SPG DRY COOLING

Member of PAHARPUR

SPG DRY COOLING

We cool the world's critical industries

260 GW
INSTALLED CAPACITY

140 YEARS LEGACY

30+ PATENTS

+2000
EMPLOYEES WITHIN PAHARPUR COOLING TOWERS

650
DRY COOLING EXPERTS

MARKETS

- POWER GENERATION
- DATA CENTERS
- OIL & GAS
- INDUSTRY
- HVAC & DISTRICT COOLING
- GREEN ENERGY & LOW CARBON
  HYDROGEN, NUCLEAR, SOLAR, GEOTHERMAL, BIOMASS

22 OFFICES & 10 MANUFACTURING PLANTS

MEMBER OF

PAHARPUR

Global leader in dry cooling technology

Trusted worldwide with the largest installed base of more than 200GW

PAHARPUR

Under Paharpur group, we propose a complete range of heat rejection solution

NEW

Hypercooler

ACHE

Field Erected Cooling Tower

Air Cooler

Hybrid (adiabatic) Cooler

Package Cooling Tower

Field Erected

Plug & Play

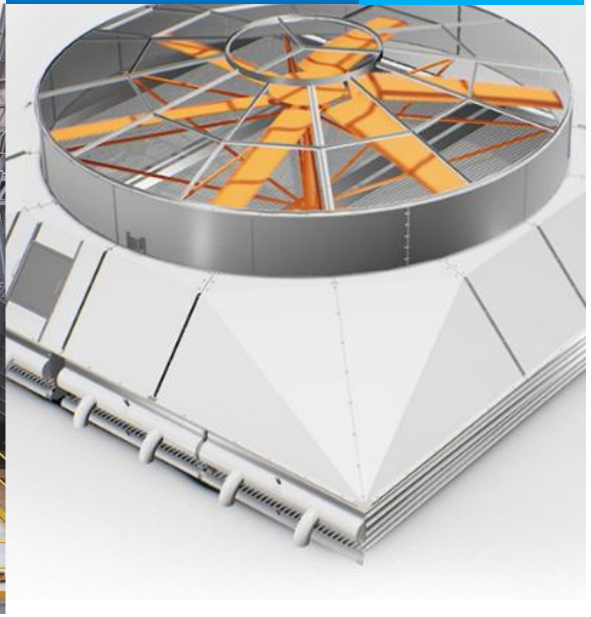
Dry

Wet

Air Cooled Heat Exchanger is an all-around solution mostly dedicated to oil & gas plants

SPG DRY COOLING PAHARPUR

Dry Cooling | **Field Erected**



>100 Global References

From **10 MW** and beyond

Flexible configurations HTRI certified

They allow the direct cooling by air of various process mediums.

Hypercooler is an efficient and compact dry cooler dedicated to hyperscale data centers

SPG DRY COOLING | PAHARPUR

Dry Cooling | Field Erected

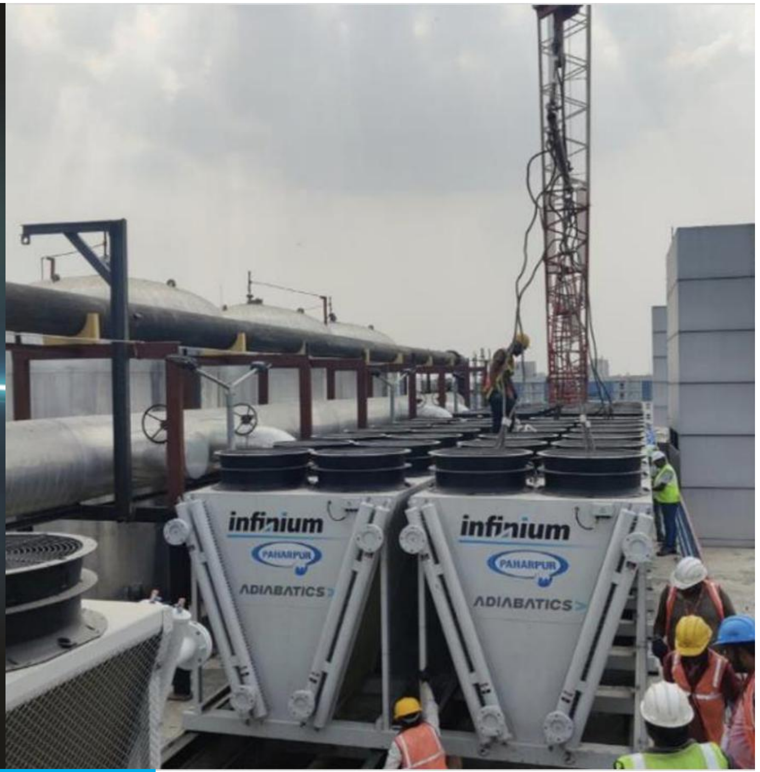
NEW

From **10 MW** and beyond

Compact, energy efficient and silent

Also available with spraying system

Dry and Adiabatic Coolers



Adiabatic cooling | Factory Assembled

From **0.2** MW To **20** MW

The right choice for plug&play solutions

Reduce **energy** consumption by up to **40% or reduce water usage by up to 80%. Available with Cu/Al or SS/Al coils**

Under SPGDC flagship, we are the world leaders in **Air Cooled Condensers**

>1000 Global References

Dry Cooling | **Field Erected**

From **5 MW** and beyond

The sustainable solution for a water-smart future.

Dry cooling solutions can decrease total water consumption by more than 95%

Cooling Towers remain the most efficient solution when water is available

>1000 Global References

From **5 MW** and beyond

Fully integrated manufacturing

Different types and configurations available for each specific need

Wet Cooling | **Field Erected**

Packaged Cooling Towers

>1000 Global References

Wet Cooling | Factory Assembled

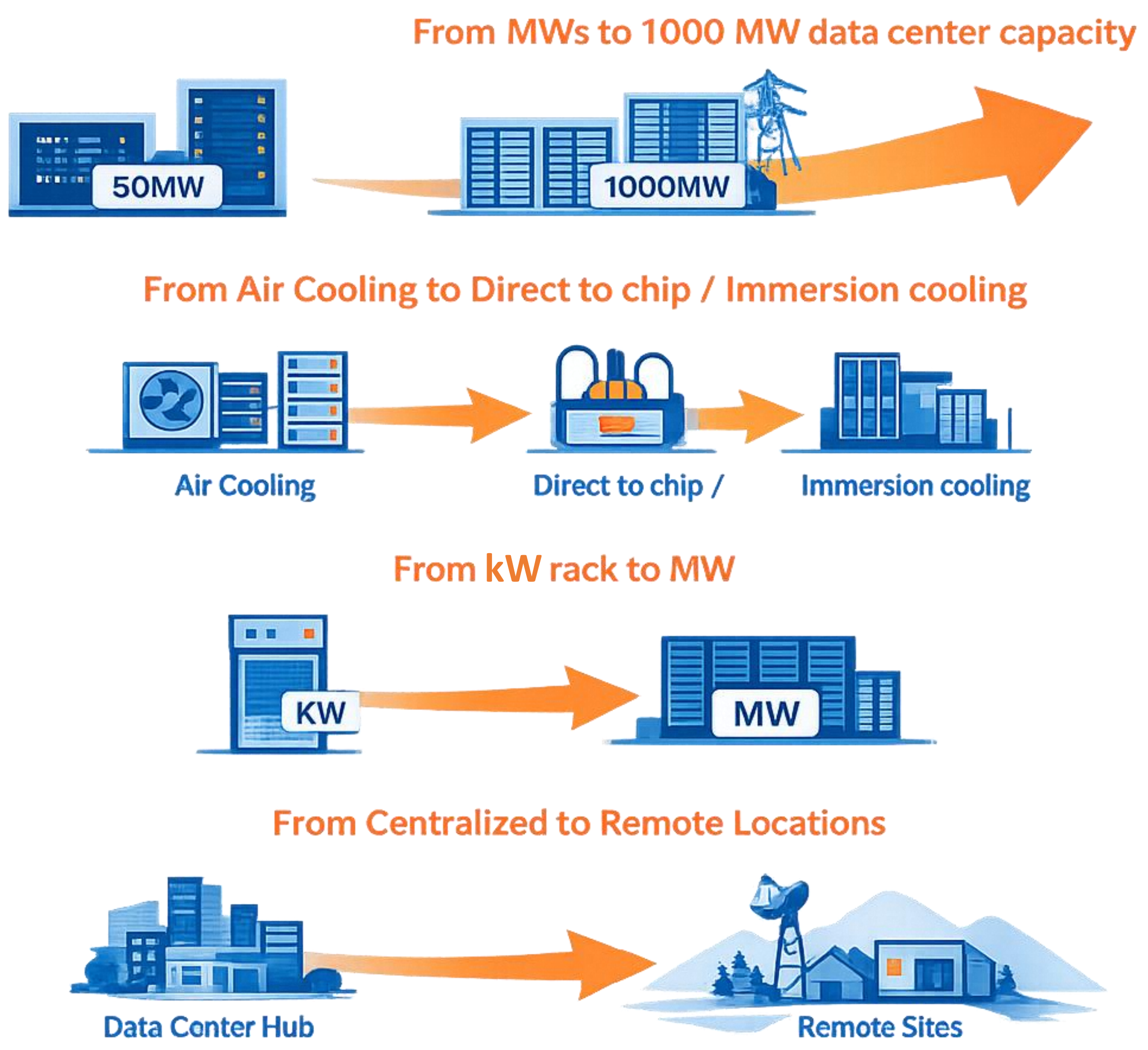
Most Efficient / Cost Effective Cooling Solution

CTI Certified

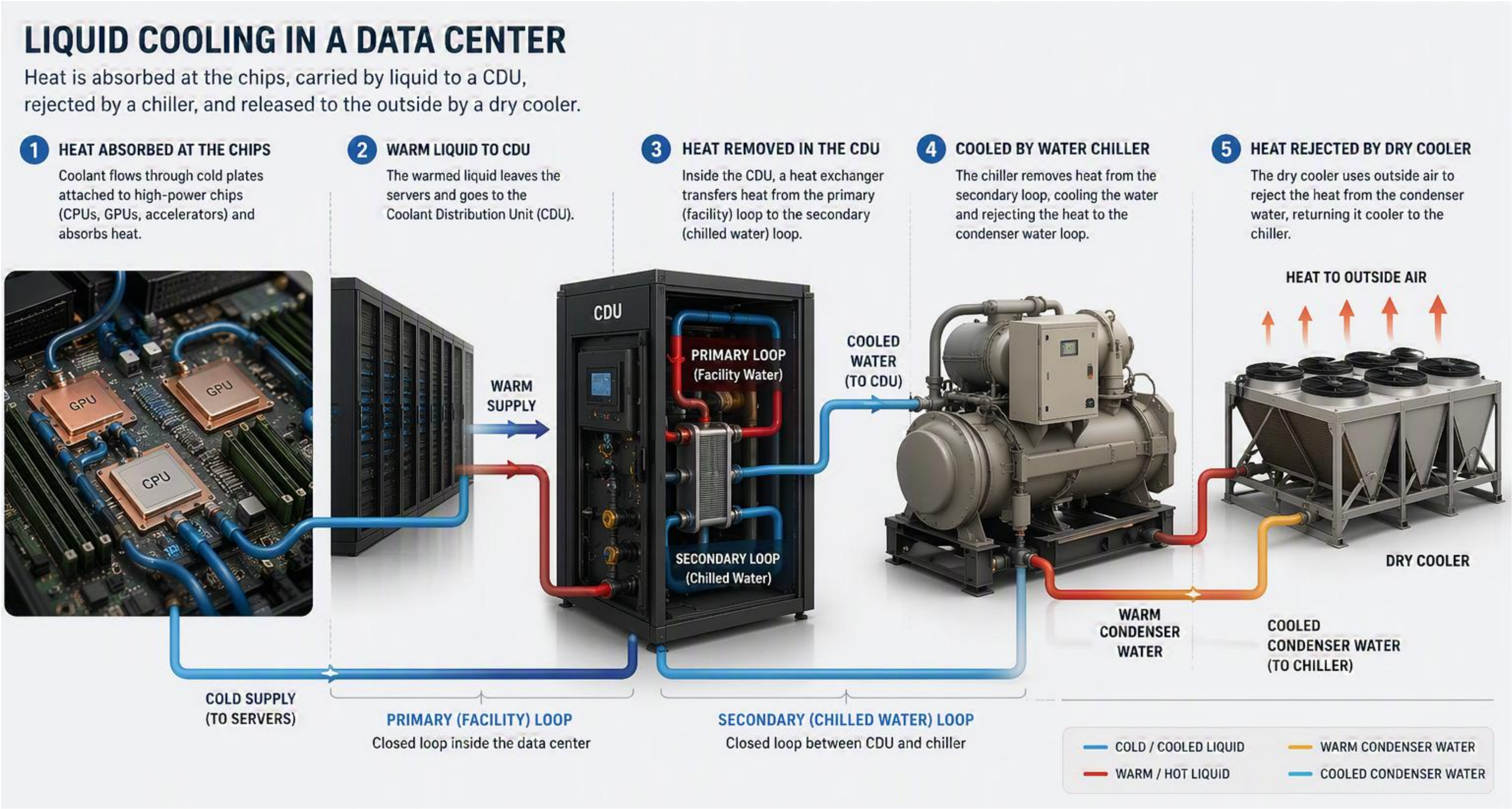
Different types and configurations available for each specific need

Data centres require high amounts of power and cooling

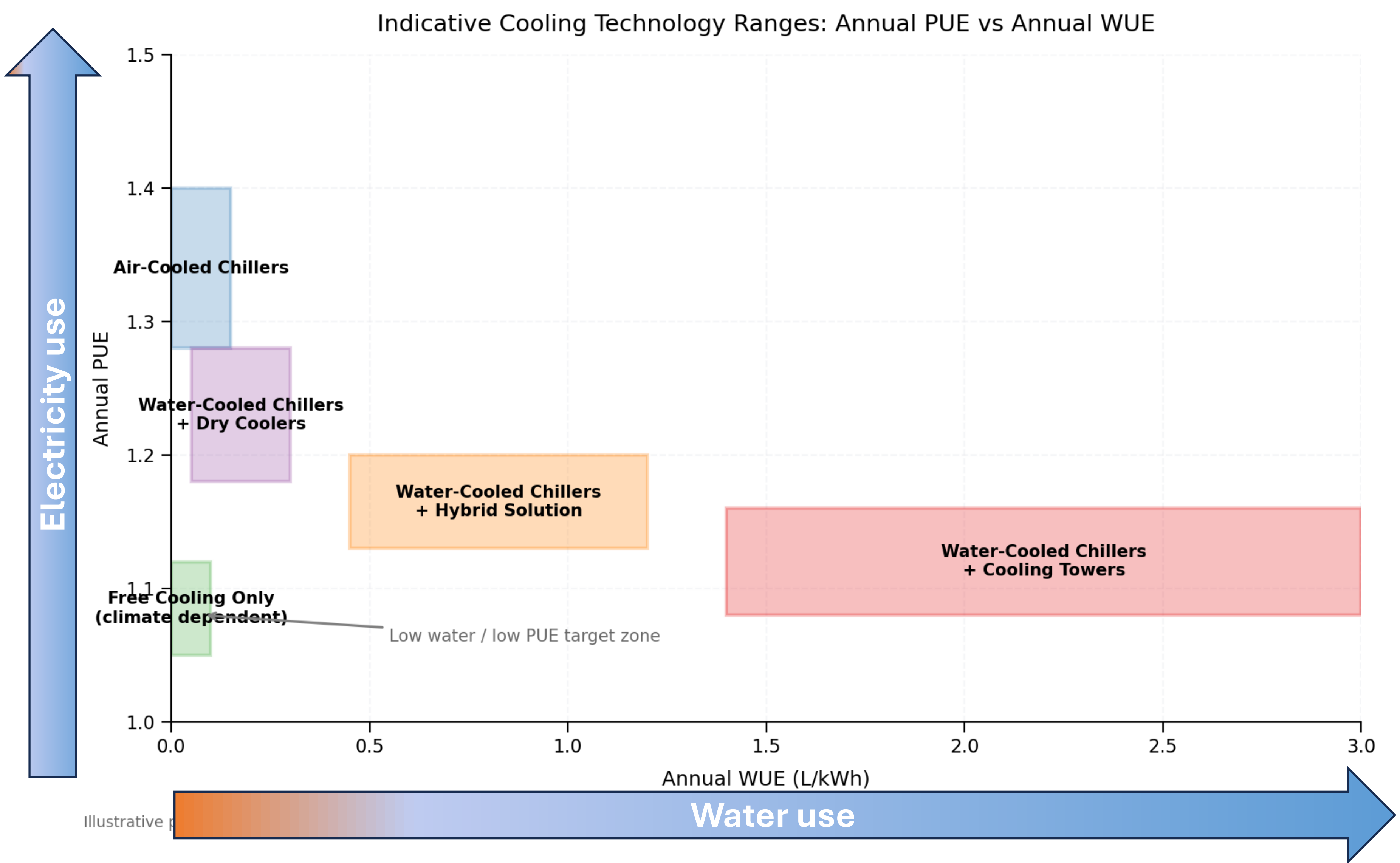
Technology is **changing quickly** and so are the cooling needs



Liquid Cooling enables higher cooling temperatures

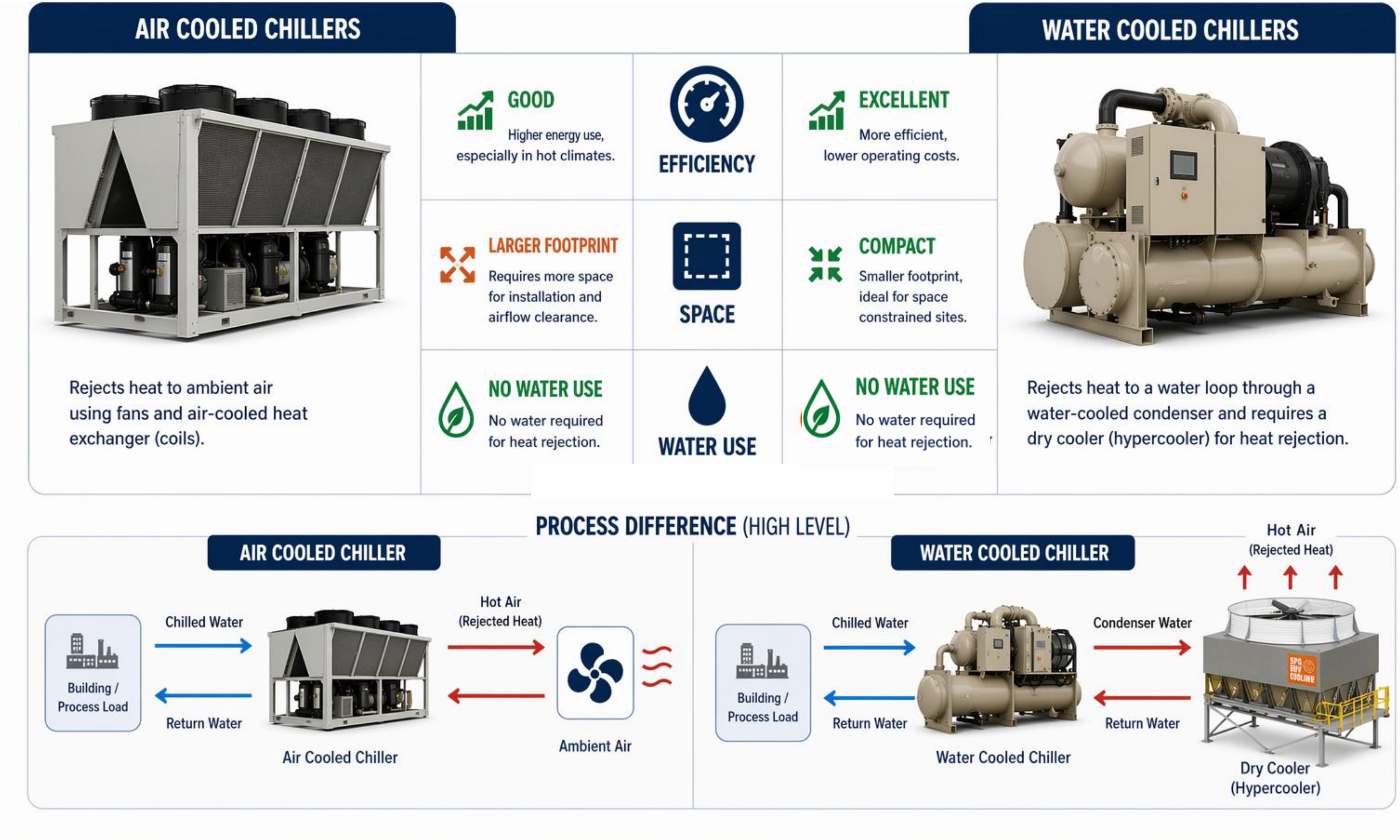


Most efficient cooling goes without mechanical cooling (chiller)

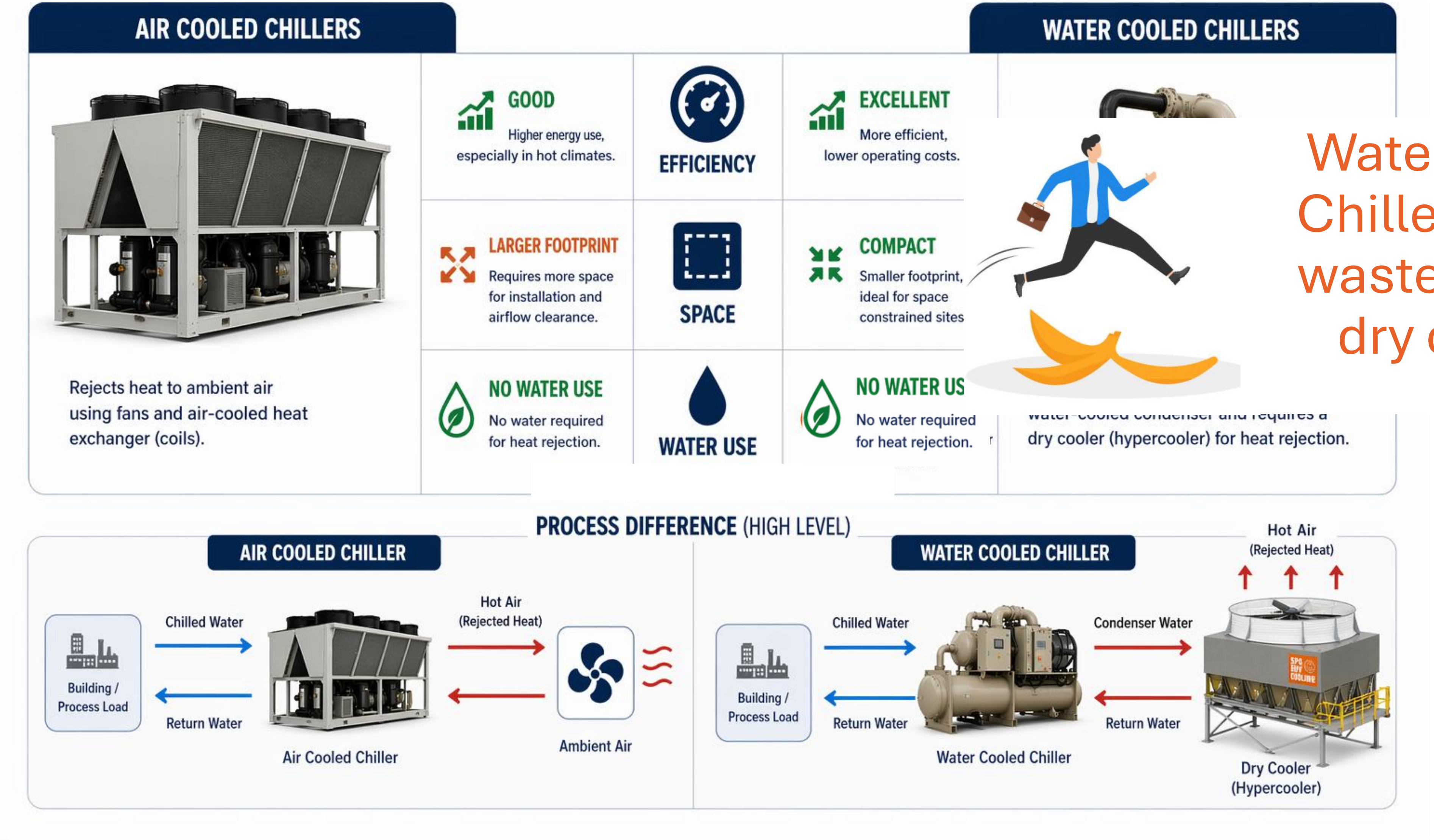


How does it work with chillers?

Water cooled chillers + dry coolers are more efficient than air cooled chillers



Water cooled chillers and dry coolers are more efficient than air cooled chillers

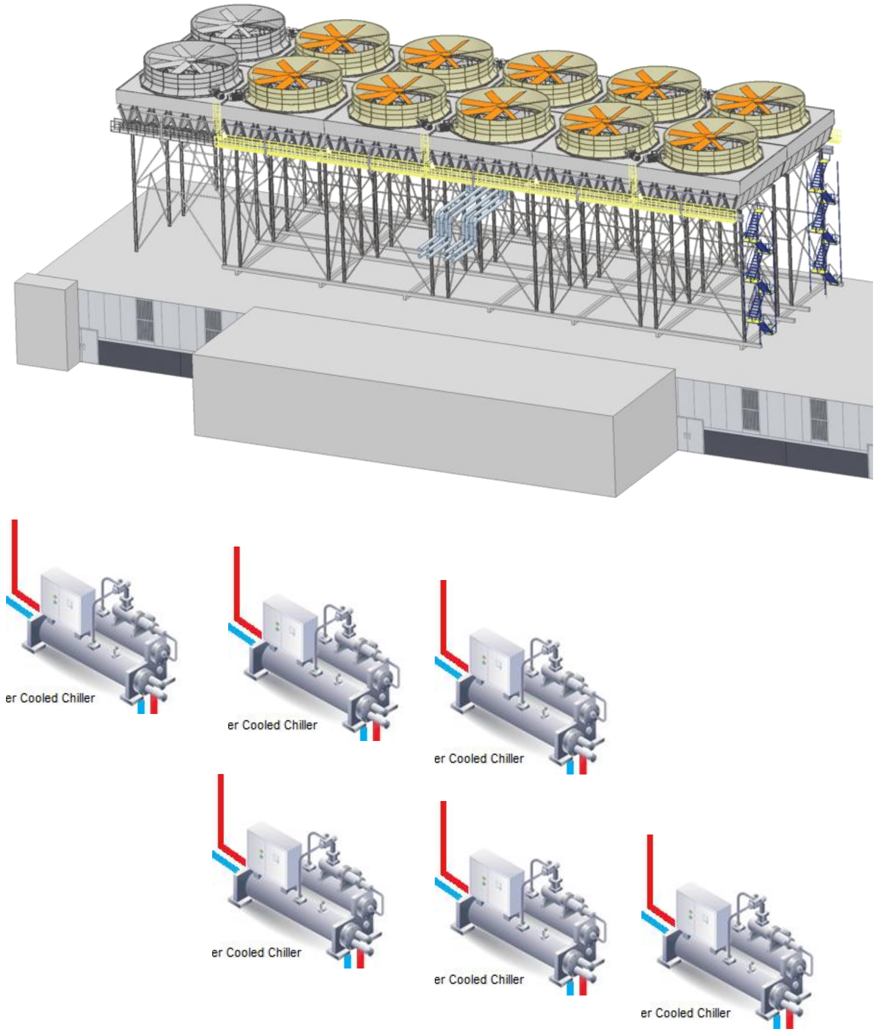


Water Cooled Chillers do not waste water (if dry cooled)

More efficient and scalable than air-cooled chillers

Criteria	Air-Cooled Chiller (ACC)	Water-Cooled Chiller + Dry Cooler
📐 **Footprint**	🔴 Very high	🟢 Low (-50%)
🔉 **Noise**	🔴 Very high	🟡 Medium (-5-7 dB)
⚡ **Power Consumption**	🔴 Very high	🟢 Low (-50%)
🛠️ **Maintenance**	🔴 Extremely high (100x more fans)	🟡 Medium (WCC system)

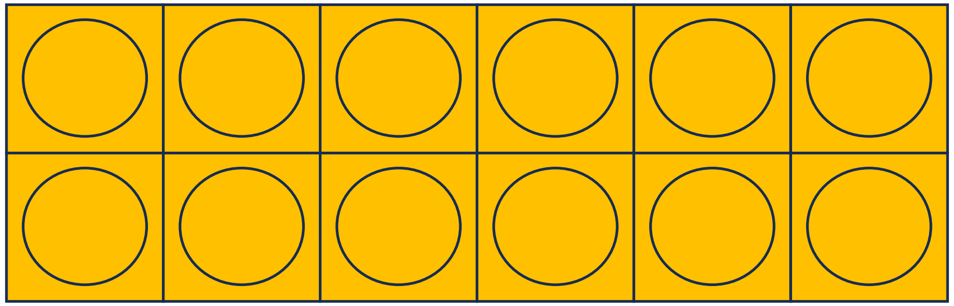
More efficient and scalable than air-cooled chillers: space



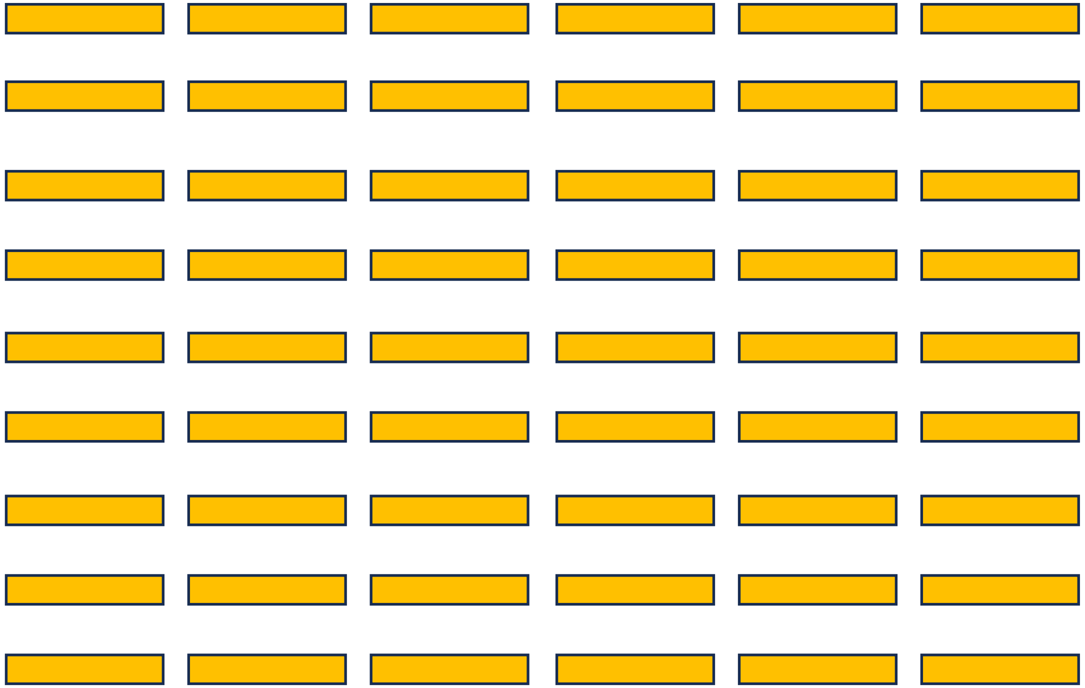
VS

x 40-60

More efficient and scalable than air-cooled chillers: space

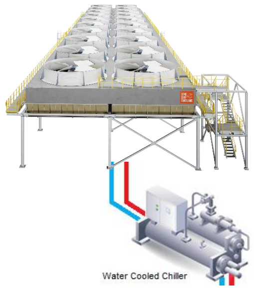


VS



x 40-60

More efficient and scalable than air-cooled chillers: space

		WCC+Dry Cooler	Air Cooled Chiller
			

Design Conditions		
Air Inlet Temperature	°C	39
Total Tons of Dissipation (per roof)	MW	74
Chilled water supply	°C	27
Chilled water return	°C	19

Quantity required		WCC+Dry Cooler	Air Cooled Chiller
Capacity per Chiller	MW	12	1.3
Number of chillers required		6	56
Dry Coolers required (n+1)		12	0

Footprint		**Per unit**	**Total**	**Per unit**	**Total**
Dry Coolers with WCC underneath	m2	140	1,681		
Air Cooled Chillers (spacing between units	m2			63	3,510

Maintenance	**Per unit**	**Total**	**Per unit**	**Total**
Number of fans	1	12	20	1120

2x lesser footprint and

100x less fans

More efficient and scalable than air-cooled chillers: noise and power consumption

WCC+Dry Cooler

Air Cooled Chiller

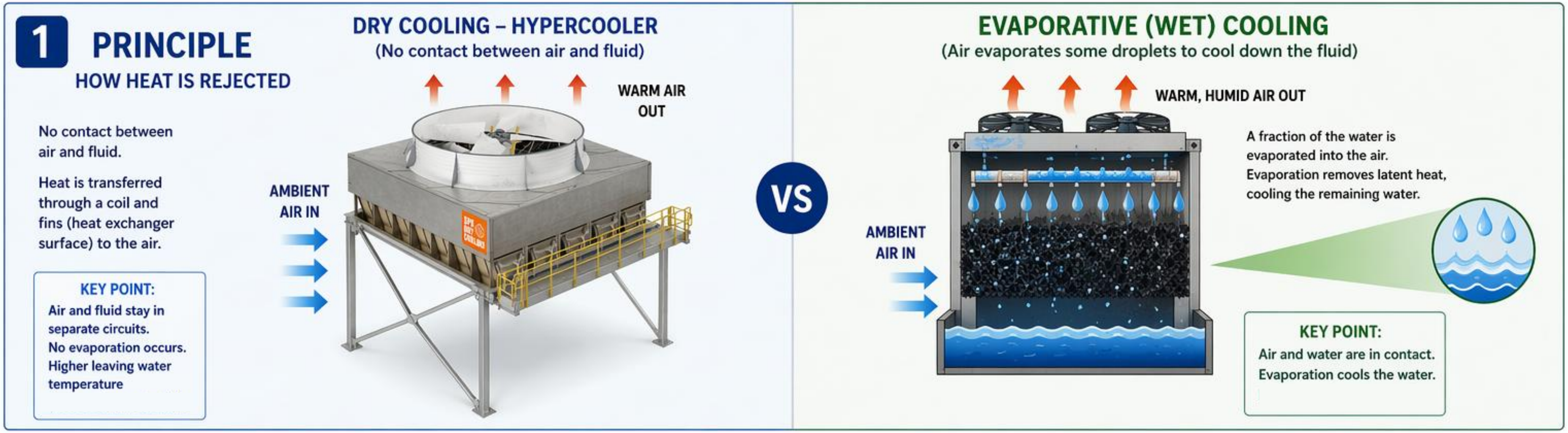
Noise	Per unit dB	Total dB	Per unit dB	Total dB
Dry Coolers	100	111	-	-
WCC	95	103	-	-
ACCH	-	-	100	117
Total		***111***		***117***

Annual Power Consumption (est'd)	Total (MWh)	Total w/o free cooling (MWh)	Total with free cooling (MWh)
Dry Coolers	7,921		
WCC	28,996	-	-
ACCH	-	73,299	42,030
Total	***36,917***	***73,299***	***42,030***

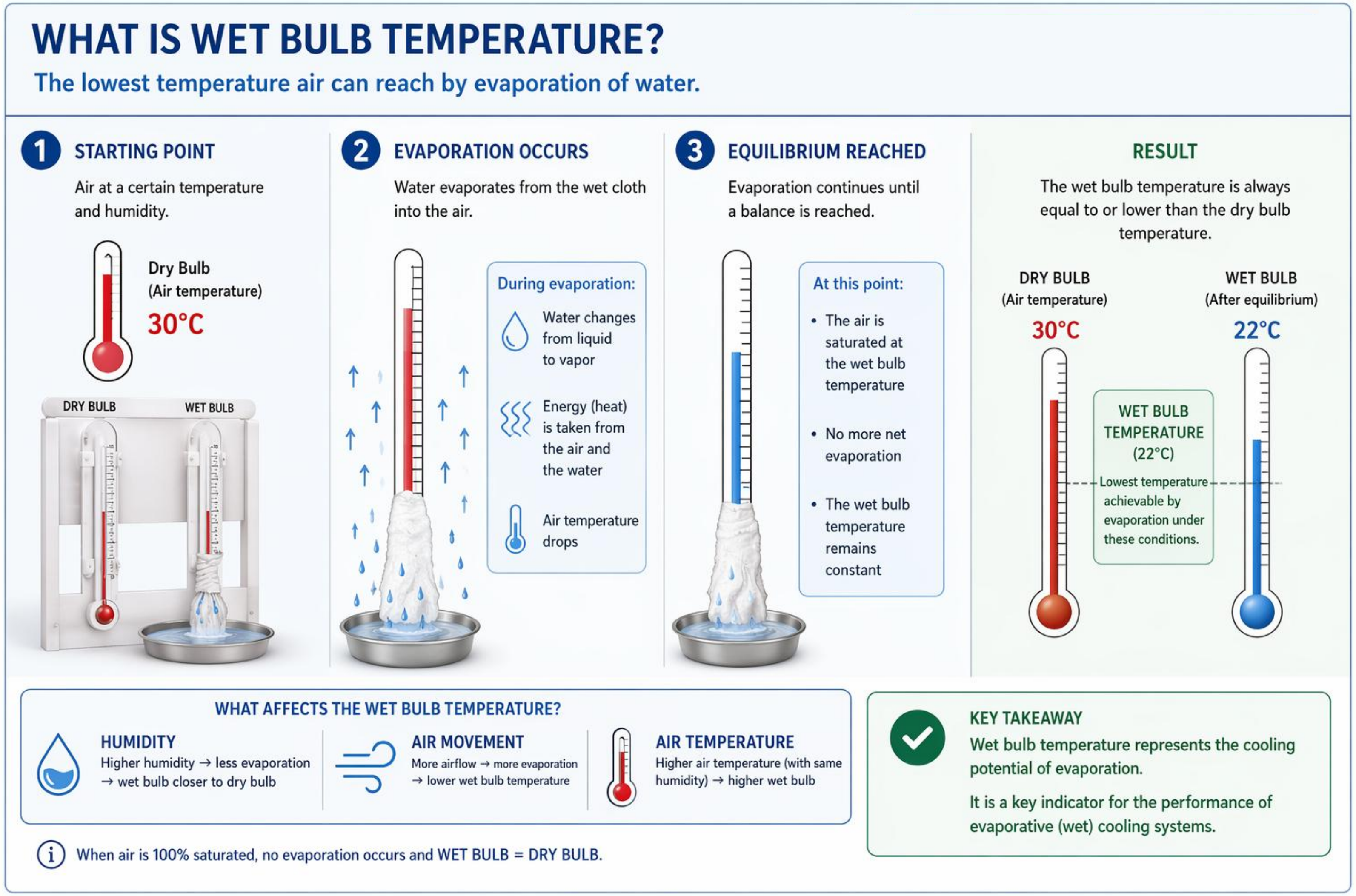
5-7dB quieter and **10-50%** reduction in annual power consumption **without consuming a single drop of water**


Evaporative vs Dry
Cooling

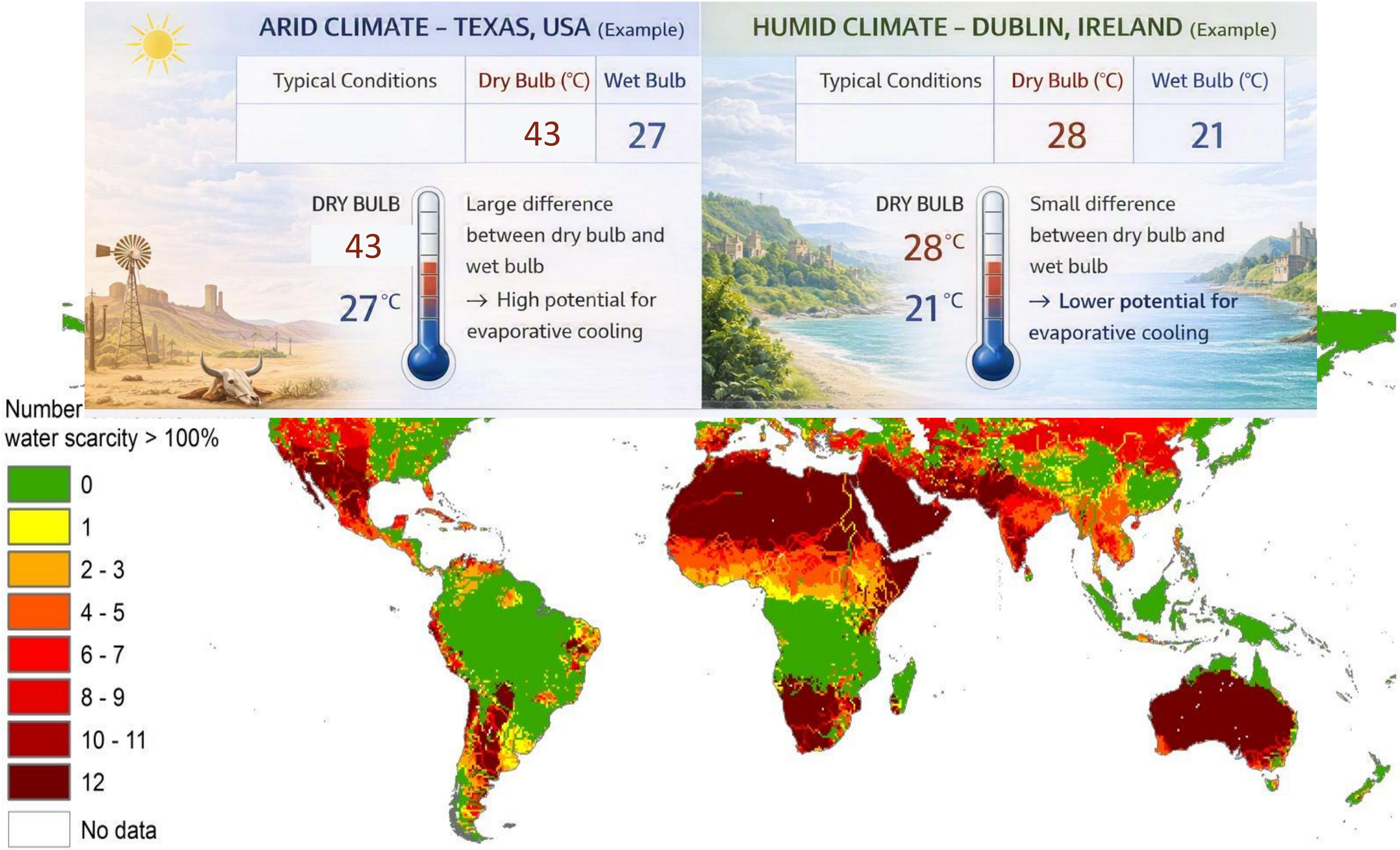
Dry and evaporative cooling are very distinct



Evaporative cooling works on wet bulb = the evaporation potential of the air



Potential for wet/dry cooling greatly varies depending on location



Evaporative cooling enables lower water temperature but evaporates a few % of the circulated water

Combining dry and evaporative cooling is the key for some locations (can get your water temp lower by another 5°C)

How can dry and wet work together? Use water wisely

1 DRY COOLER WITH SPRAY

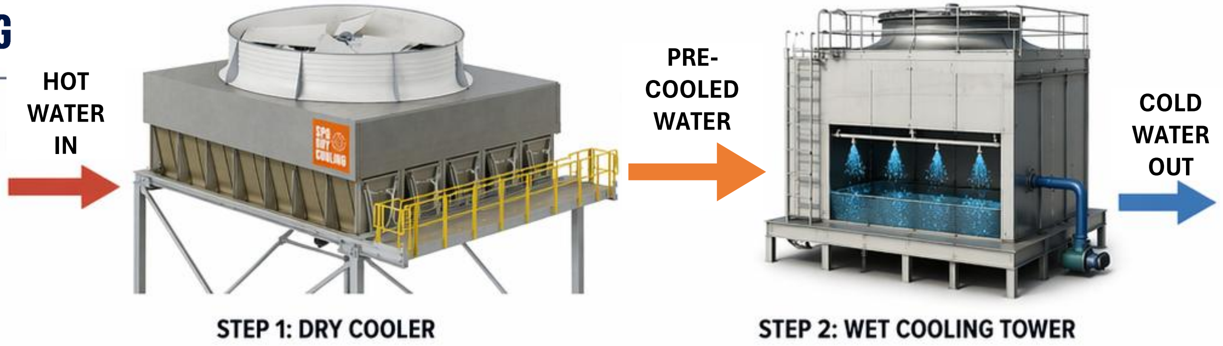
Air is pre-cooled with sprays until it gets closer to wet bulb

2 DRY COOLER WITH PADS

Air is pre-cooled with pads until it gets closer to wet bulb

3 SERIES COOLING

Two-stage process: air is pre-cooled in a dry cooler, then further cooled in a wet cooling tower.




What is your
favorite dry
cooler?

Available dry coolers and their shortfalls

Up to 2-4 MW per unit

Up to 1-2 MW per unit

FLAT AIR COOLED HEAT EXCHANGER (ACHE)

VS

KEY PAIN POINTS

COMPACTNESS	Very large footprint. Requires significant space.
HEAVINESS	Heavy steel structure. High structural & civil requirements.
INSTALLATION / PACKAGE	Site-built solution. Long erection time and complex installation.

PACKAGED AIR COOLER

KEY PAIN POINTS

POWER CONSUMPTION	High fan power consumption, especially in high ambient conditions.
SITING REQUIREMENTS	Needs more clearance and access for maintenance and airflow.
HOT AIR RECIRCULATION	Risk of recirculation in confined or improperly designed sites, reducing performance.
NOISE	High noise levels due to fans, may require mitigation.

SUMMARY

Flat ACHEs are robust and suited for large-scale applications but come with challenges in compactness, weight, and installation complexity.

Packaged Air Coolers are compact and easy to deploy but face challenges in power consumption, siting, hot air recirculation, and noise.

Hypercooler: Efficient. Compact. Water-Free.

Package Cooler

ACHE

Up to 10 MW per cell

How to solve hyperscalers challenges altogether?

Energy Efficiency

Large fans move air much more efficiently and quietly than small ones:

Up to **30%** reduction in auxiliary losses and **4-8 dB(A)** lower

How to solve hyperscalers challenges altogether?

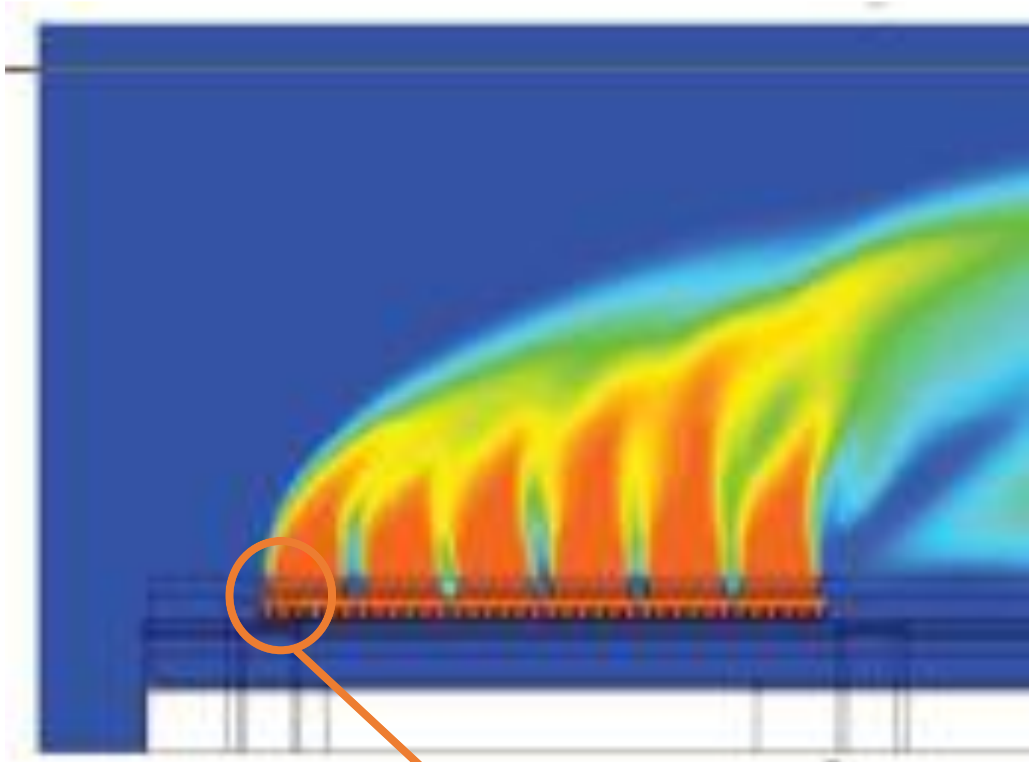
Maintenance

One large axial fan covers the duty of 100 small EC fans

How to solve hyperscalers challenges altogether?

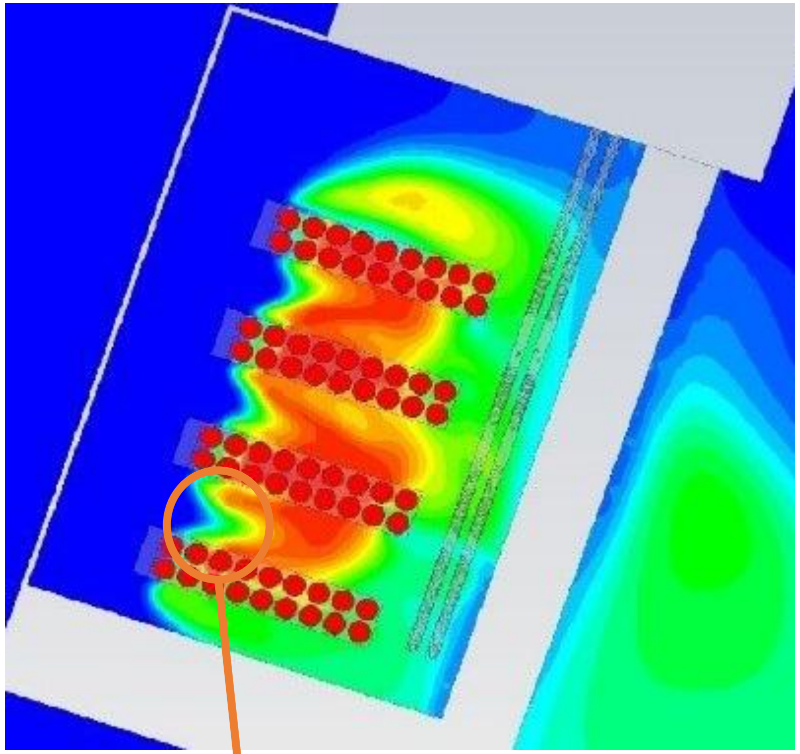
Hot Air Recirculation

Hypercooler



No recirculation between individual units

Package Dry Cooler (or chiller)



Hot air from a neighbouring unit can be ingested in the next one

How to solve hyperscalers challenges altogether?
Footprint

V arrangement

combined with a **light**

elevated structure

ensures

up to **20-40% smaller**

footprint

Hypercooler is the best-performing dry cooling solution on the market

SPG DRY COOLING

	Flat Arrangement	Package Dry Cooler	Hypercooler
📐 **Footprint**	🔴 High	🔴 High (needs spacing between units)	🟢 Low (-50%)
🔉 **Noise**	🟡 Medium (+2 dB)	🔴 High (+4 dB)	🟢 Low (= baseline)
⚡ **Power Consumption**	🟡 Medium (baseline)	🔴 Higher (+20%)	🟢 Low (-30%)
🛠️ **Maintenance**	🟡 Medium	🔴 Very high	🟢 Very low

From 50 MW dissipation


Modular Chiller
Plants

Modular Chiller Plant with Dry Coolers

Water Conservation Built In.

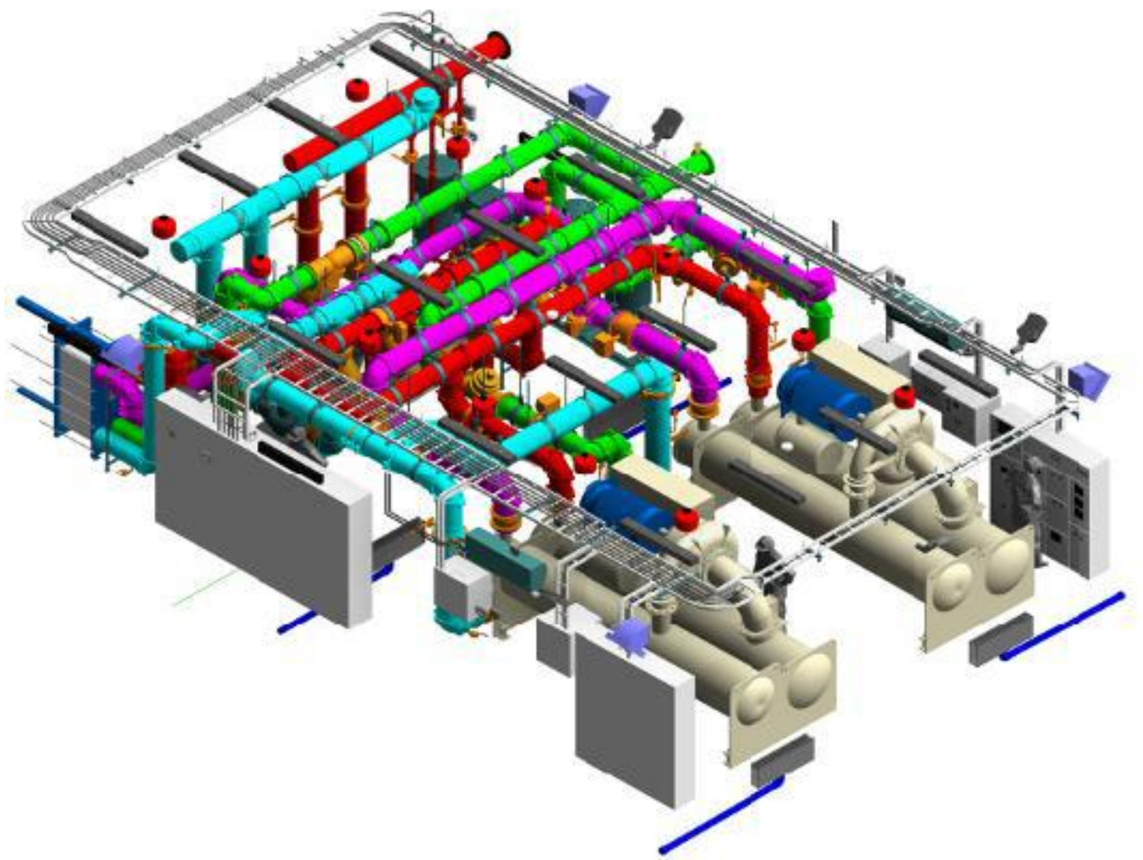
DRY COOLED (AIR COOLED HX)

- Zero water use
- Up to 30% auxiliary power reduction
- Noise reduction by 4–8 dB(A)

ADIABATIC ASSIST

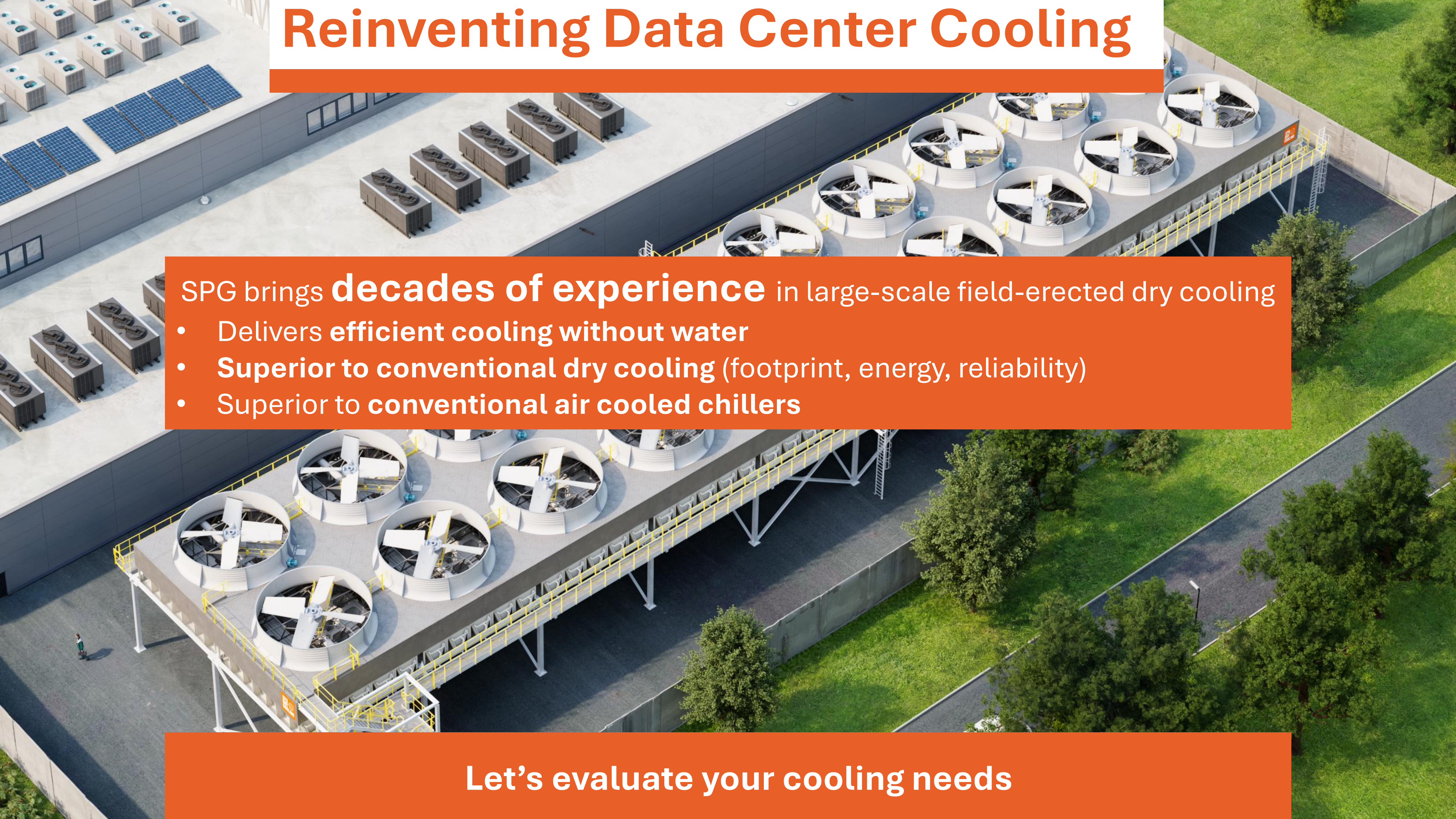
- Up to 80% less water vs. cooling towers
- VFD optimization
- Closed-loop operation

Modular Chiller Plant – Dry or Wet



- 750 – 3,600 ton capacity range
- Designed for high-density, high-performance computing
- Delivers on-demand, precise cooling with high energy efficiency
- Tier III/IV and ASHRAE TC 9.9 compliant
- Factory-tested, plug-and-play installation
- Minimal on-site work
- System can be pre-staged and stored
- 44'L x 14'W x 13.5’H (typical)
- 130,000 lbs per module (typical)

Reinventing Data Center Cooling



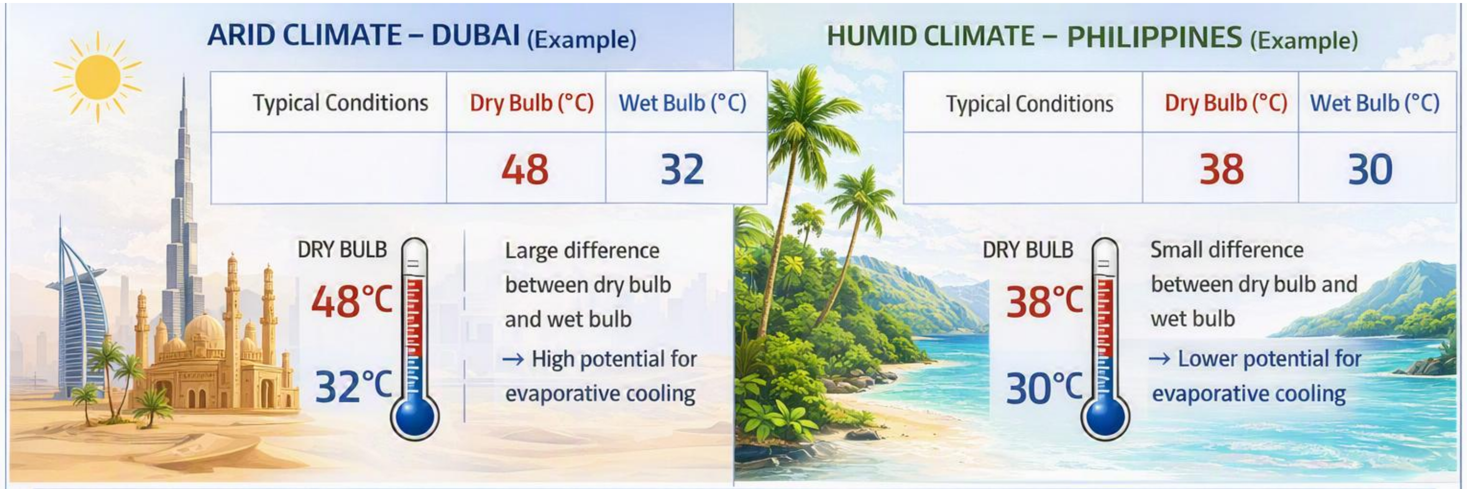
SPG brings **decades of experience** in large-scale field-erected dry cooling

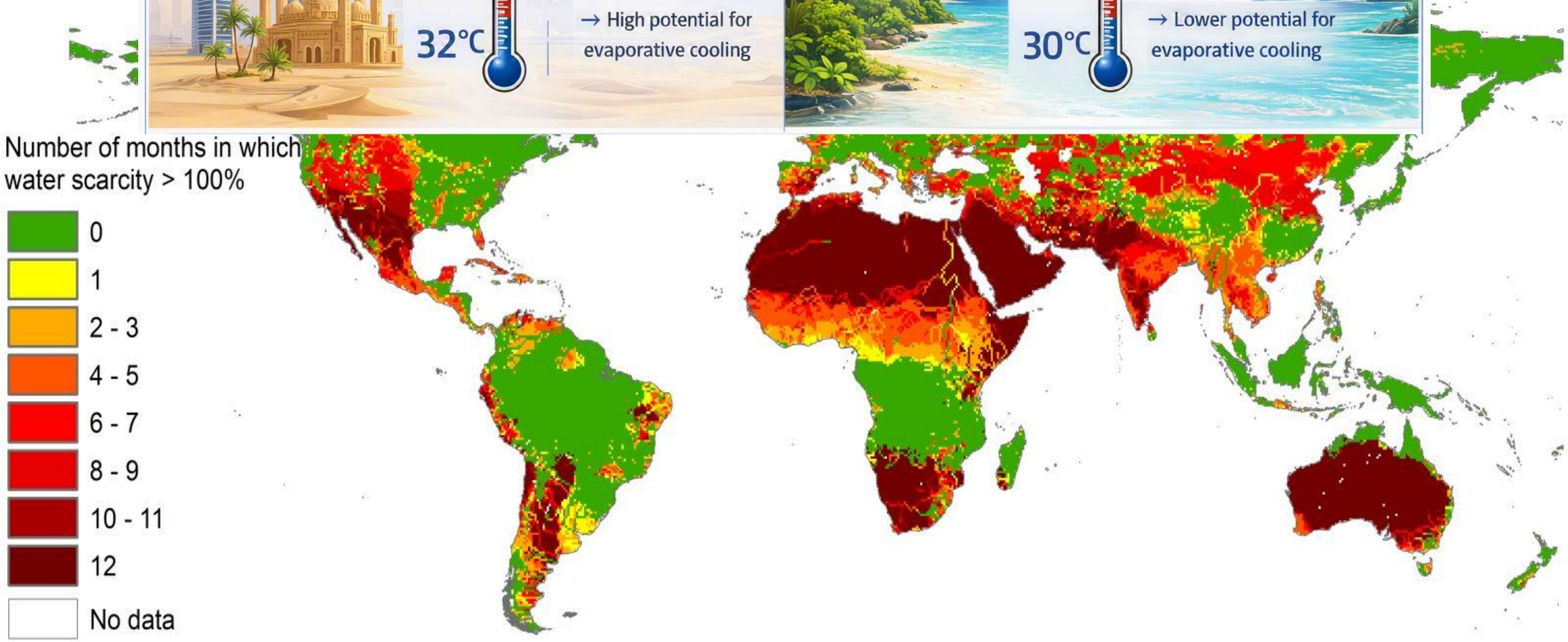
- Delivers **efficient cooling without water**
- **Superior to conventional dry cooling** (footprint, energy, reliability)
- Superior to **conventional air cooled chillers**

Let’s evaluate your cooling needs

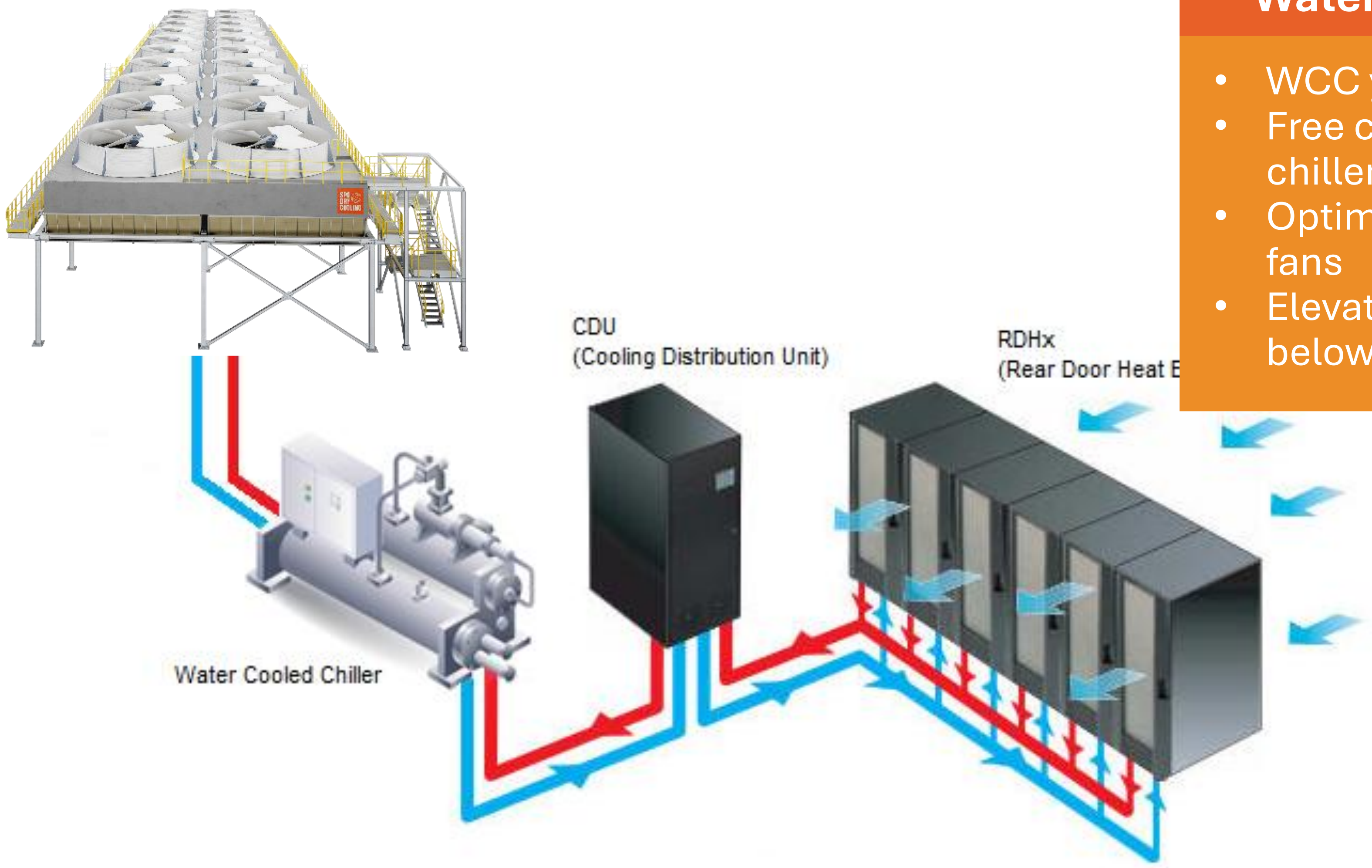

BACKUP

Middle East needs to cope with very hot climate and water scarcity





Combined with a water cooled chiller, it enables to drastically reduce PUE & footprint



Water Cooled Chiller + Dry Cooler

- WCC yield higher efficiency
- Free cooling simply by bypassing chiller
- Optimized air cooling with large size fans
- Elevated layout creates free space below to install equipment

Combined with a water cooled chiller, it enables to drastically reduce PUE & footprint

Criteria	Air-Cooled Chiller (ACC)	Water-Cooled Chiller + Dry Cooler
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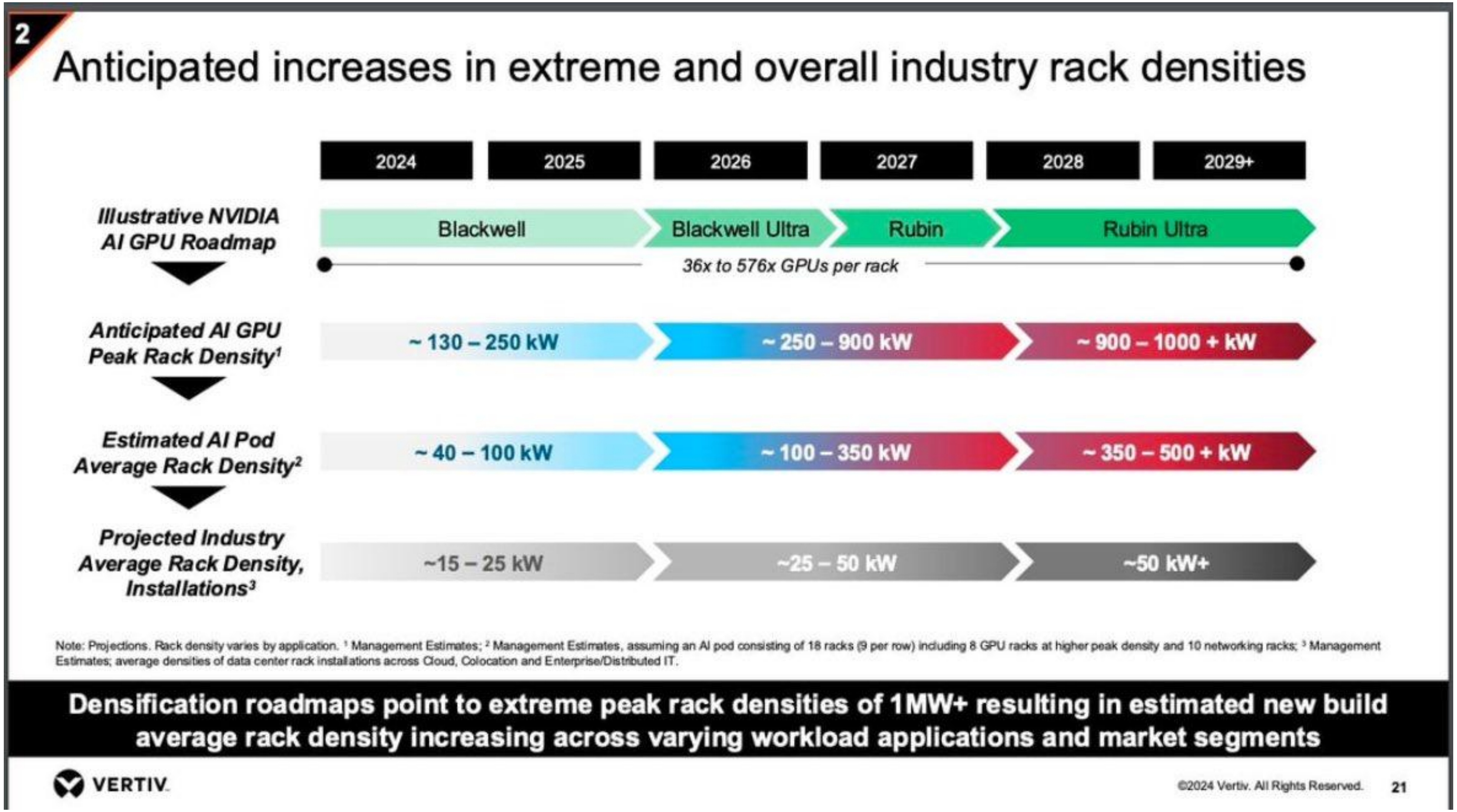
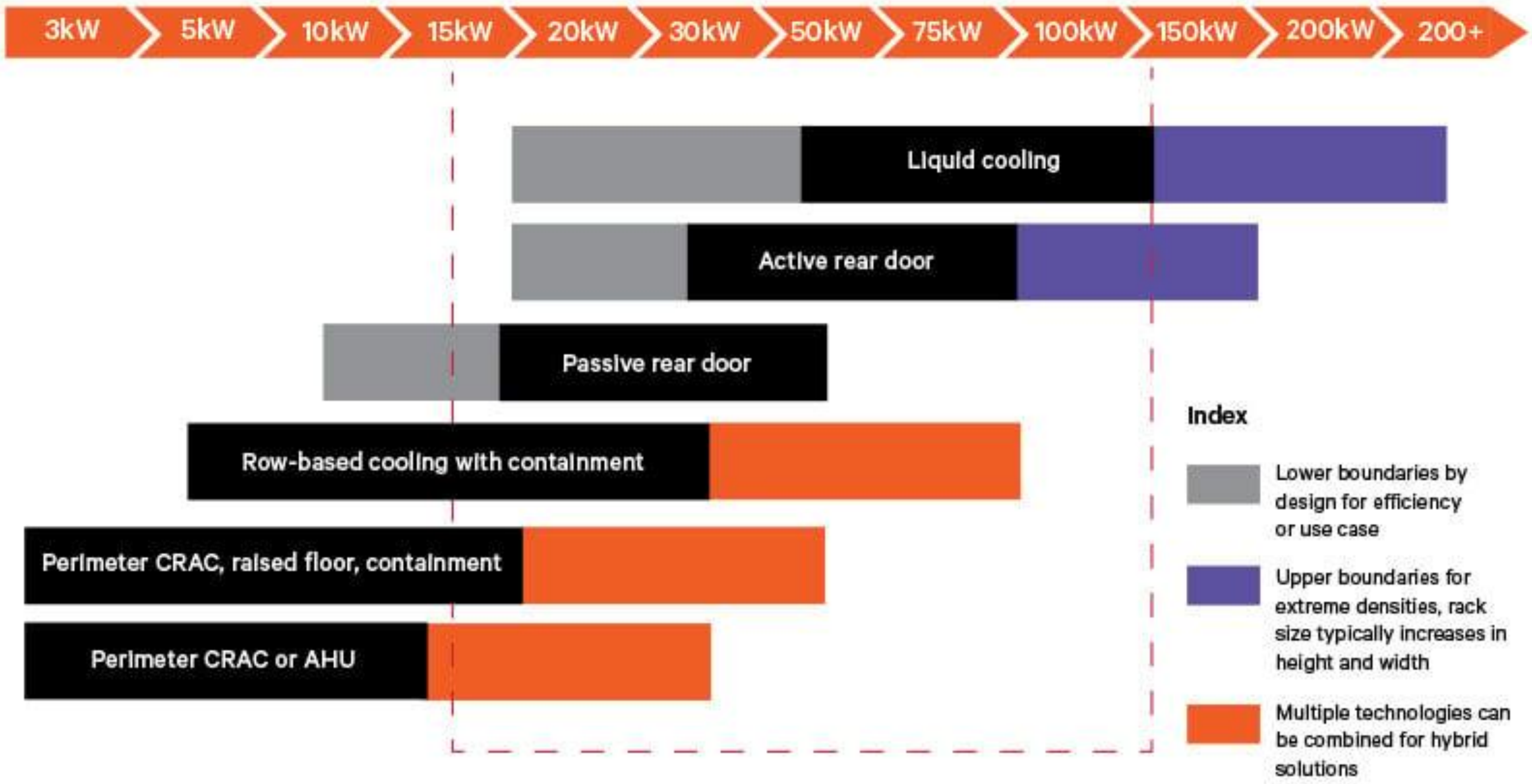
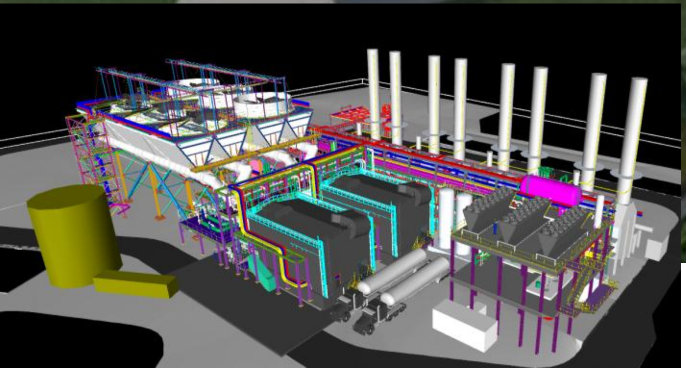
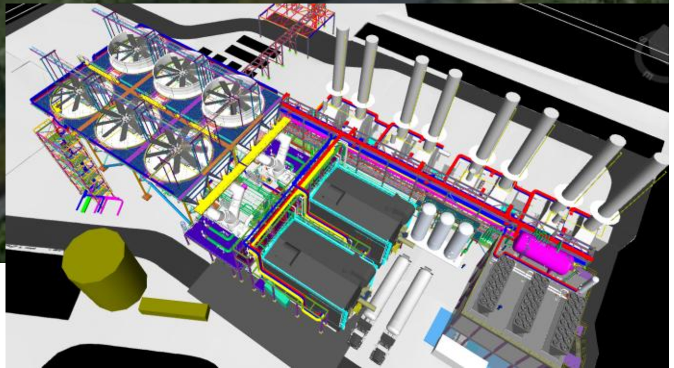
Rack Density Evolution



Applicability Air vs Liquid Cooling







DUB10
Dublin, Ireland

- Data Centers consume more than 20% of Ireland’s electricity
- 3x30MW IT Load and 120 MW of power generation from a captive power plant
- Supplying 2x dry cooled W-Style for Data Center’s power supply
- SPGDC equipment selected for Echelon’s first captive power plant

STTelemedia Global Data Centres

infinium

STT Global Data Centre
Bangalore, India

- 18MW IT Load, **5.5 MW cooling capacity**
- Air Coolers specifically **designed for Immersion Cooling**
- Exclusive Service Level Agreement (SLA) with a **2 hours turnaround**

Bazian

Turkey

- (ACHE) Air Cooled Heat Exchangers
- Combined Cycle Power Plant auxiliary cooler
- Advanced engineering for high pressure-temperature case
- Compliance with API 661 and ASME Sec VIII Div .3

SIEMENS energy PAHARPUR SPG DRY COOLING

Herne 6 Project, Siemens Germany 600MW

- Combined cycle Power Plant
- Low Noise Cooling Tower
- Low noise achieved by air inlet and outlet silencers designed by Paharpur
- Unique design with concrete risers

Wet Cooling Tower