

SUSTAINABLE HEAT REJECTION FOR DATA CENTERS

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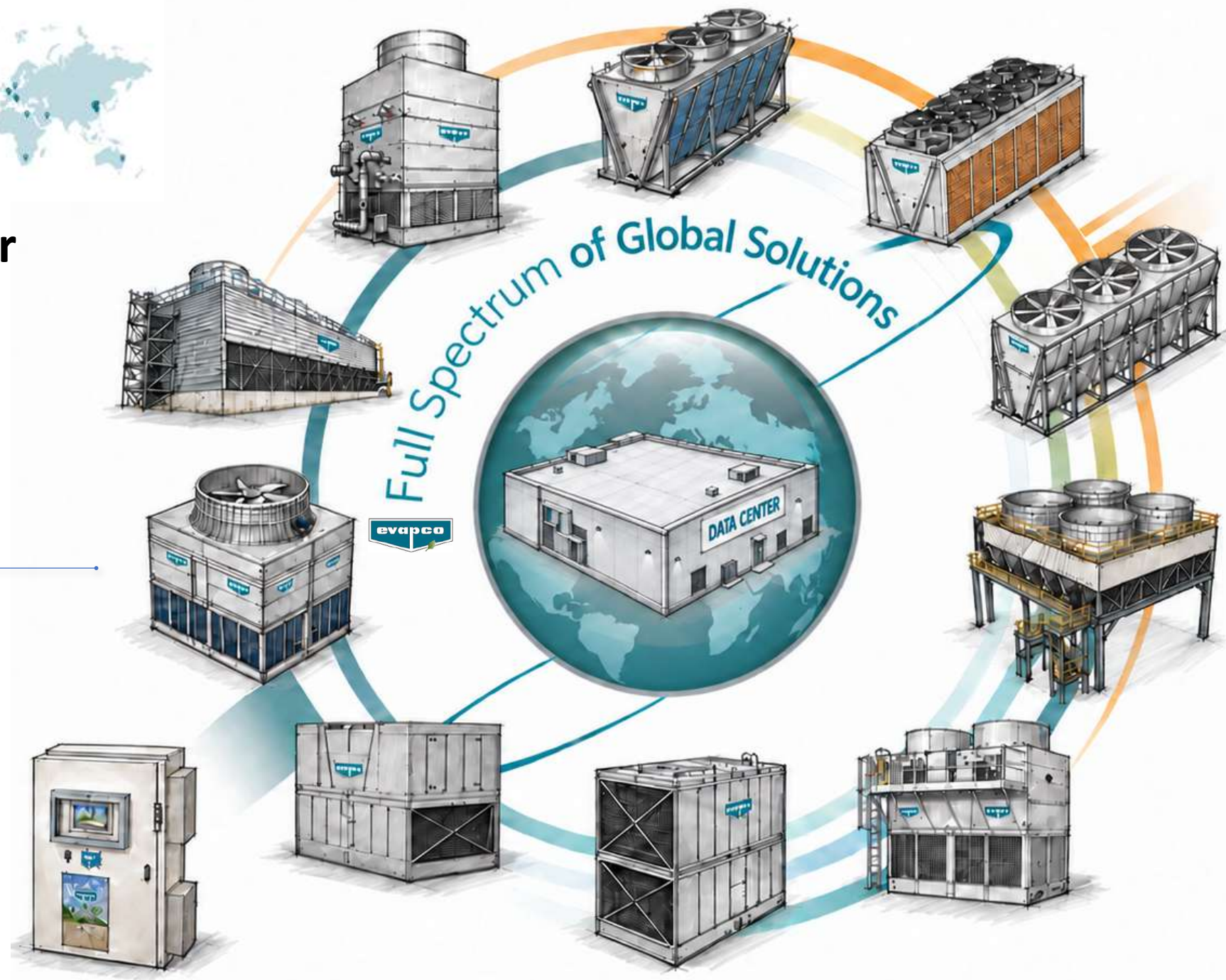




Your Global Data Center Cooling Partner

Full Spectrum of Cooling PRODUCTS:

- Dry Coolers
 - Adiabatic Coolers
 - Hybrid Coolers
 - Evaporative Coolers
 - Open Cooling Towers
 - Water Treatment
-
- Controls



Global Locations



178 Regional Support Offices – 32 Manufacturing Locations

Heat Rejection Plant – Design considerations

CLIMATE



COLD



TEMPERATE



HOT

UTILITIES



WET



DRY



POWER

PLANNING



DENSITY



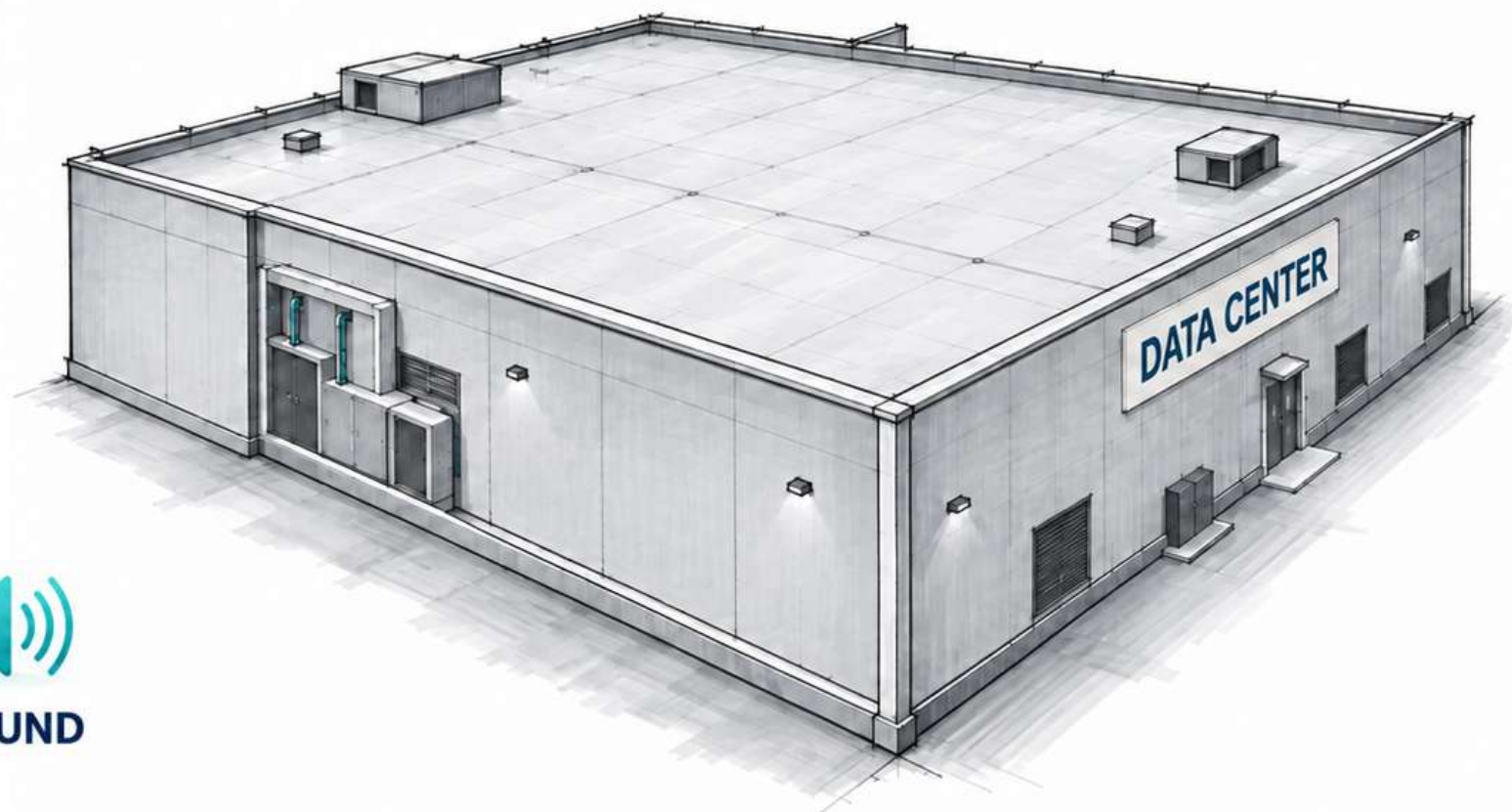
SOUND

Data Centre Study

London Clerkenwell

150 MW

Total IT Load



TEMPERATE



DRY



DENSITY



SOUND

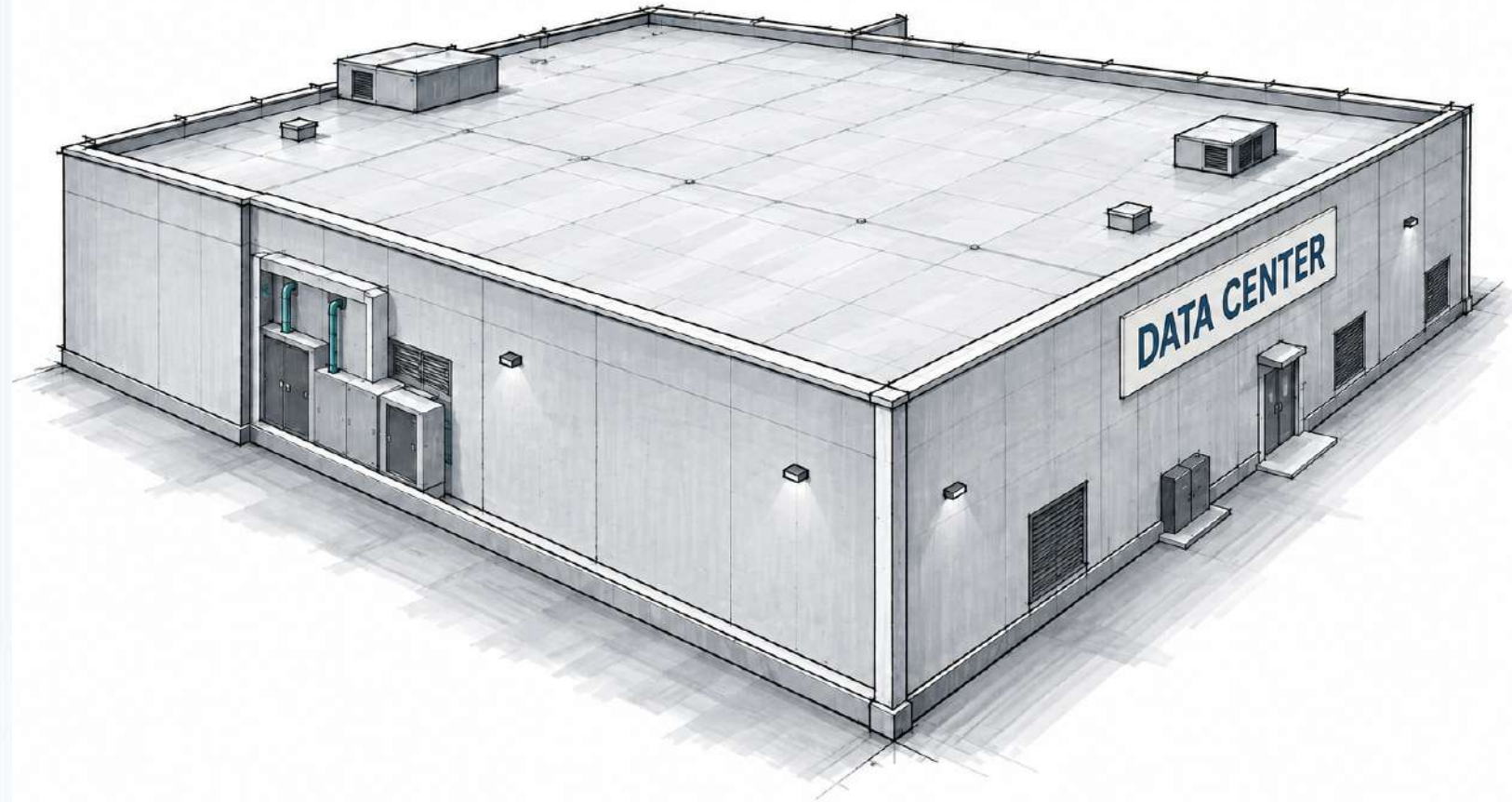
Source basis: ASHRAE IWE2 Copenhagen · 8,760 hourly observations

Project Location



London Clerkenwell Climate – Dry-Bulb Frequency

IWEC2 binned typical year



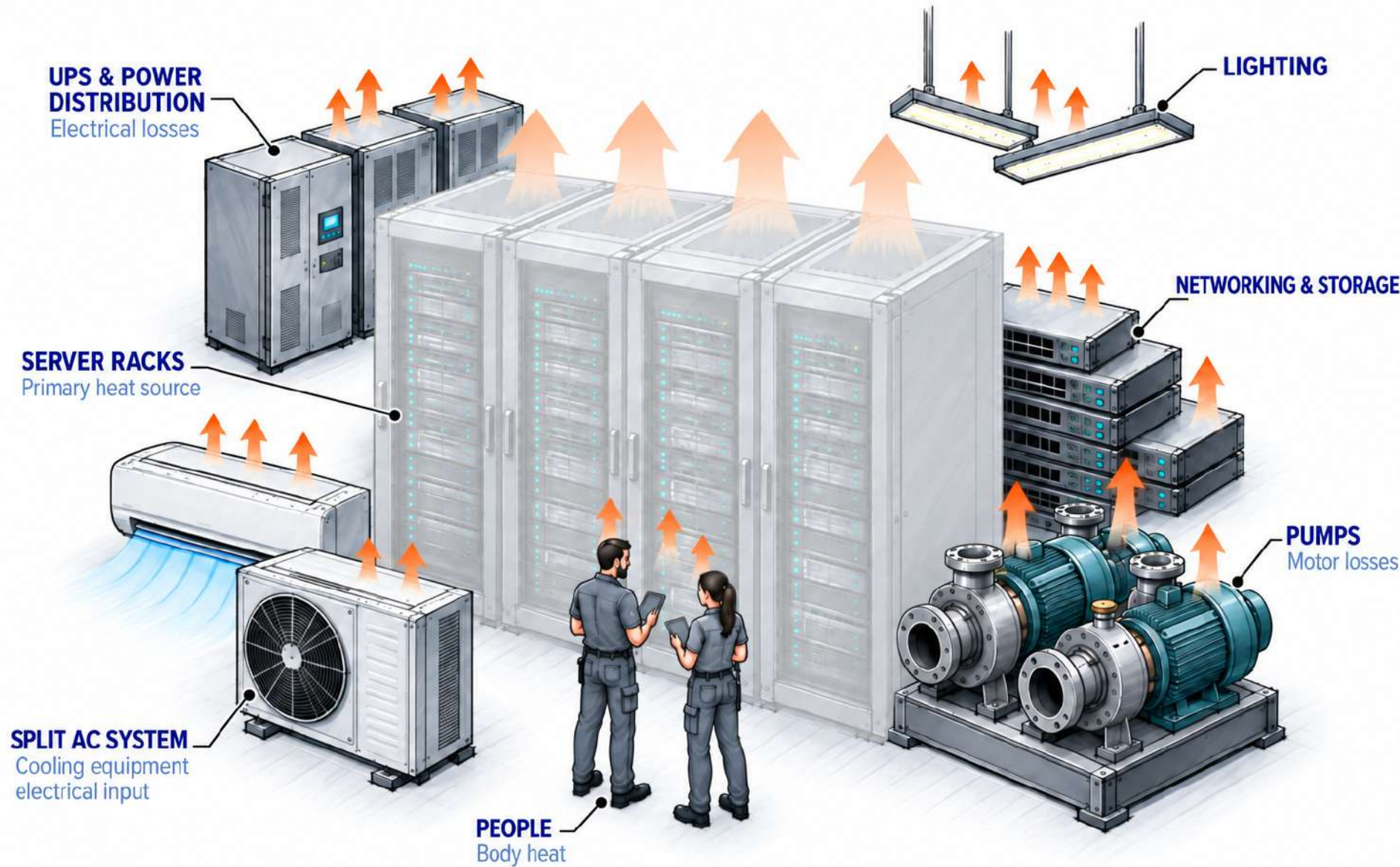
Primary Heat Source

150 MW
Server Racks [IT Load]



Additional Loads

17 MW
Ancillary Items

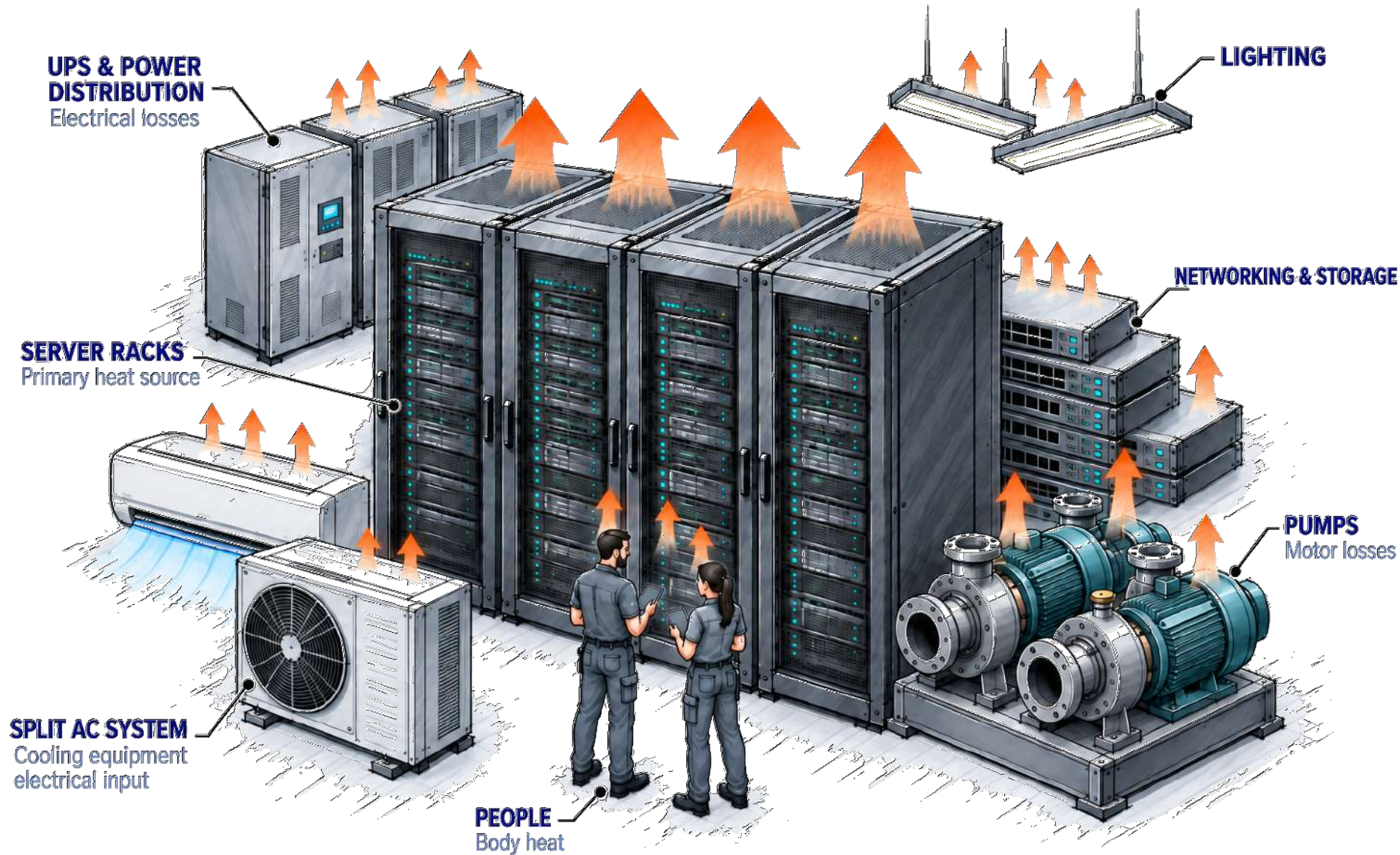


Total Building Load

167 MW

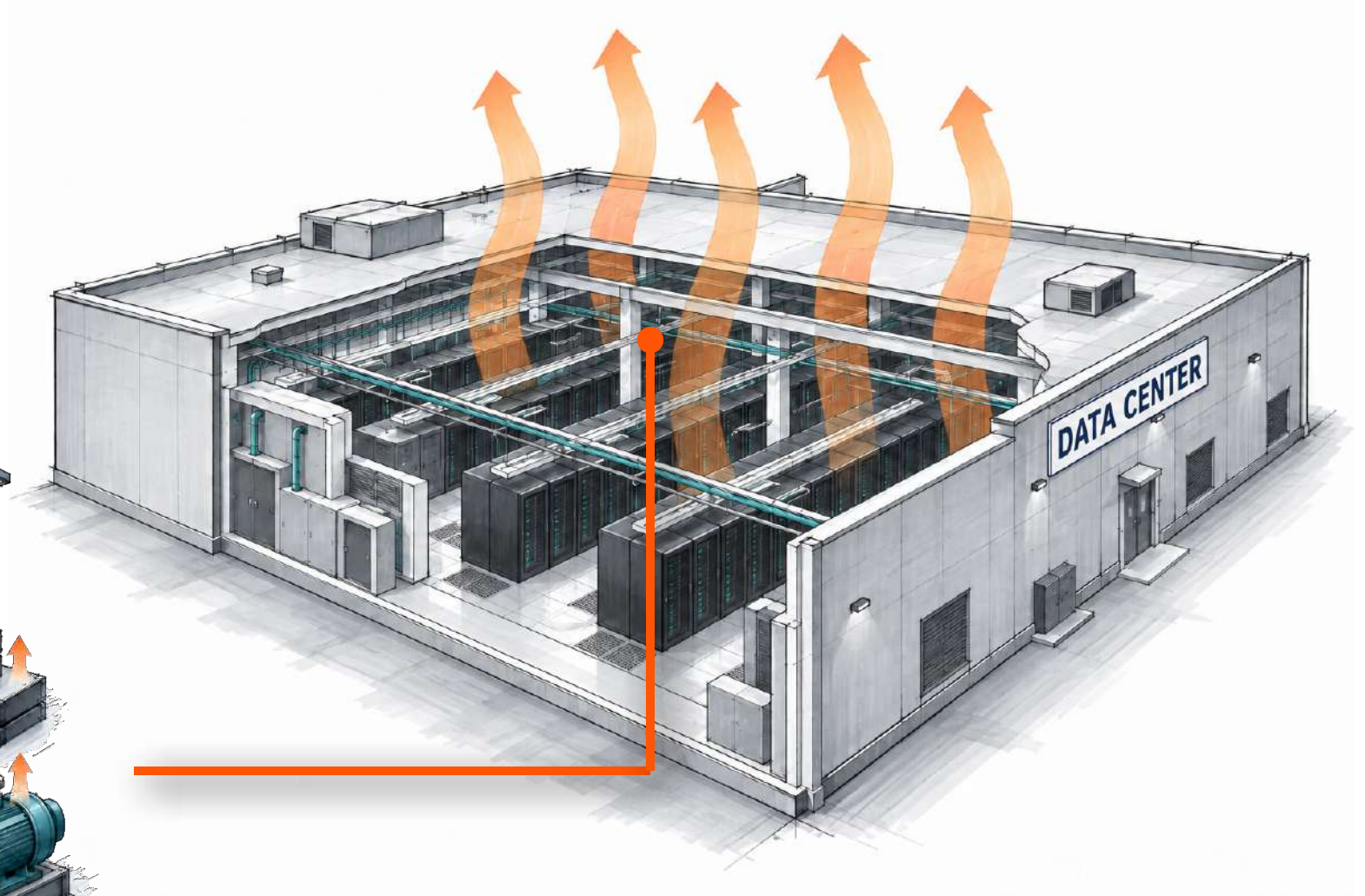
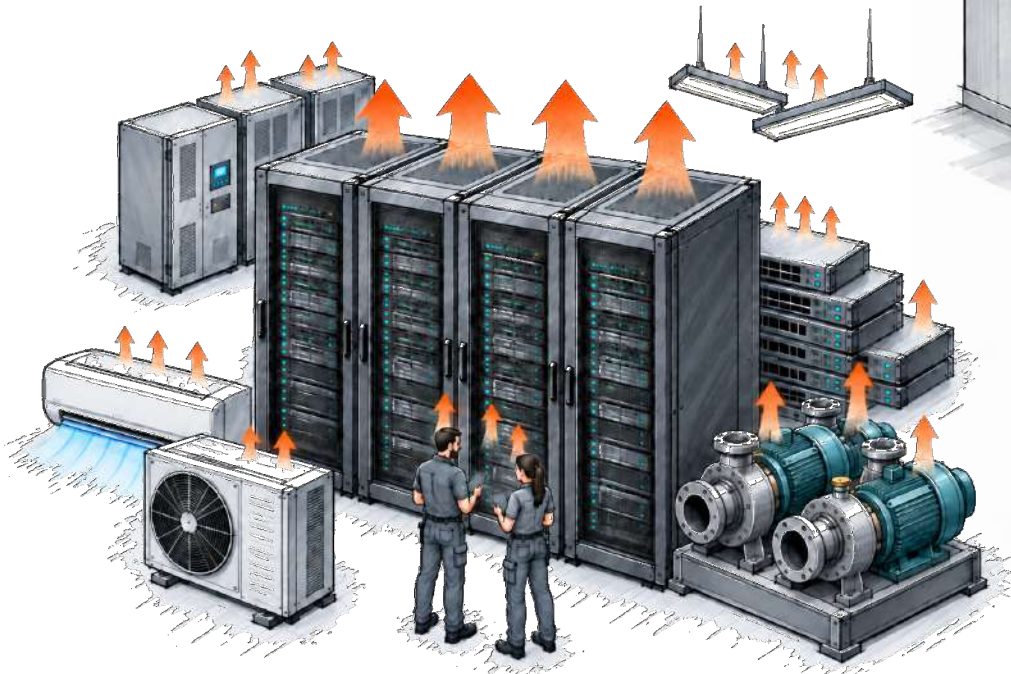
[150 MW + 17MW]

Heat Rejection



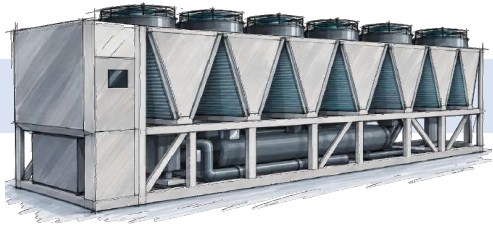
Heat Rejection

167 MW
Heat Rejection



TRADITIONAL FLUID COOLING SOLUTION

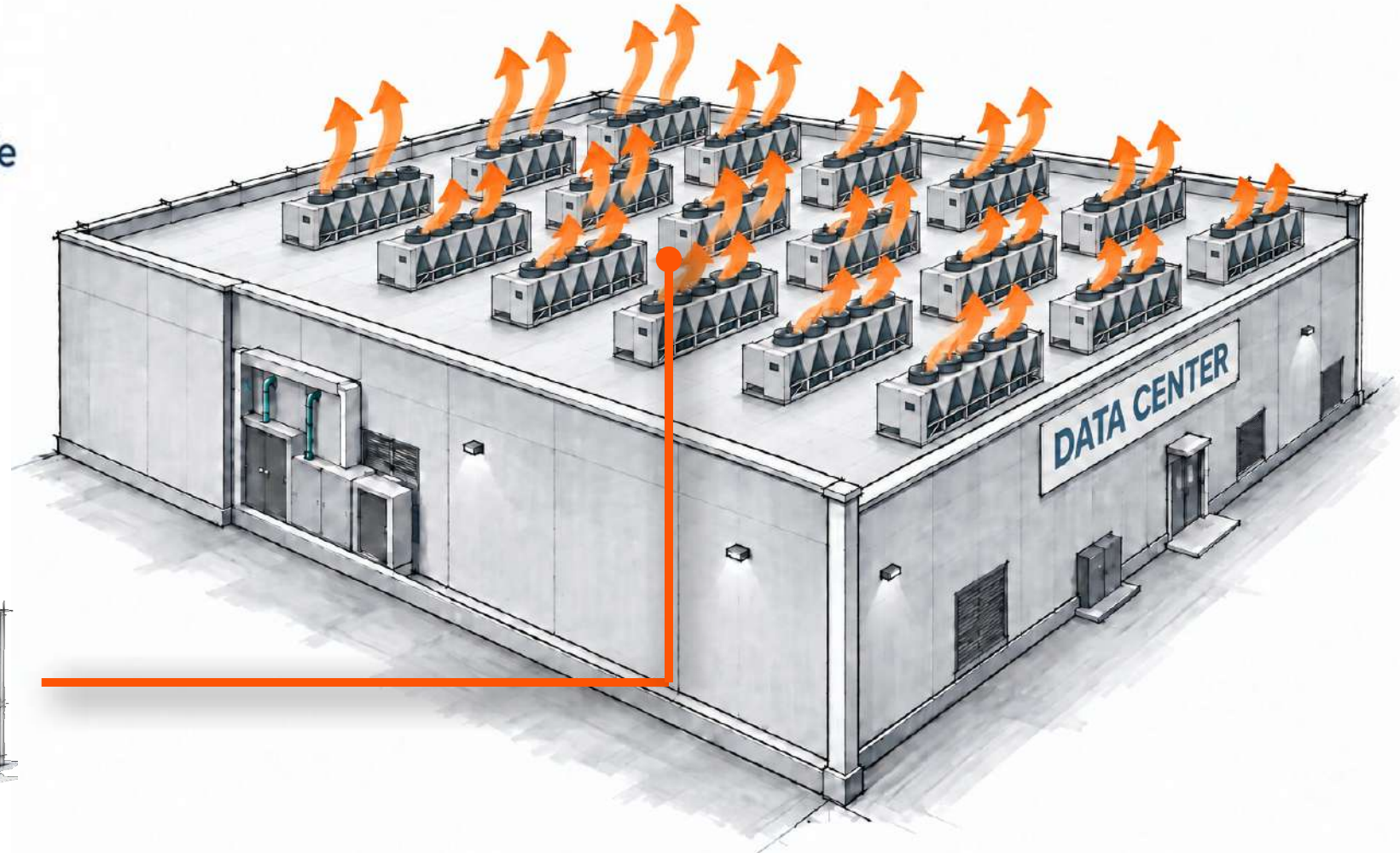
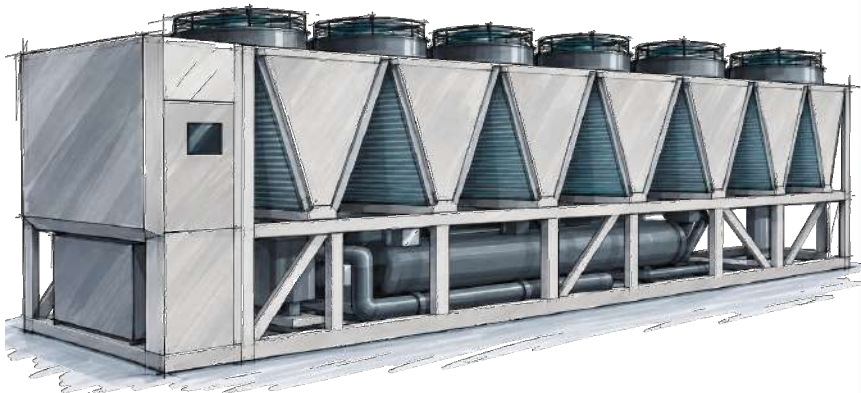
Air Cooled Chiller

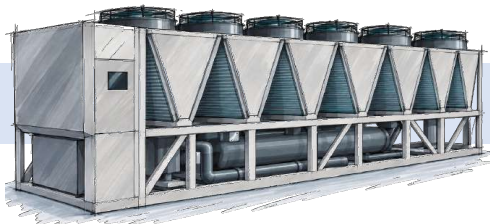


100 Heat-Rejection Modules

1.5 MW IT Load per Module

1.67 MW Heat-Rejection Duty per Module

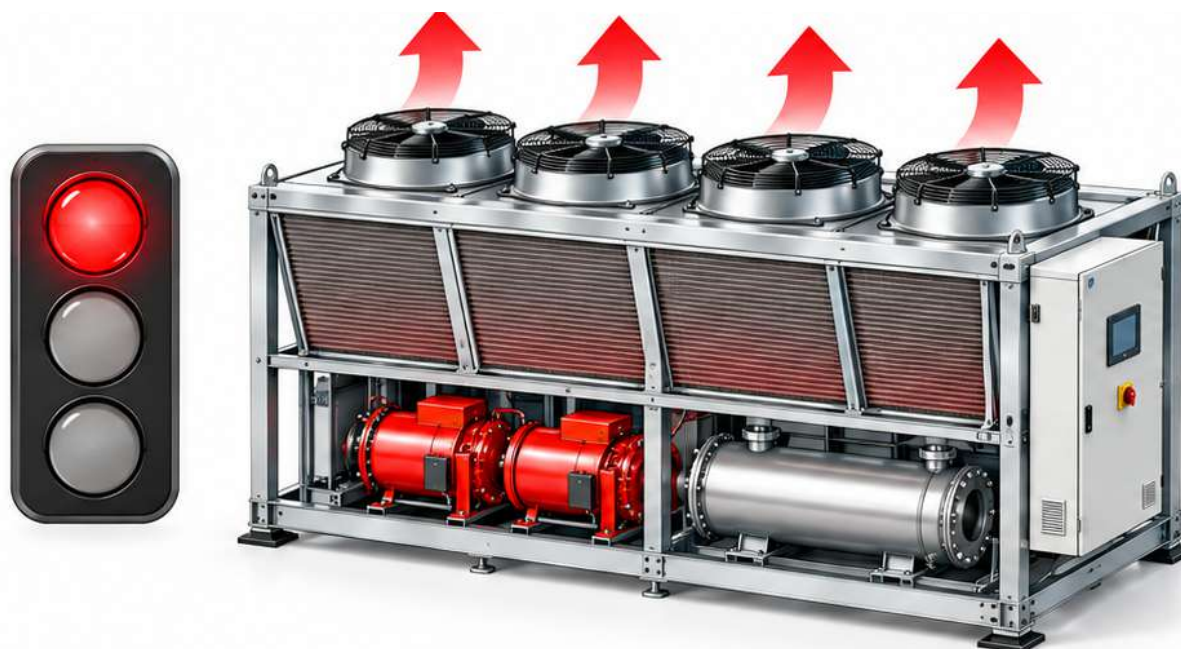




TRADITIONAL FLUID COOLING SOLUTION

Air Cooled Chiller

100% Mechanical Cooling All Year



No free-cooling coils

Compressors provide all the cooling

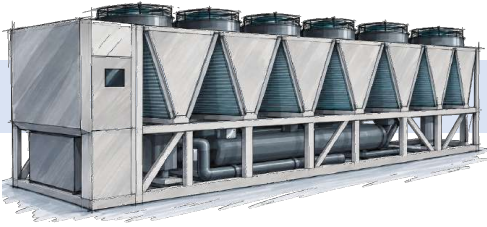
Even when outdoor air is cold

Without free cooling, compressors operate whenever cooling is required.

100% refers to the share of cooling duty provided mechanically, not constant full-load compressor power.

ALTERNATIVE

Air Cooled Free Cooling Chiller



THE 3 STAGES OF FREE COOLING

Cooler outdoor air

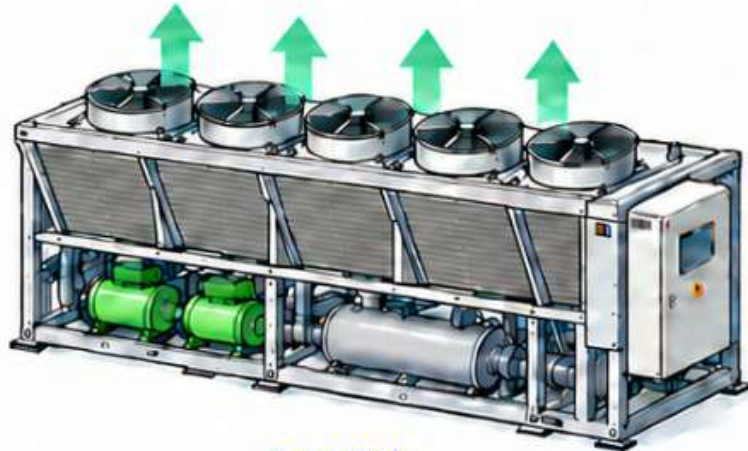
Warmer outdoor air



1 100% FREE-COOLING

Free-cooling coils meet the entire cooling duty.

Compressors OFF



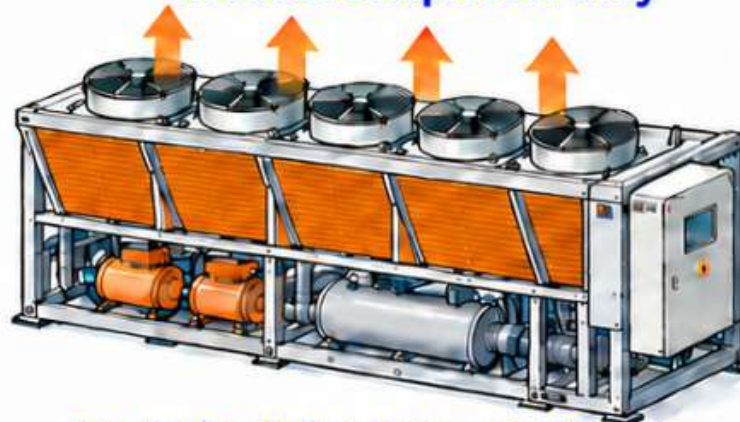
Fans Only



2 CHILLER TRIM

Free-cooling coils pre-cool the fluid. Compressors provide the remaining cooling.

Reduced compressor duty



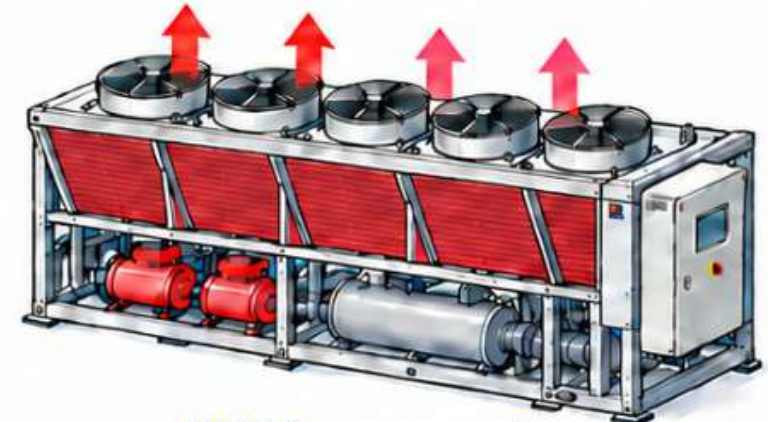
Free Cooling Coils + Compressor Trimming



3 FULL MECHANICAL

Outdoor air is too warm for useful free cooling. Refrigeration meets the entire cooling duty.

No free-cooling contribution

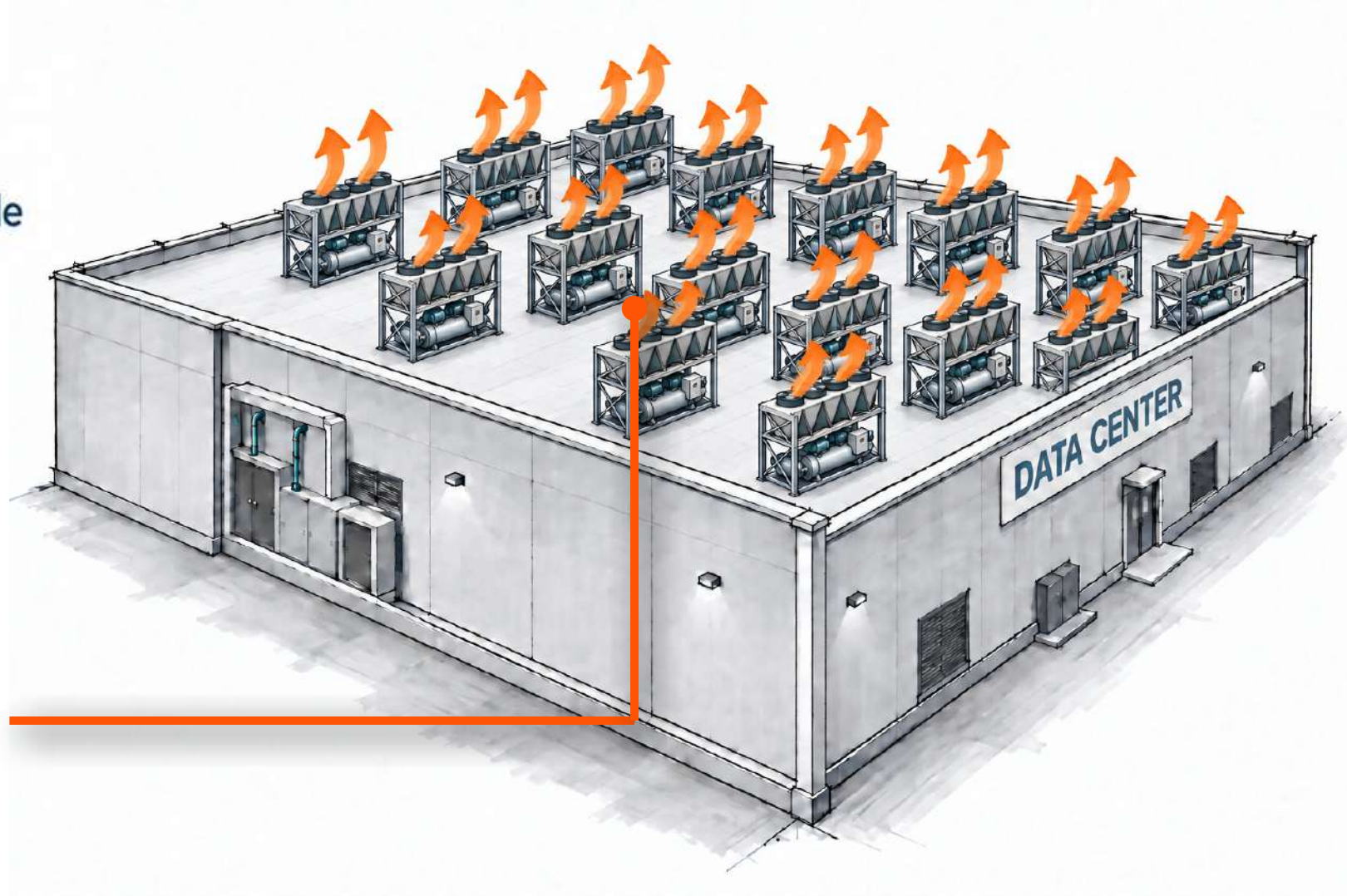


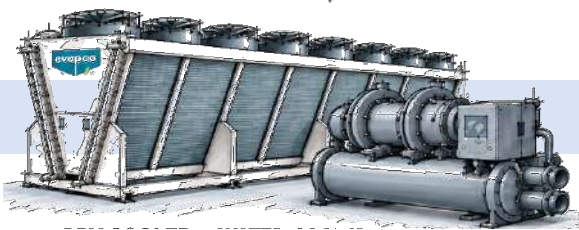
100% Compressor + Fans

ALTERNATIVE

Dry Cooler + Water Cooled Chiller

100 Heat-Rejection Modules
1.5 MW IT Load per Module
1.67 MW Heat-Rejection Duty per Module

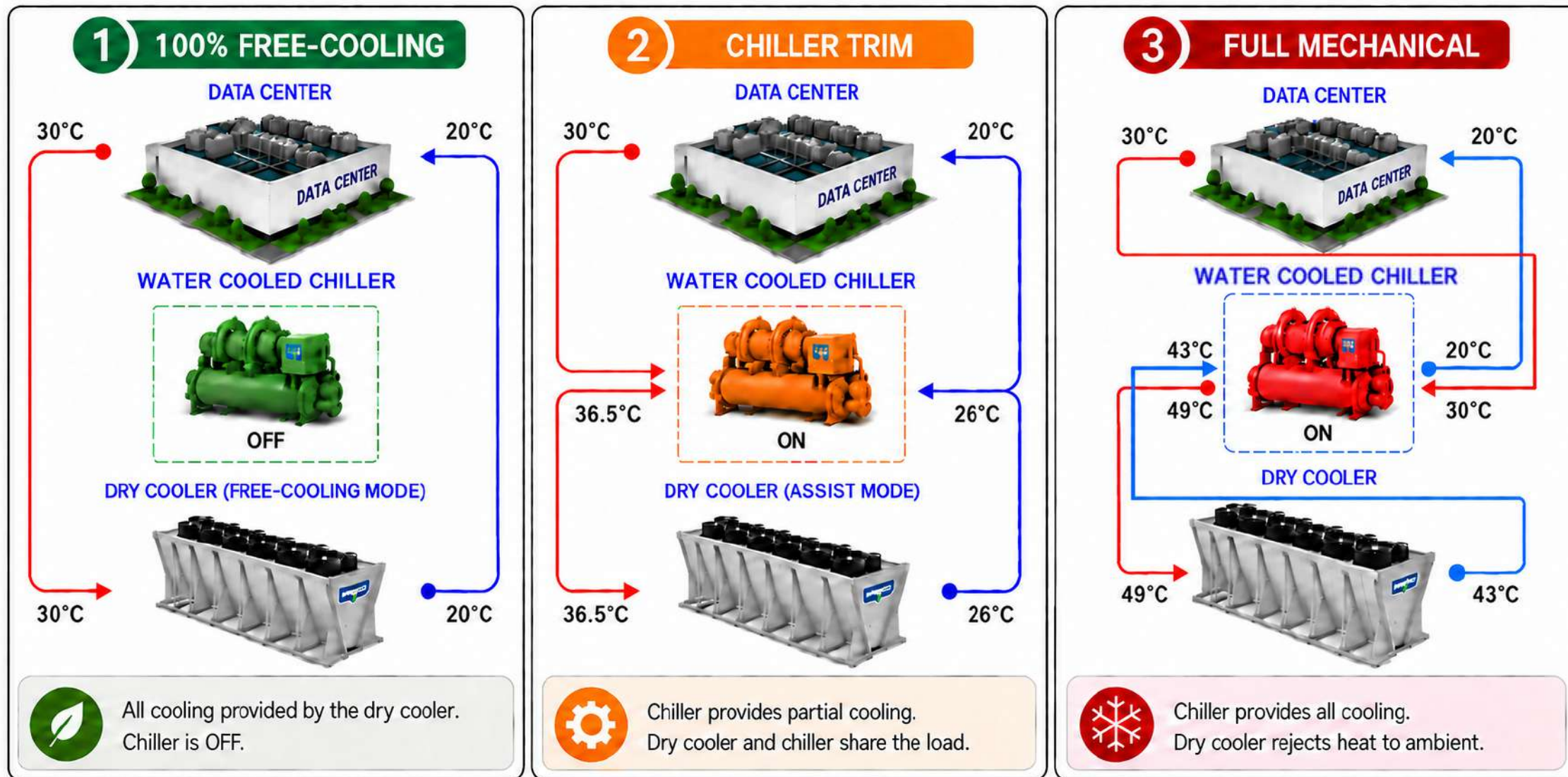




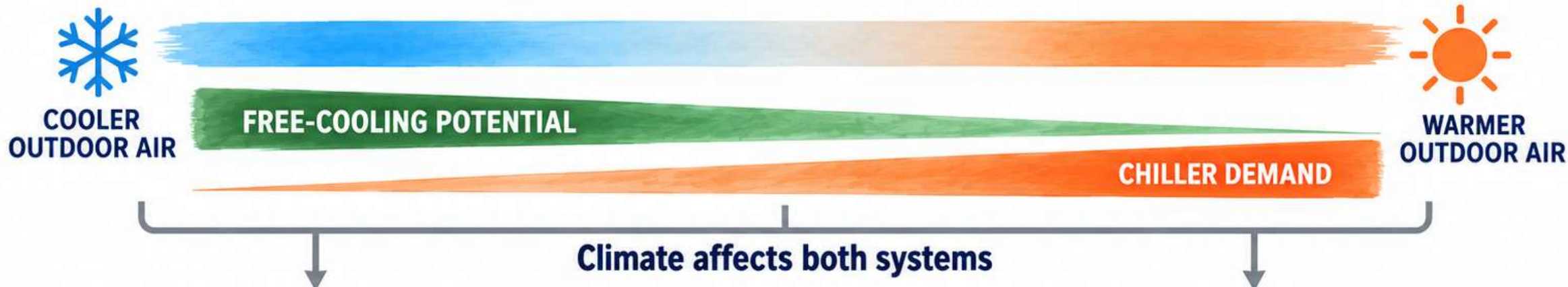
ALTERNATIVE

Dry Cooler + Water Cooled Chiller

THE 3 STAGES OF FREE COOLING

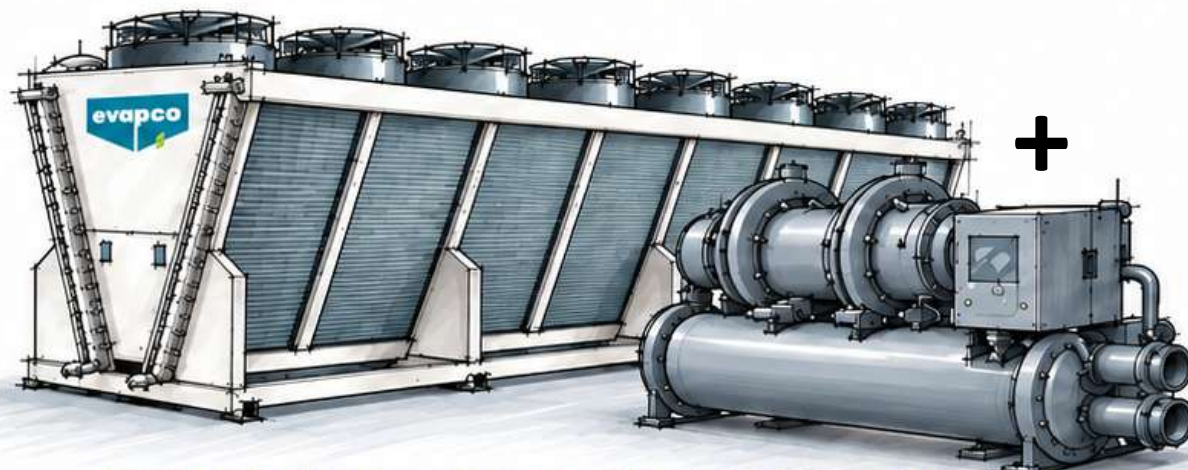


Free-Cooling Potential Depends on Climate



FREE-COOLING CHILLER

Free cooling depends on outdoor temperature and coil approach.

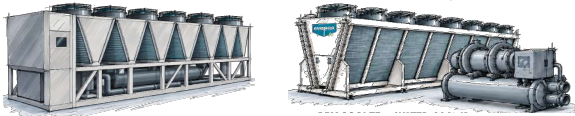


DRY COOLER + WATER-COOLED TRIM CHILLER

Free cooling depends on outdoor temperature and cooler approach.

More hours of cool weather = more opportunity for free cooling

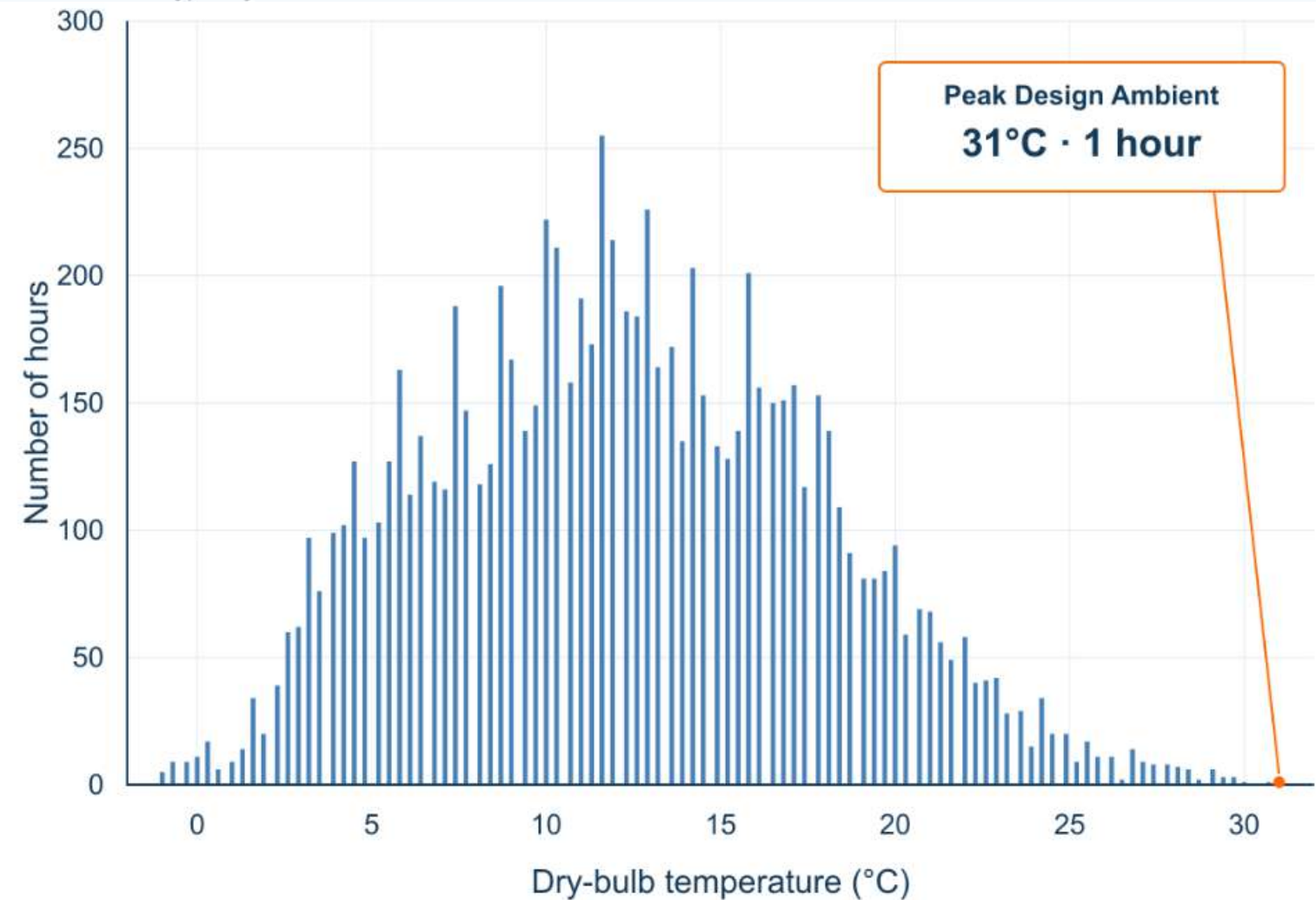
PERFORMANCE COMPARISON



Map: Natural Earth / geo-countries

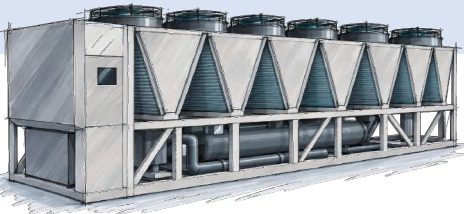
London Clerkenwell Climate – Dry-Bulb Frequency

IWEC2 binned typical year

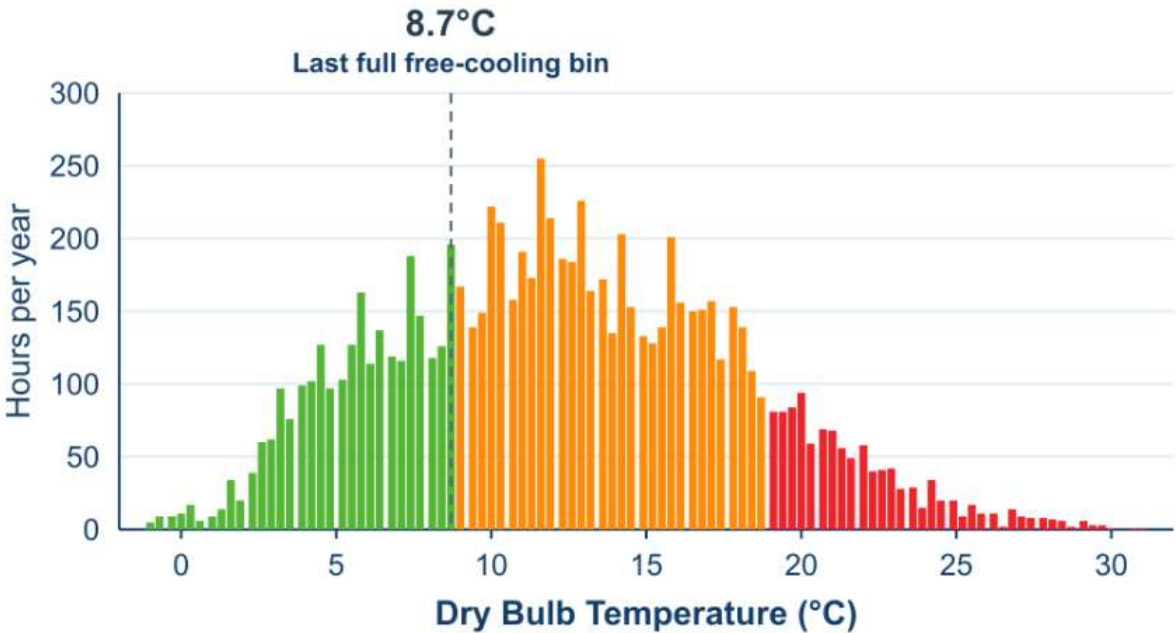


Source: supplied London IWEC2 bins · 99 bins · 8,760 hours
Peak annotation reflects the highest supplied bin, not an independently verified design condition.

Free Cooling Air Cooled Chiller



Air-Cooled Free Cooling Chiller
Hours per year vs. Dry Bulb Temperature

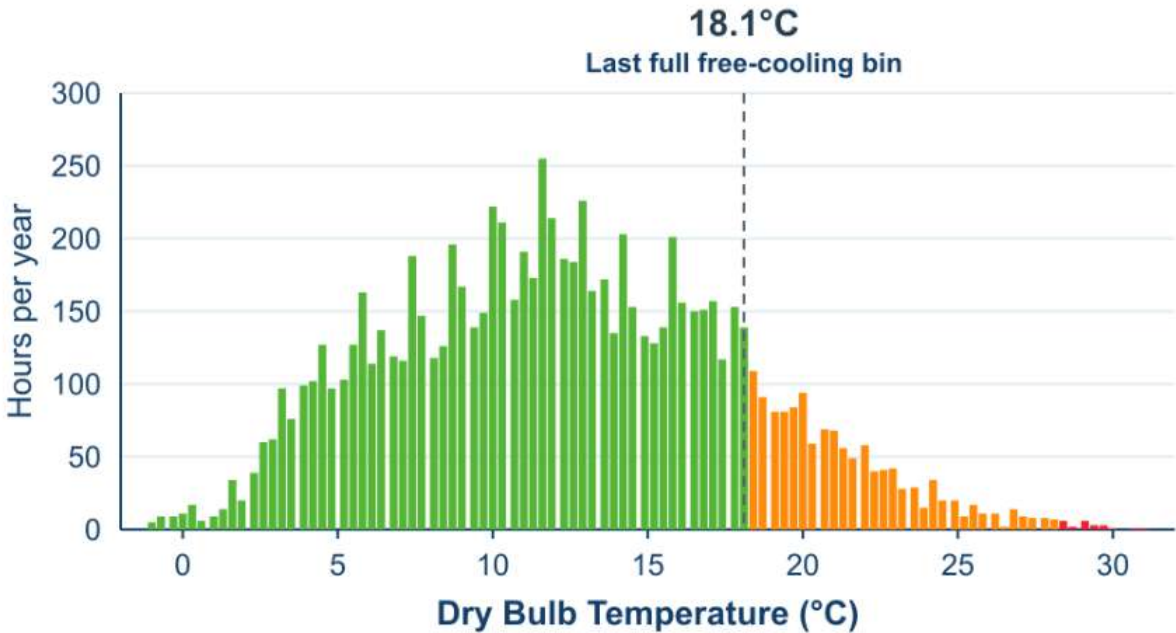


Free cooling	Partial free cooling	Full mechanical
2,547 h Full free cooling 29.1% of year -1°C to 8.7°C	5,126 h Partial free cooling / chiller trim 58.5% of year 9°C to 18.7°C	1,087 h Full mechanical 12.4% of year 19.1°C to 31°C

Dry Cooler with Water Cooled Chiller



Dry Cooler + Water-Cooled Chiller (EER 9)
Hours per year vs. Dry Bulb Temperature

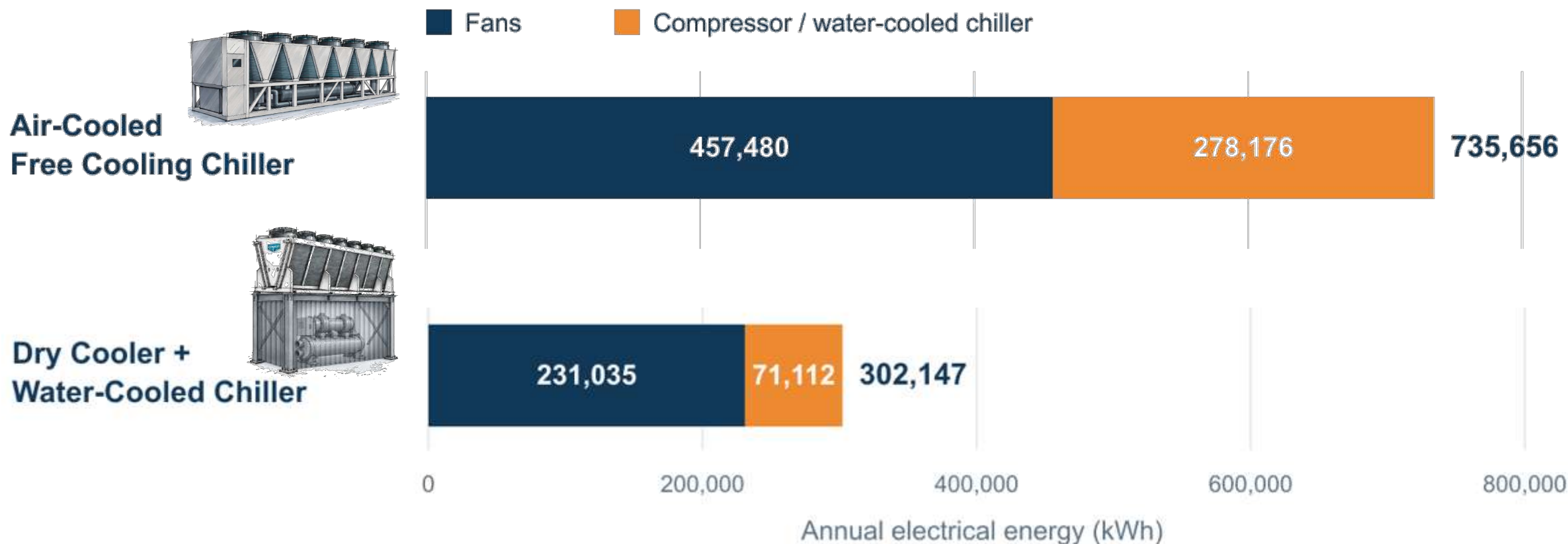


Free cooling	Partial free cooling	Full mechanical
7,473 h Full free cooling 85.3% of year -1°C to 18.1°C	1,264 h Partial free cooling / chiller trim 14.4% of year 18.4°C to 28.1°C	23 h Full mechanical 0.3% of year 28.4°C to 31°C

Annual Electrical Energy Comparison

London Clerkenwell · IWECC2 binned climate · 1.67 MW cooling duty · 8,760 hours

433,510 kWh annual saving
58.9% lower annual electrical consumption



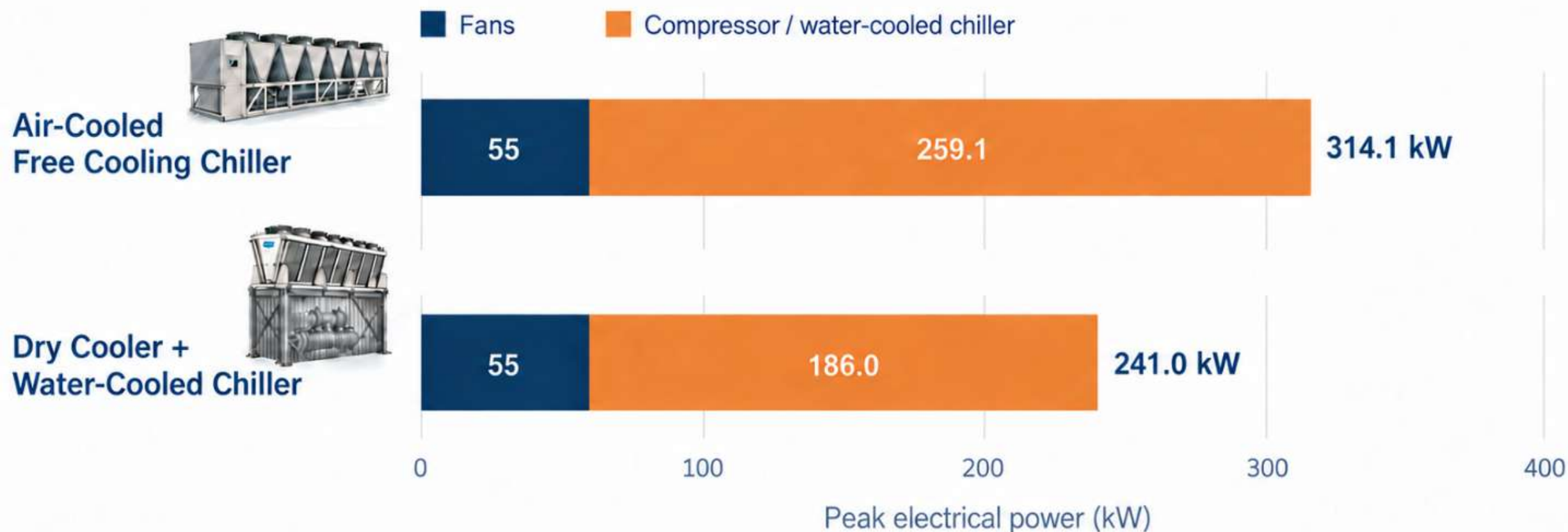
Annual system EER: 19.9 (air-cooled) vs 48.4 (dry cooler + chiller). Savings calculated before rounding.

Source: supplied revised London workbooks. Electrical scope: fans + compressor/chiller; excludes unlisted auxiliaries.

Peak Electrical Power Comparison

London Clerkenwell · 1.67 MW cooling duty · 31°C dry bulb

73.1 kW peak power reduction
23.3% lower peak electrical power

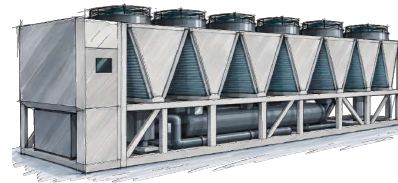


Adjusted assumption: Both systems use 55 kW peak fan power; cooling capacity requires validation.

At 31°C dry bulb. Chiller power unchanged. Scope: Fans + compressor/chiller; excludes unlisted auxiliaries.

150 MW IT Data Centre in London

1.5MW IT Cooling per Module



**DRY COOLER +
WATER-COOLED CHILLER**

**43.35 million kWh
ANNUAL ELECTRICITY SAVING**

58.9% Lower cooling-system electricity

23.3% lower peak electrical power

VERSUS

AIR-COOLED FREE-COOLING CHILLER

Scaled from the supplied London Clerkenwell IWEC2 model. Assumes 100 modules operating at the modelled duty for 8,760 hours.
Savings cover fans and chillers only, not total data-centre electricity.

The COMPLETE Spectrum of Fluid Cooling Solutions

	 Open CT  WET	 Closed CT  WET	 Hybrid  WET DRY	 Adiabatic Pad DC  ADIABATIC	 Adiabatic Spray DC  ADIABATIC	 Double-Stack Adiabatic DC  ADIABATIC	 Flat DC  DRY	 V-Shaped DC  DRY	 Double-Stack V-Shaped DC  DRY	 High-Capacity DC  DRY	 Industrial-Capacity DC  DRY
Maximum Capacity	8 MW	4 MW	4 MW	2 MW	2 MW	3.5 MW	0.5 MW	1.5 MW	3 MW	3.5 MW	8 MW
Unitary Capacity	★★★★★	★★★★	★★★	★★★★	★★★★	★★★★★	★★	★★	★★★★	★★★★★	★★★★★
Peak Power	★★★★★	★★★★	★★★	★★	★★	★★	★★	★★	★★	★★	★★★
Yearly energy consumption	★★★★★	★★★★	★★★	★★	★★	★★	★★	★★	★★	★★	★★★
Peak water	★	★	★★	★★	★	★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Yearly water consumption	★	★	★★	★★	★	★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Footprint	★★★★★	★★★★★	★★★★★	★★	★★	★★★★	★★	★★	★★★★	★★★★★	★★★★★
CAPEX	★★★★★	★★★★★	★★★	★★★★	★★★★	★★★★	★★★★	★★	★★	★★	★

CT = Cooling Tower · DC = Dry Cooler · Ratings reproduced from supplied comparison.



Allow us to
help you identify the
OPTIMUM
Fluid Cooling Solution
For **YOUR**
Data Center



THANK YOU



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