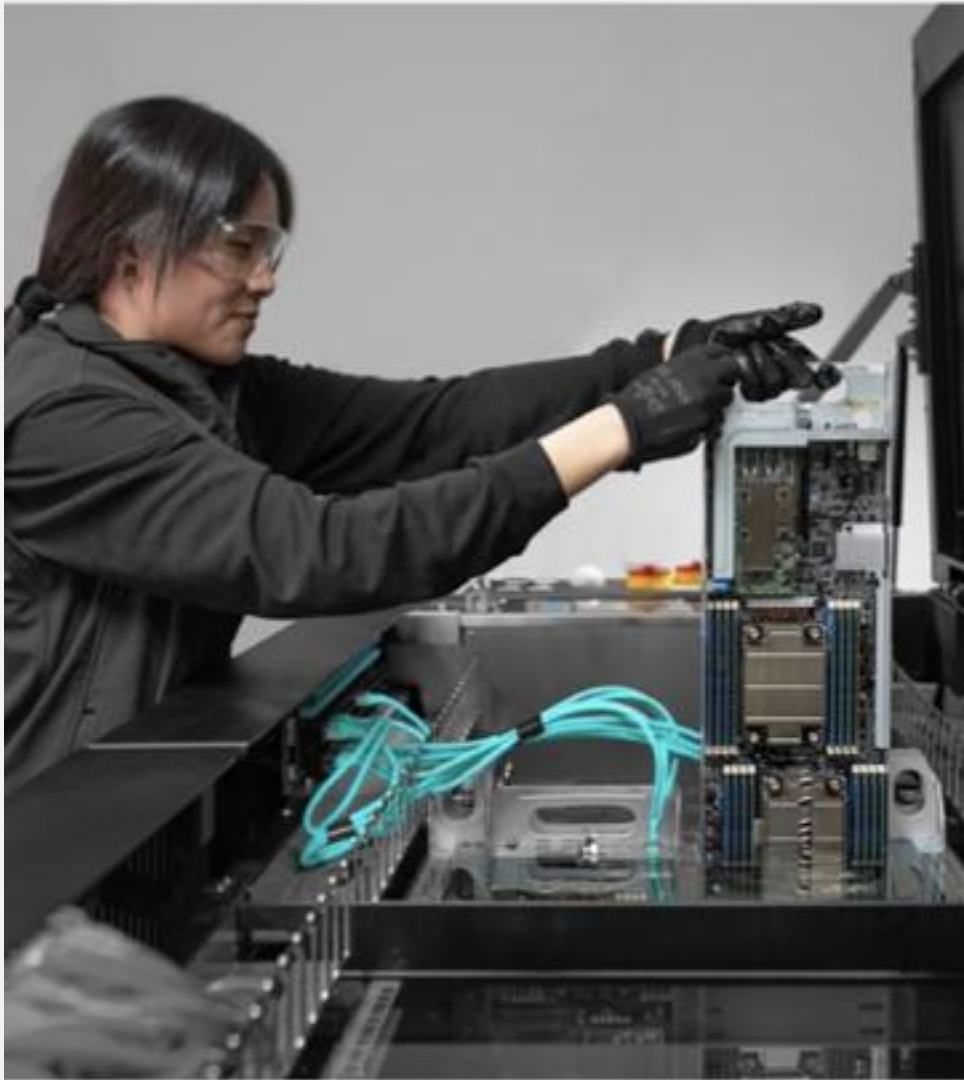
Datacenters having to report on ESG-related KPIs

TCO:
Total Cost of Ownership

02.

About Submer

Who Are We?



Submer's Mission

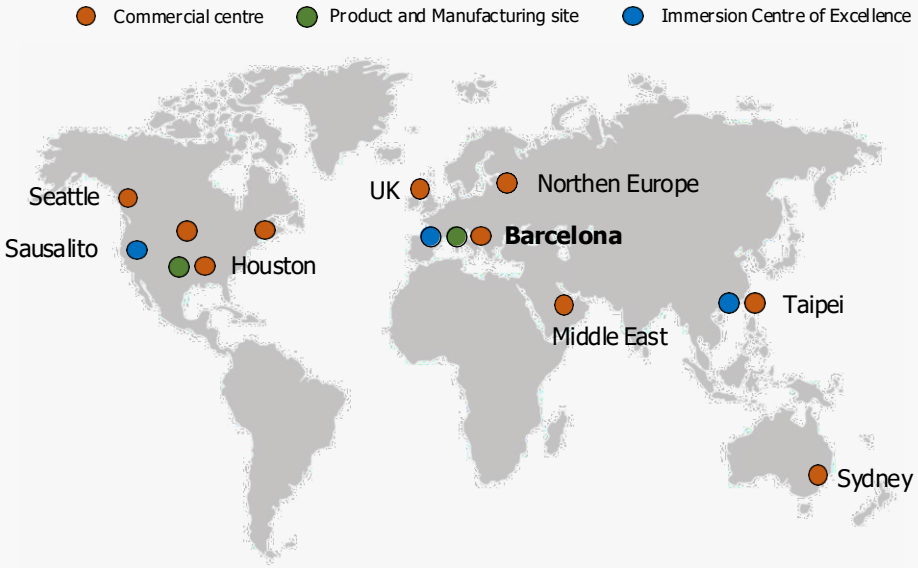
Our Mission

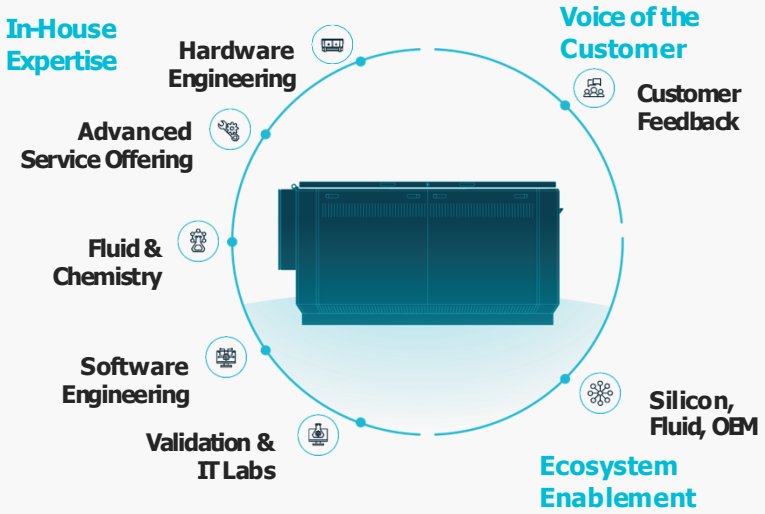
To build sustainable datacenters and lead the way to a greener future

Why?

To make a difference and contribute to a fairer, more efficient, planet-friendly datacenter industry landscape

We integrate client needs and ecosystem players' inputs to developing our products while building the new market and value chain





From our 3 Immersion Centres of Excellence:

- Submer engages with key ecosystem players (Silicon, OEMs, Fluids) to contribute to their evolution towards Immersion Cooling solutions.
- We test and ensure compatibility of accessories and components with our solution (connectors, gloves, cables…

Submer's core is built upon a full-stack technologies and services skillset. This helps us to provide the industry with the knowledge, product and services needed for the new datacentres era.

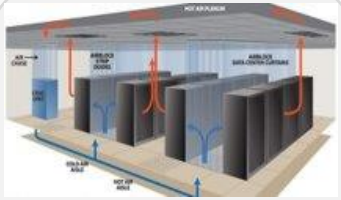
03.

Cooling Technologies

How Do They Compare?

Overview of Main Cooling Technologies

submer



Air-to-Air

Cannot cope with current (let alone future) IT hardware cooling needs

Low power density – large & expensive buildings

Lower air temperatures required

Excessive power and/or water consumption

Heavy use of HVAC systems

Direct Liquid Cooling (DLC)

Whole solution coming from the server vendor - least disruptive transition from air

High heat dissipation capacity

Complexity compromises reliability

Risk of leakage into the IT HW

Cooling DIMMs and other components present a challenge

Requires custom solutions and can lead to vendor lock-in

Requires significant air cooling

Time-consuming servicing

Single-Phase Immersion Cooling

New operating procedures, somewhat disruptive

High heat dissipation capacity

Simple & reliable

Future-proofs facilities – fast adoption of new technologies

Same immersion infrastructure support multiple server generations

No server vendor lock-in

Most competitive TCO

Biodegradable fluid

Less noisy environment

Two-Phase Immersion Cooling

New, disruptive

High heat dissipation capacity

Presents health risk – toxic "forever" chemicals

Requires overengineered tanks & complex filtration systems

Fluid evaporation means complex servicing

Expensive fluid (~$90/kg)

Environmentally dangerous

Regulation restrictions

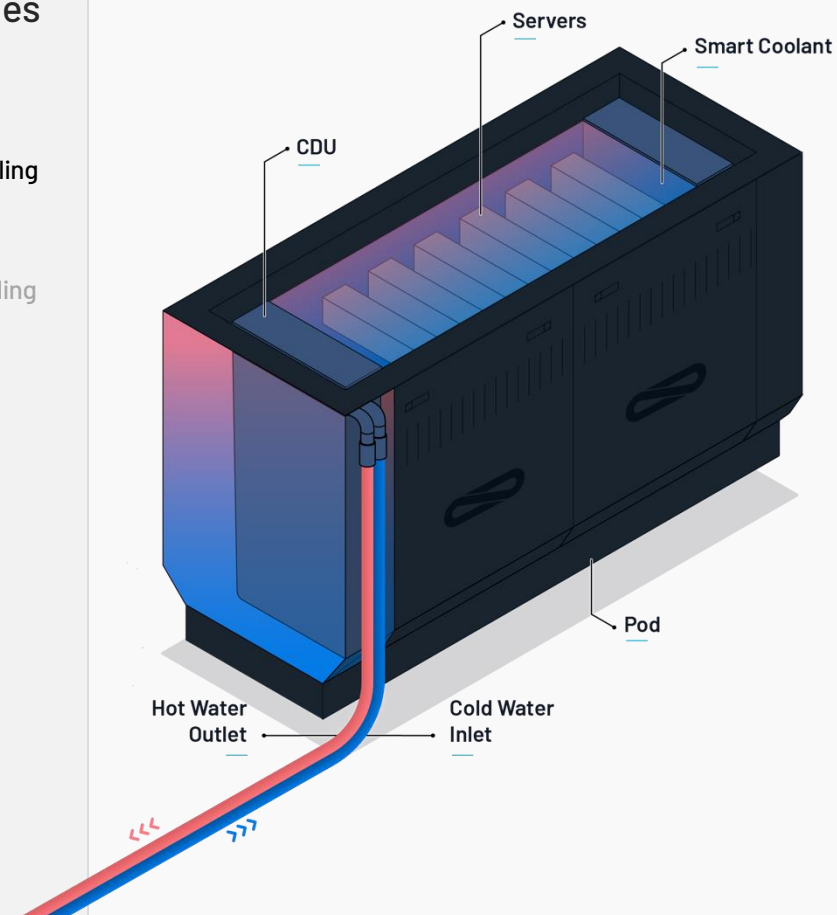
DLC vs Single-Phase Immersion Cooling

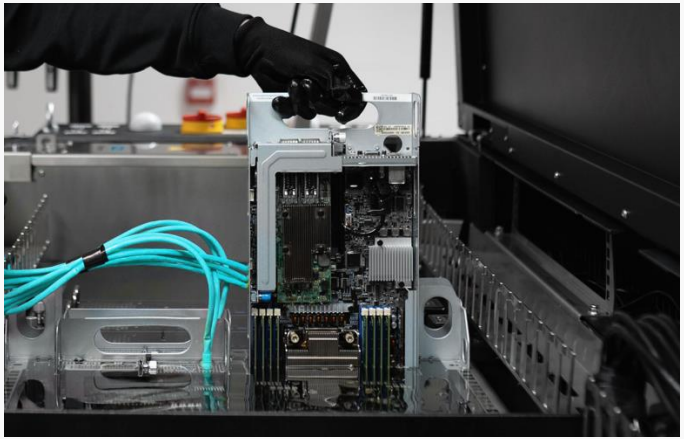
submer

	Perception	Reality
 **Direct Liquid Cooling (DLC)**	Familiar Innovative Straightforward Easy to implement Widely accepted Good TCO	Complex Compromised reliability Risk of leaks Complex and time-consuming operation Supported by OEMs/ODMs Cooling cost on servers - refreshed every 3-5 years + vendor lock-in
 **Immersion Cooling**	Disruptive Messy operation Expensive Not supported by OEMs/ODMs Less power density (tank)	Simple and reliable New operating procedures Cooling cost on the infrastructure Immersion-born SKUs & growing support Future-proof datacenters

Single-Phase Immersion Cooling

submer



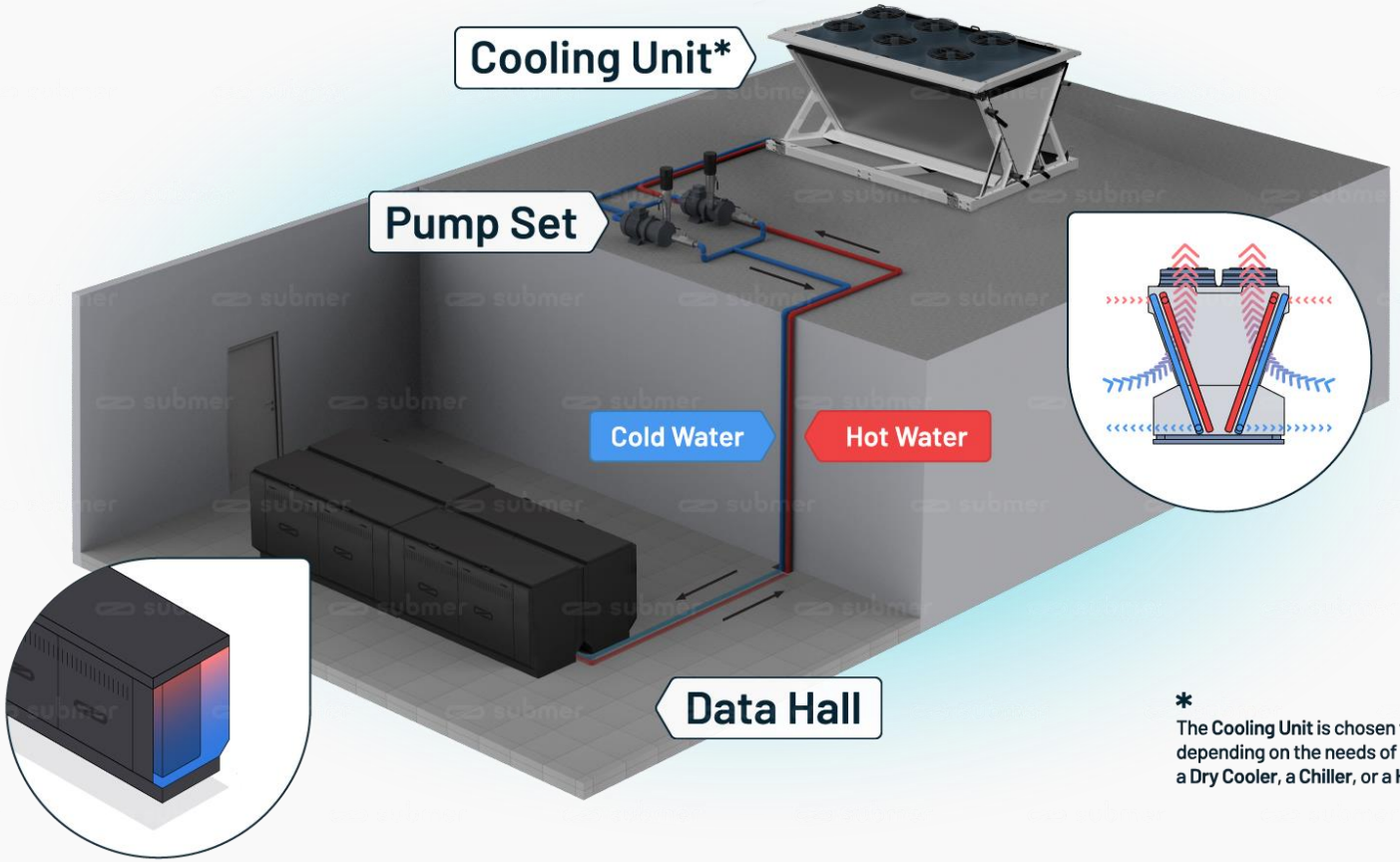


Pros & Cons

- Perceived as disruptive
- High heat dissipation capacity
- Simple & reliable
- Future-proof facilities – fast adoption of new technologies
- Competitive TCO – Same immersion infrastructure supports multi-vendor generational HW refreshes

How Single-Phase Immersion Cooling Works

submer



*
The **Cooling Unit** is chosen from these options depending on the needs of the customer: a **Dry Cooler**, a **Chiller**, or a **Hybrid System**.

04.

SmartPod EVO

Plug & Play Immersion at Scale

SmartPod EVO: Key Features

submer

SmartPod EVO

The easiest path to immersion, this compact solution unlocks the potential of every square meter in your datacenter.

Efficient & sustainable

High availability*
Dissipates 140 kW**
Energy efficient
Minimized environmental footprint

Easy to deploy

Compact solution for complex layouts
Fast Plug & Play deployments
Connects to a standard water loop***

Easy & predictable daily IT operations

Modular cable management
Ready for standard 19" patch panels
PDUs in dry zone

(*) High availability without concurrent mainteinability.

(**) Depends on operating conditions.

(***) This can be designed by any MEP engineering company. Check water loop requirements and performance charts.

SmartPod EVO: Main Components

Tank
A sleek design that protects all your IT gear submerged in coolant.

Dry Zones
Both Front & Rear dry zones are configurable and can have hybrid environments with modular cabling systems and PDUs. They feature adjustable brackets suitable for standard 19" accessories. Each dry zone can house up to 6 PDUs when used for power only.

Control Box*
Power switchgear and control hardware for active components. Control buttons are embedded.

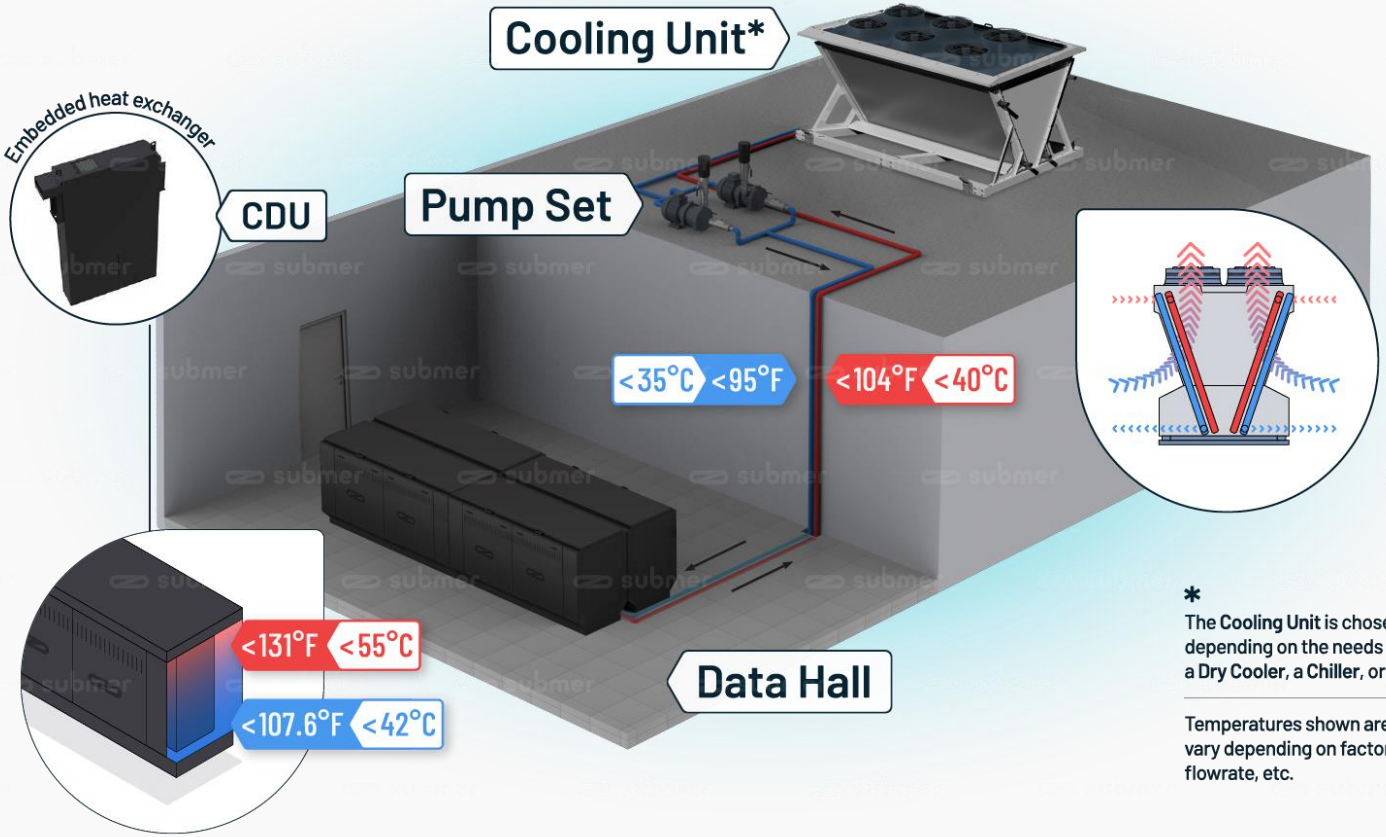
Switch Supports
Designed to hold switches outside of the tank, vertically or horizontally (optional).

Cooling Distribution Unit (CDU)
Circulates coolant through the internal circuit and maintains its set point temperature by transferring the heat to water.

(*) Control box location is configurable. Check data sheet for details.

SmartPod EVO: How it Works

SmartPod EVO



*
The **Cooling Unit** is chosen from these options depending on the needs of the customer: a **Dry Cooler**, a **Chiller**, or a **Hybrid System**.

Temperatures shown are approximate as they vary depending on factors such as set point, flowrate, etc.

SmartPod EVO: Hybrid Deployment Example

submer

In this example:

- Immersion is compatible with standard air-cooled racks

- 82.4°F/28°C air for the room, 71.6°F/22°C for the enclosed air racks

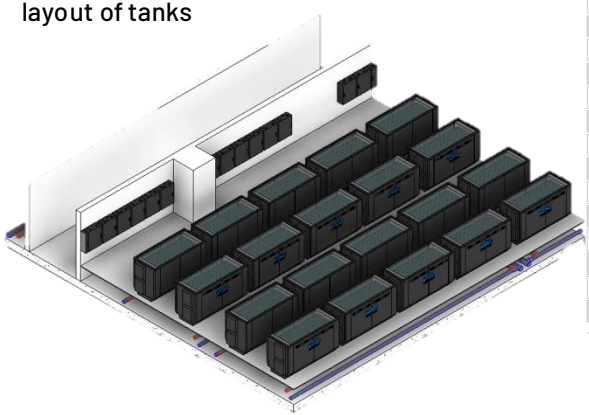
- 7.2 MW Tier III design in immersion

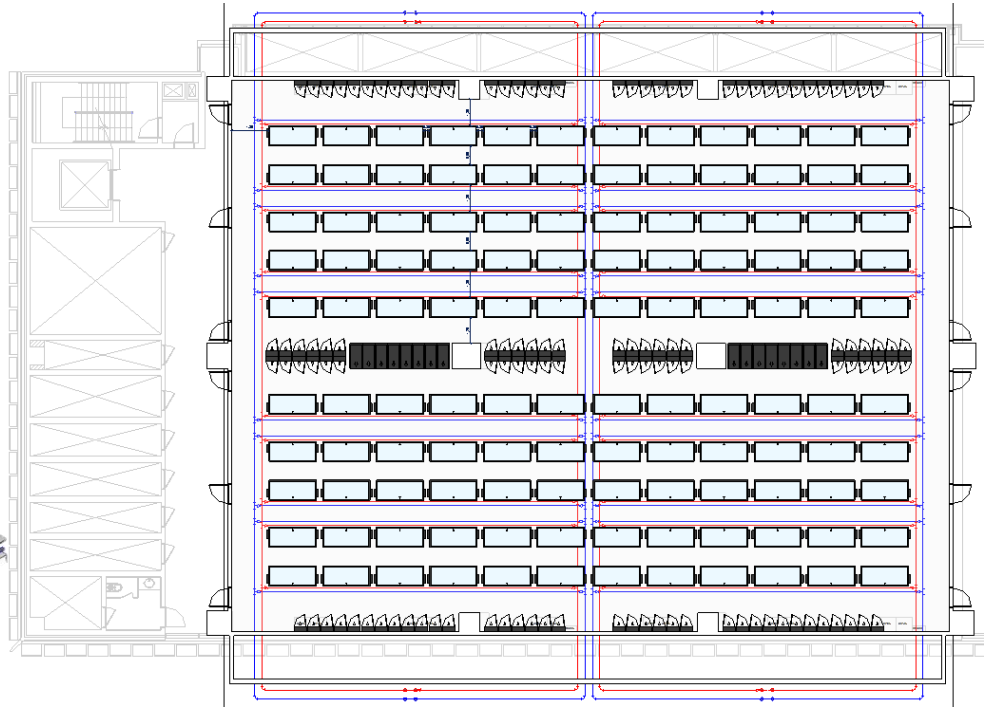
- 320kW enclosed air-cooled racks

- Daily IT and cabling operations

- Cable management in & out of the pods

- External control boxes in walls to optimize layout of tanks





04.

SmartPod EXO

Enduring Performance to Rely On

SmartPod EXO: Key Features

submer

Setting new standards in performance, our immersion cooling solution ensures your datacenter is future-proof and climate-resilient.

SmartPod EXO

Reliable Performance

High availability (5x9s)*
Concurrent Maintainability*
Dissipates up to 361 kW**

Climate Resiliency

Heat reuse & free cooling optimized
Opportunity to completely eradicate direct water usage

Smooth & predictable daily IT operations

Modular cable management
Ready for standard 19" patch panels
PDUs in dry zone

(*) Requires a SmartPod EXO Twin Tank, together with external ATS and UPS and specific operating conditions.
(**) Requires a SmartPod EXO Unitank and specific operating conditions.

SmartPod EXO: Main Components

Tank (1)

A robust design that protects all your IT gear submerged in coolant. Features in-tank structured cable management.

Cooling Distribution Unit (CDU) (2)

High performance CDU with integrated water control valve for maximum energy efficiency.

Can be placed on either side of the pod.

Choose single or dual CDUs to match the availability requirements.

Built-in touch screen* provides local access to monitoring and control.

(*) The touch screen is an optional feature

SmartPod EXO: Main Components

Front Dry Zone (3)

Configurable with standard 19" accessories, and suitable for switches and networking cabling.

Protects the equipment and provides access to the communication ports without removing any panels.

Integration Kit (4)

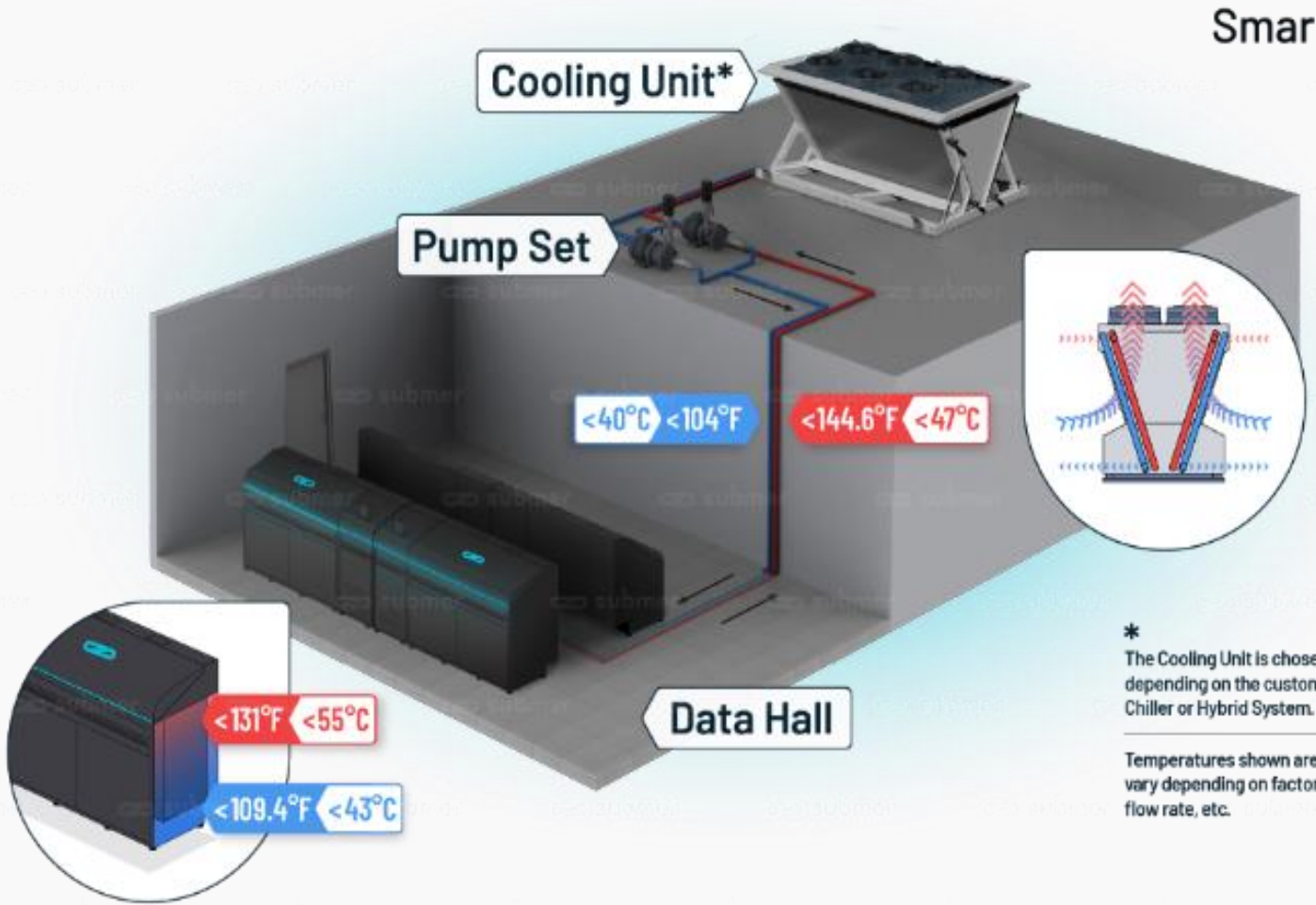
Pipe sections connecting the CDUs and the tanks for the immersion fluid to circulate within the closed loop.

Rear Dry Zone (5)

Holds standard high-power PDUs, with configurable accessories for power distribution cabling.

(*) The touch screen is an optional feature

SmartPod EXO: How it Works



*
The Cooling Unit is chosen from these options depending on the customer needs: Dry Cooler, Chiller or Hybrid System.

Temperatures shown are approximate as they vary depending on factors such as set point, flow rate, etc.

SmartPod EXO UniTank vs TwinTank

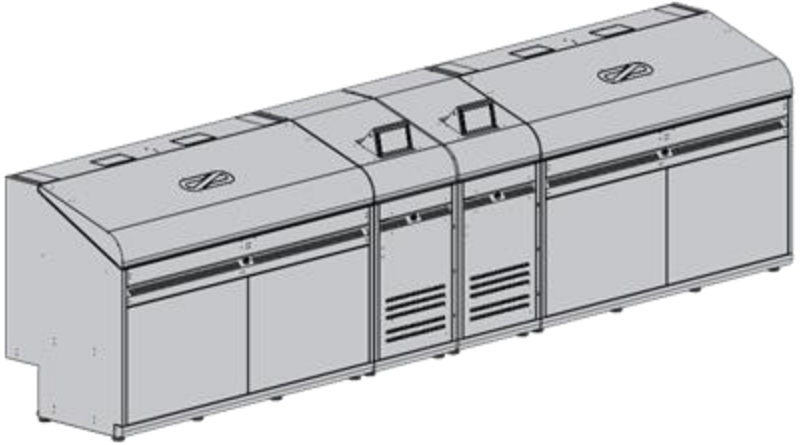
submer

SmartPod EXO
Unitank

To maximize power density

System set up to deliver the maximum performance, maximizing power dissipation capacity

SmartPod EXO
Twin Tank



To maximize uptime

System set up to provide concurrent maintainability and ensure high availability (5x9s)

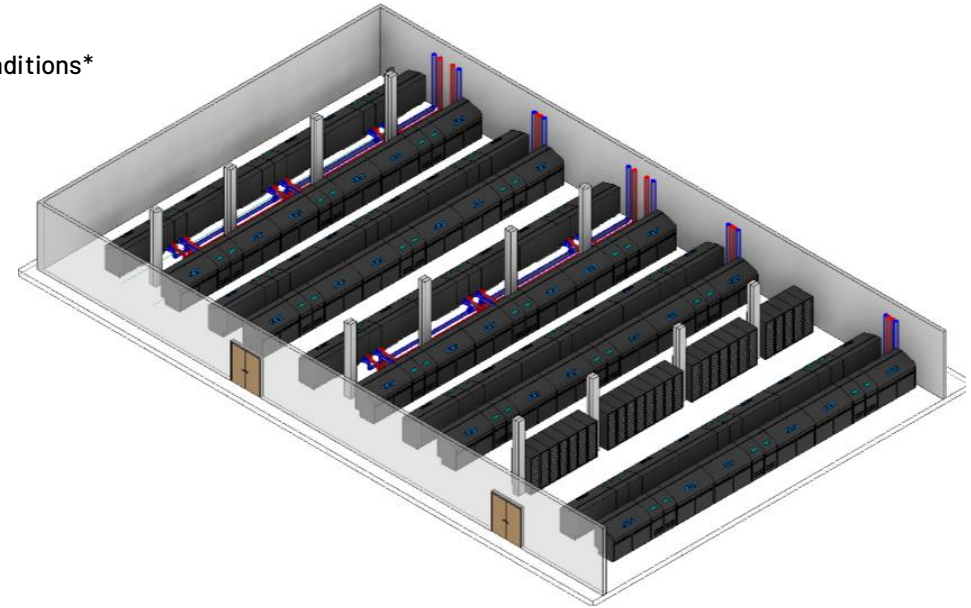
(*) The touch screen is an optional feature

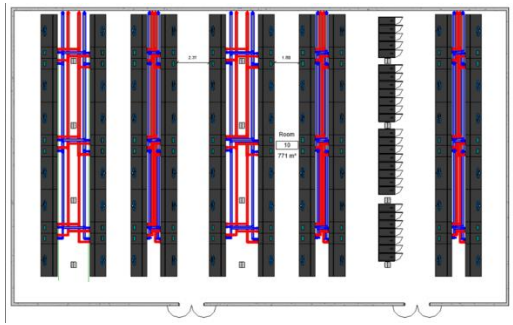
SmartPod EXO: Hybrid Deployment Example

submer

In this example:

- Immersion is compatible with standard air-cooled racks
- 30x SmartPod EXO TwinTank → 60x pods
- Tier III design in immersion
- Dissipation capacity depends on operating conditions*
    - 3.96 MW with water at 104°F/40 °C
    - 11.4 MW with water at 68°F/20 °C
- Daily IT and cabling operations
- Cable management in & out of the pods

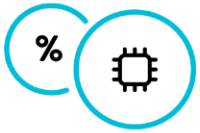




(*) Immersion fluid set point 131°F/55°C

SmartPod EXO: Features

submer

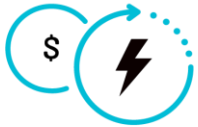


HIGH PERFORMANCE – Maximize Density per sq.ft.

- Crafted especially for high capacity and high performance, the SmartPod EXO delivers exceptional high density per square foot.
- Extended water temperature range provides flexibility and eases integration.

AVAILABILITY – The Twin Tank's Concurrent Maintainability

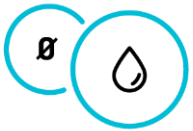
- With the twin tank's versatile operation modes, each CDU handles a single tank in nominal mode or two of them in boost mode.
- Tanks and CDUs are deployed in pairs to mitigate the effect of any potential adverse events.



LOW OPEX – Reduce Energy Consumption

- Regulated water flow rate consistently maintains water usage at an optimal level, maximizing its temperature, and minimizing your energy consumption as a result.

SmartPod EXO: Features

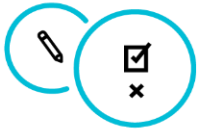


FREE COOLING – Go Waterless

Operating with hot water up to makes free cooling a viable option, in turn, giving you more location choices around the world.

MODULAR – Friendly Equipment Arrangement

Front dry zone for IT and network cabling, and rear dry zone for power distribution mean teams manage respective areas seamlessly.



ORGANIZED – Standardized Cabling

Configurable patch panels, guides, trays, and additional accessories for easy management and scalability.

05.

Benefits

How Can Immersion Cooling Benefit You?

How Submer Solutions Address Industry Challenges

Business

Complexity of Cooling Options

What's the most compelling from a TCO perspective?

Market is flooded with liquid cooling providers (vendor lock-in).

Consider location, equipment, IT layout, etc.

TCO as Main Driver

Compelling TCO from chip to infrastructure

Cooling infrastructure that will outlast several IT generations

Easy & predictable daily IT operations

Performance

Density

Have we exceeded Moore's Law?

CPUs at 200-400W and GPUs moving to 1200-1400W

Air cooling is no longer adequate

Proven Technology Runway

Submer's solid ecosystem, innovation, & interoperability

FCHS with Intel proves we are well on the path to cooling more than 1000W+ TDP

Intel and Submer Illuminate the Path to Immersion Cooling for 1000W TDP

Sustainability

Climate Resiliency

Global warming has exceeded 1°C since pre-industrial times

Temperatures are rising and water resources are shrinking, leading to increasingly restricted site selection

Ipcc.ch

Free Cooling

Ability to efficiently operate at higher ambient temperatures

Less water consumption since free cooling is enabled

Less demanding infrastructure leads to reduced emissions

How Submer Solutions Address Industry Challenges

Business

Power & Space Constrains

Power supply limitations and rising electricity costs

Expected exponential growth, therefore reduced footprint is essential

Efficient Use of Resources

Reduced PUE / TUE

Free up space in an existing data hall

Move power from cooling to compute

PUE: Power Usage Effectiveness
TUE: Total-power Usage Effectiveness

Performance

Flexibility

Increasingly hot components

General compute & distributed heat flux workloads

Increasingly hot DIMMs, FPGAs, & many other components

Hardware and Workload Agnostic

100% IT components covered and properly cooled

Future-proofed datacenter for any IT hardware and workloads

Sustainability

Regulations

Net-zero carbon emissions by 2050

IPCC goals

The Paris Agreement

Datacenters reporting on key areas

Improves 5/6 Key Areas

1. GHG emissions
2. Water management
3. Circularity
4. Energy efficiency
5. Renewable energy
6. Design/siting/building optimization

TCO Savings

submer

We could try to wow you with precise claims about the potential savings but, in reality, there are so many different factors that contribute to your TCO:

DC location

Ground cost ($/sqm)

Temperatures

Form factor

Greenfield/ Brownfield

Utilities

DC equipment

Building

Mechanical

Electrical

Plumbing

Heat Reuse

Submer equipment

Footprint

Tank & fluid

Maintenance

Layout optimization

Daily IT operations

IT layout capacity

IT layout

Compute

Network equipment

Utilization factor

Financials

Cooling cost vs infrastructure cost

Scalability

ESG

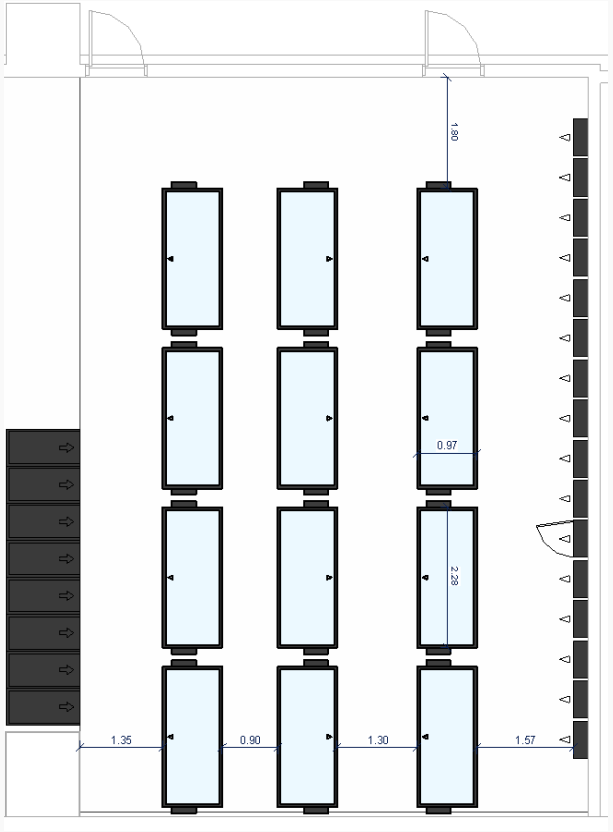
Long term resiliency

Reporting

Water usage

Obtain Incredible Density per SQM

SmartPod EVO



TANK

Tank footprint: 23.8 sq.ft (2.21 m^2)

Tank density: 140kW

Power density: 5.88 kW/sq.ft (63.35 kW/sqm)

STANDARD LAYOUT / operational space

Room space (tank + CB, switch, cabling): 1075 sq.ft (100 m^2)

Room IT power: 1680 kW

Power density: 1.56 kW/sq.ft (16.80 kW/m^2)

Potential layout.

ESG & Sustainability KPIs

submer

- mPUE of 1.03
  PUE lower than 1.10
- Potential to reduce direct water consumption down to 0
- Reduce energy consumption
- Biodegradable, non-toxic SmartCoolant
- Optimization of HW lifespan
- 3X less space needed vs air cooling
  (immersion-ready servers)
- Heat reuse capabilities

Telefónica's Results Prove Reliability

submer

Worst-case scenario of record-breaking temperatures in Madrid, Spain

Efficiency Testing Summary

LOCATION:
Madrid, Spain

Test Number	1	2	3	4	5	6
Start	15-8-22 22:00	17-8-22 15:00	19-8-22 15:00	22-8-22 11:00	29-8-22 15:00	31-8-22 8:00
End	17-8-22 15:00	19-8-22 15:00	22-8-22 11:00	24-8-22 12:00	31-8-22 8:00	5-9-22 11:00
Duration (days)	2	2	3	2	2	5
Set Point (ºC)	45	45	50	50	55	55
PUE Average	1,08	1,04	1,04	1,08	1,08	1,04
WUE Average	1,23	1,13	1,13	1,25	1,22	1,11
Average kW Dissipation	22,25	44,74	44,70	21,52	21,58	44,40
Water Consumption (m3)	19,95	26,06	36,63	25,2	18	52,15
Room Temperature	27ºC	25ºC	29ºC	31ºC	27ºC	28ºC
External Temperature	31ºC	29ºC	35ºC	36ºC	32ºC	33ºC
Humidity	57%	54%	52%	51%	66%	56%

Maintained level of reliability
Coolant temperature, 100% redundancy of CDUs.

High efficiency
The greater the load, the greater the stability.

Improved hardware performance
Processing capacity does not vary in immersion cooling, savings of 5% in IT compared to traditional solutions.

submer

Thank You