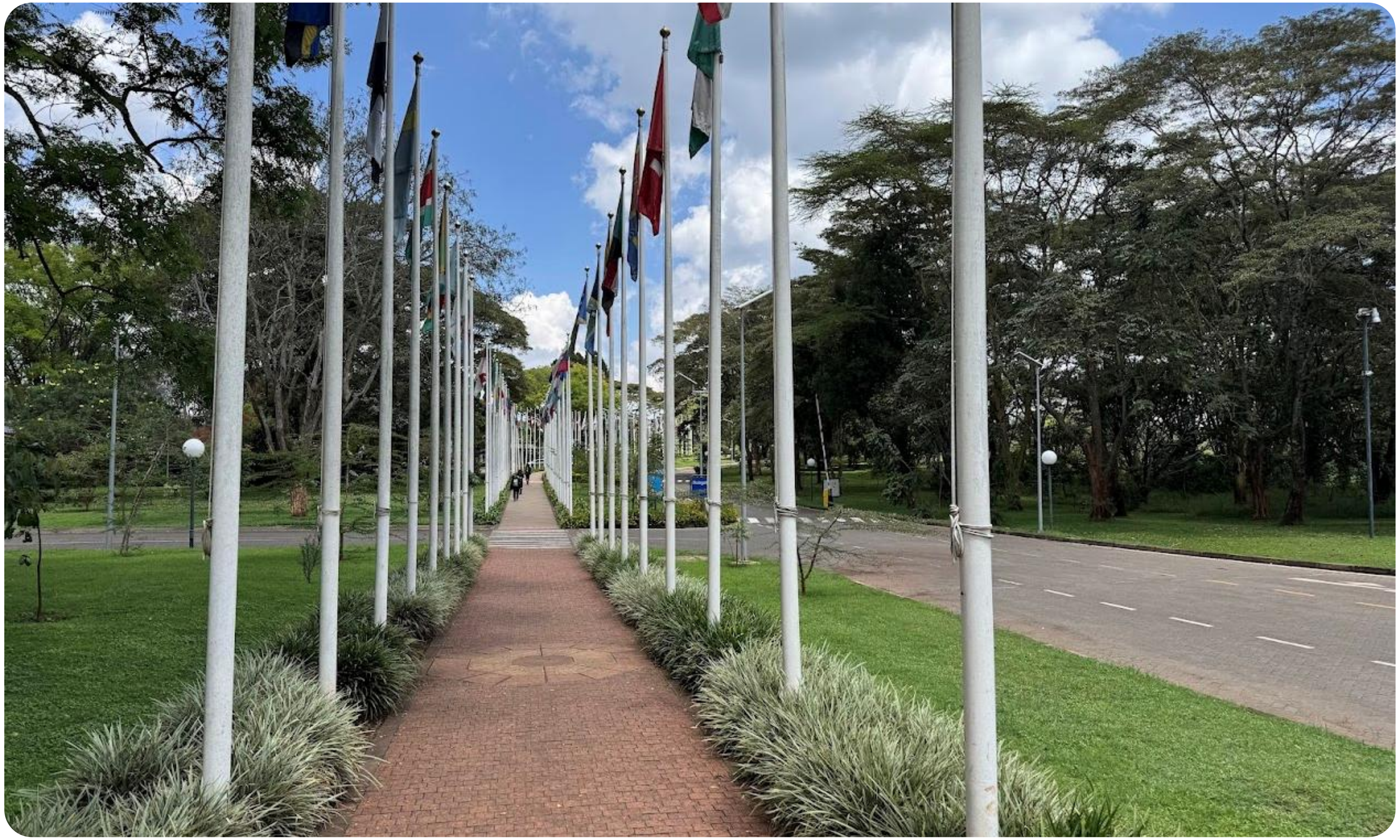
Policy & Technology Pathways for Sustainable Datacenter Infrastructure



Agenda

- Welcome
- Global Outlook on Cooling and Datacenters
- From Rack to Recovery: Cooling Technologies
- Policy Drivers and Performance Indicators
- Sustainable Procurement Guidelines for Datacenters & Servers

Global Outlook on Cooling

Ray Gluckman, Gluckman Consulting
Patrick Blake, UNEP, Climate Change Division

Pathways to Near-Zero Emission Cooling in Data Centres

presentation by Ray Gluckman

MOP 37, Nairobi, November 2025

Gluckman Consulting
specialists in refrigeration and climate change

Background to Cooling Emissions

- in 2022 cooling is estimated to have:
  - consumed 20% of global electricity
  - created 7% of global GHG emissions
- use of cooling will grow significantly by 2050
  - driven by:
    - population growth, GDP growth
    - climate change
    - AI and data centre growth
- 2050 global cooling capacity likely to be 3 times higher than in 2022
- how can that be achieved without a massive increase in GHG emissions?

UNEP Global Cooling Watch 2023 and 2025 (1)

- analysis of global cooling markets, with forecasts to 2050
- includes assessment of all types of “active” cooling including:
  - **Comfort Cooling**
    - residential buildings, non-residential buildings and in cars / other transport
  - **Refrigeration and Process Cooling**
    - domestic, food retail, food service, cold chain, industrial
    - data centres
- analysis provided from the Global Cooling Emissions Model

UNEP Global Cooling Watch 2023 and 2025 (2)

- modelling shows significant growth of cooling required by 2050
  - 2022 installed capacity: 22 TW
  - possible 2050 capacity: 68 TW (growth factor = 3.1)
- bad news: risk of significant growth in GHG emissions
  - and enormous strains on electricity supplies
- good news: there are pathways to near-zero GHG emissions in 2050
  - with efforts to reduce growth and maximise efficiency
  - creating massive GHG emission reductions
  - and savings of USD trillions

GCW 2025: Sustainable Cooling Hierarchy

Passive Cooling
Minimise cooling loads: e.g. building design

Low Energy Cooling
Avoid refrigeration: e.g. fans / evaporative coolers

High Efficiency Equipment
Optimise design and operation

Rapid HFC Phase-Down

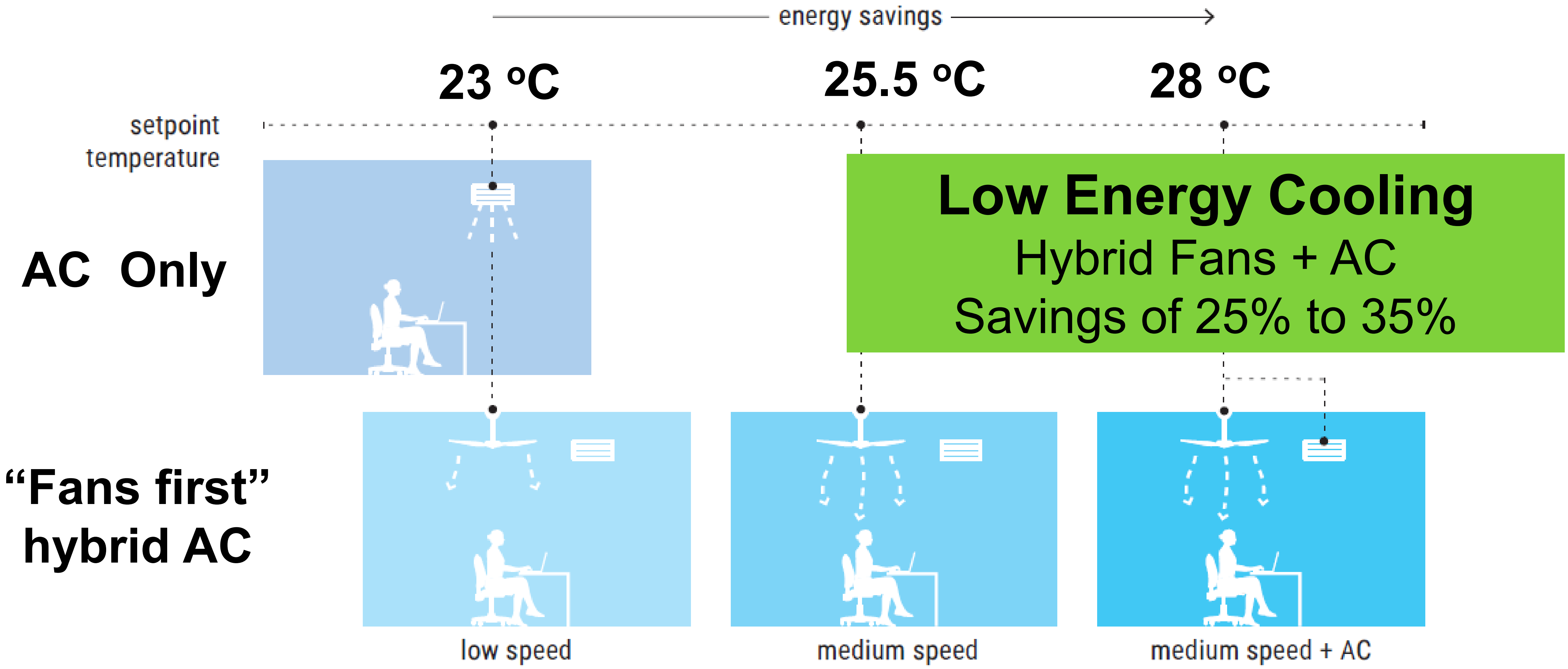
Example 1 (Non-data Centre): Retail Cabinets

Passive Cooling

Refrigerated retail display case

Adding doors can reduce cooling load by 50%

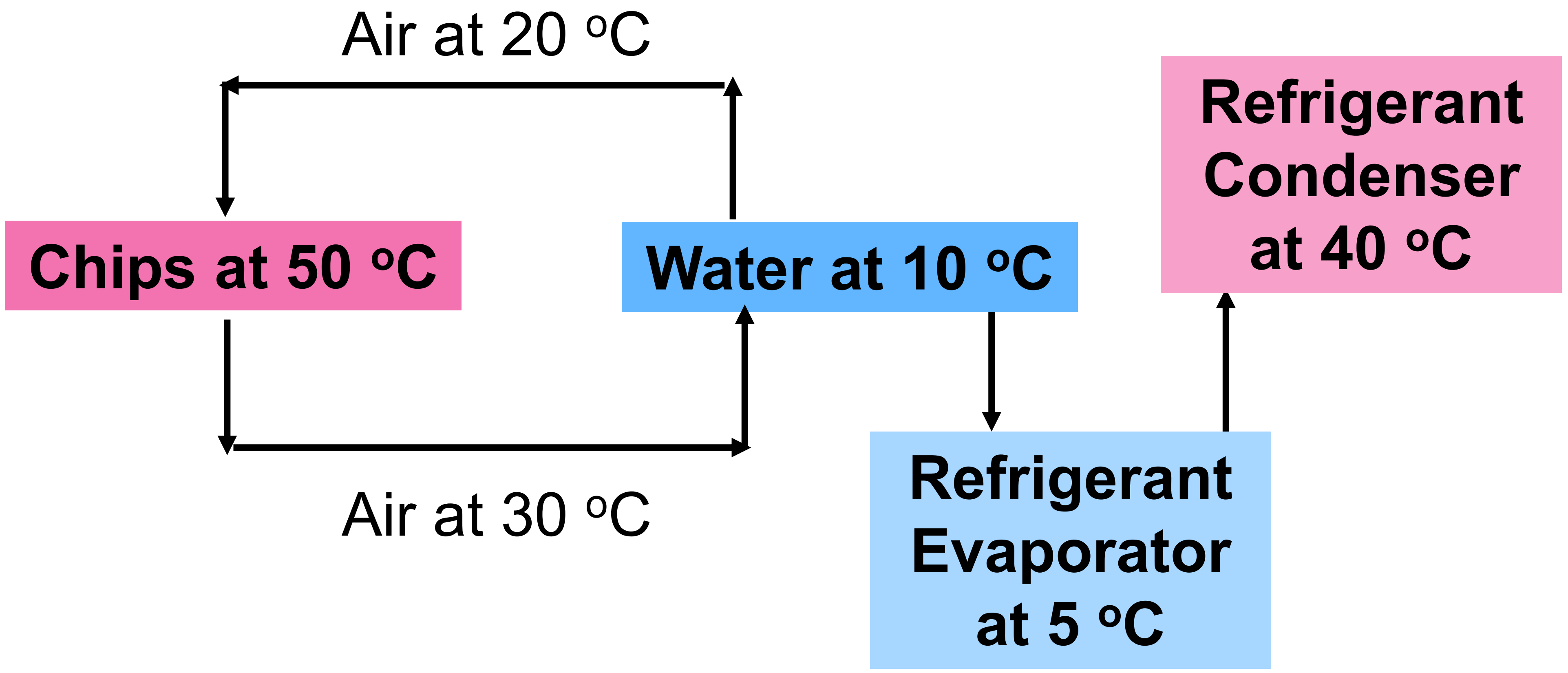
Example 2 (Non-data Centre): Hybrid AC



How does this apply to Data Centres?

- Computer chips use a lot of electric power
  - all of this becomes waste heat and cooling is required
- Older data centres have a PUE of >2
  - energy used for cooling is equal to or greater than energy used in chips!
- Older approach is to “air-condition” a data centre to remove heat
  - this is very inefficient and increasingly difficult with high power chips

Air-Cooled Data Centre



Applying the Sustainable Cooling Hierarchy

- treat data centres as process cooling loads
  - using an air-conditioning approach is very inefficient

Passive Cooling

Design chips for lower specific power

Locate data centres in cool conditions and use “free cooling”

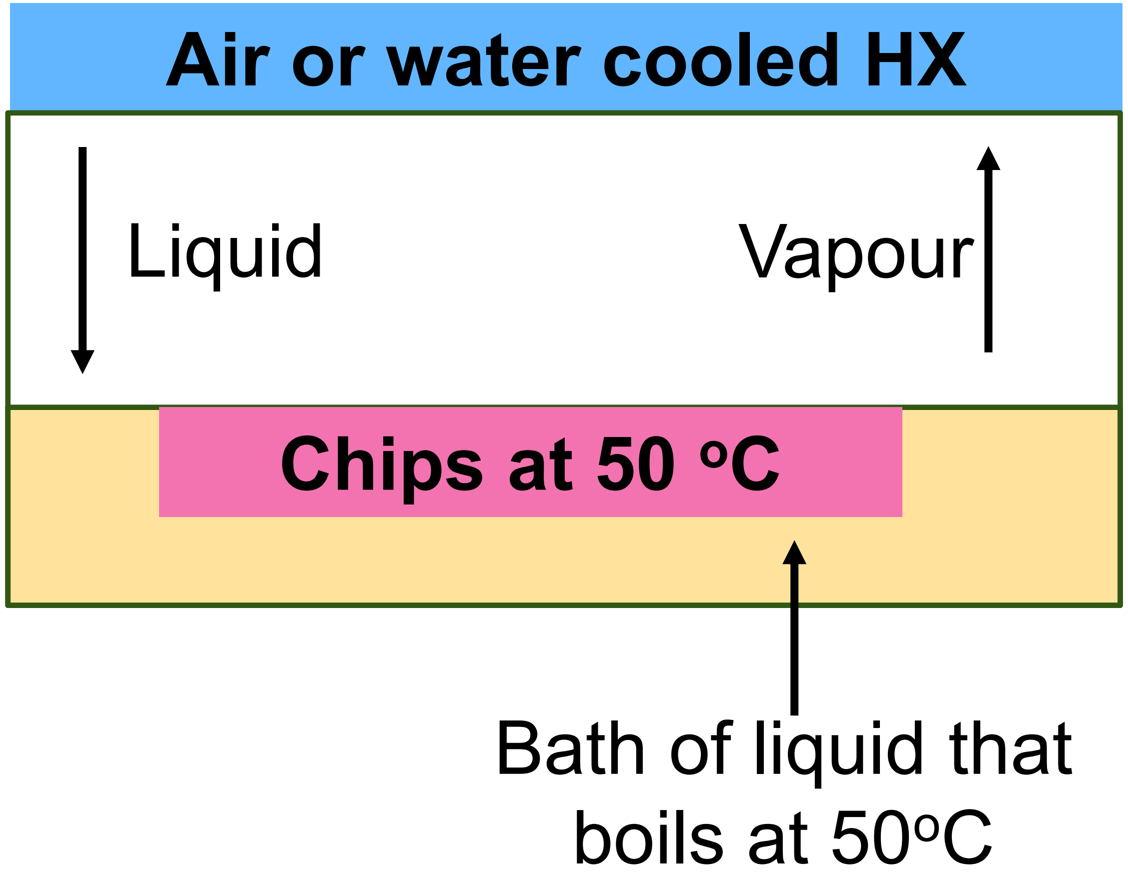
Low Energy Cooling

Design chips to operate at highest practical temperature

Use liquid cooling

Use evaporative immersion cooling, **<u>without</u>** refrigeration

Evaporative Immersion Cooling



The only energy required is to move air or water through heat exchanger

PUE of 1.05 possible

The higher the chip temperature, the easier it is to cool and the more useful the waste heat becomes

Concluding Remarks

- data centre loads likely to increase rapidly
- the old “air-conditioning” approach to data centre cooling needs to be avoided
- various strategies can be adopted
  - improved chip design
    - higher efficiency; higher operating temperature
  - use of free cooling in cool weather
  - Liquid cooling
  - immersion cooling is an important long-term option

From Rack to Recovery
Cooling Technologies & Refrigerant Use in Datacenters

Dr. Sankar Padhmanabhan, Global Solution Expert – Data Centers
Danfoss Climate Solutions

From Rack to Recovery – Cooling Technologies & Refrigerant use in Data Centers

Dr. Sankar Padhmanabhan
Global Solution Expert – Data Centers

Montreal Protocol Meeting

Data center market update

Current state

- We expect 10GW of new deployments in 2025, which leads to a growth rate of 20%-25%.
- Significant transformation in terms of power density requirements and connectivity demands.
- Developers to accelerate the search for new energy sources.
- Growing trend among data center operators to reuse heat in Europe.

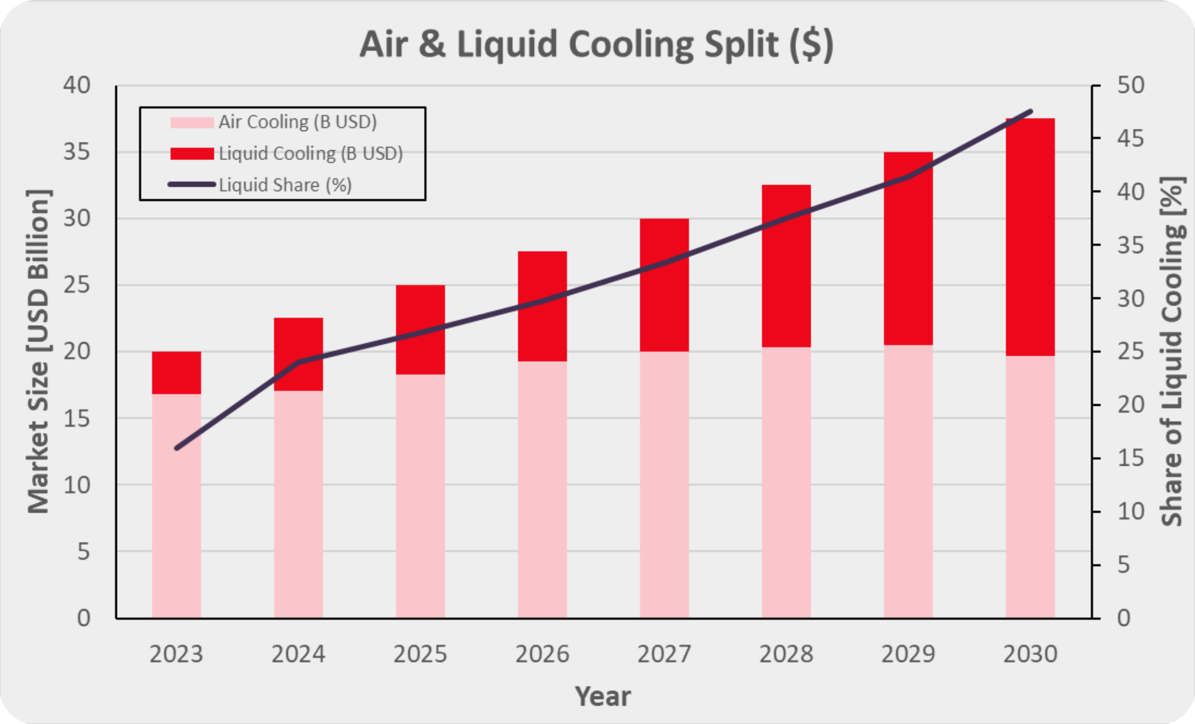
Ongoing trend

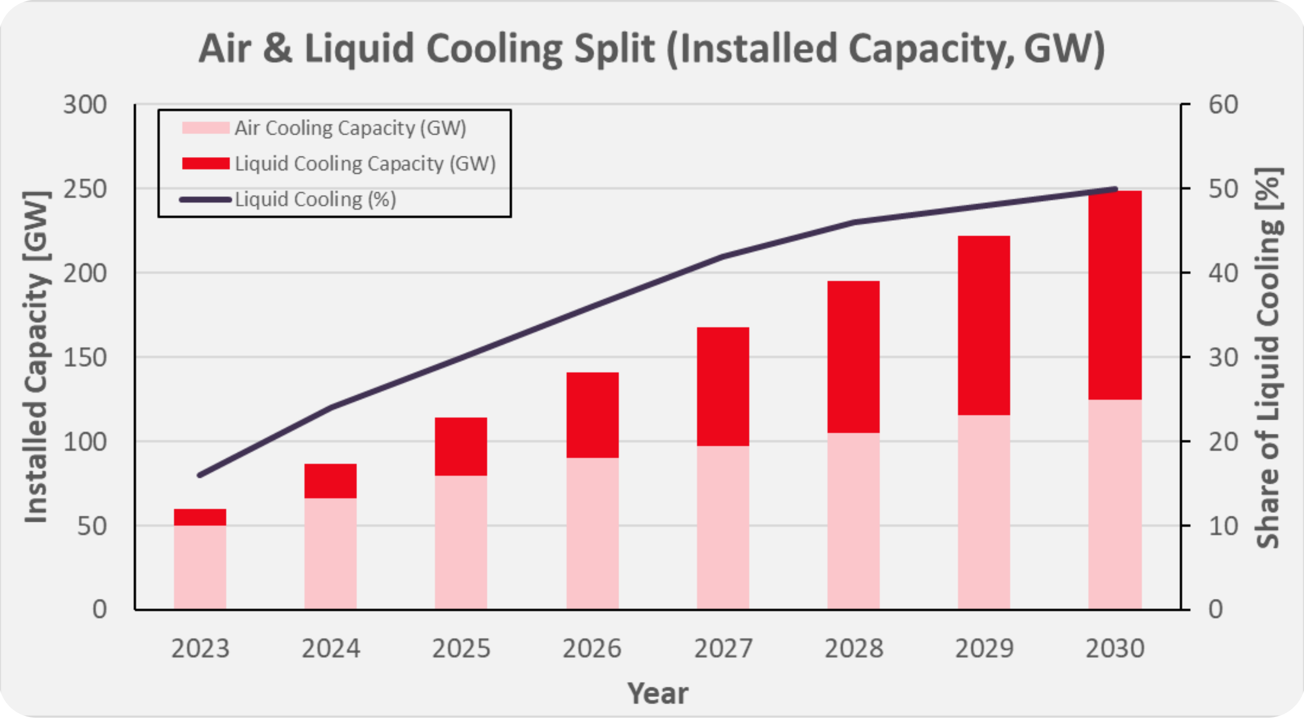
- Global data center demand to surge despite chip supply and power constraints.
- Liquid cooling on the path to become the norm.
- Reshaping the collaboration among industry players to jointly develop AI data centers, through M&A, partnerships.
- Increasing demand/interest in supplying/offering both CDUs and chillers.

Long-term estimation

- The global data center cooling market is projected to reach 17-22 EURbn by 2028.
- We are expecting 100GW of additional data center capacity deployed globally by the end of this decade.
- Data centers will be viewed in an Industrial scale instead of Commercial scale

Market trend





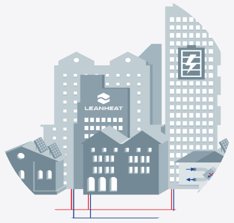
Liquid cooling forecasted to reach ~50% market share by 2030 (Market share and Installed capacity)

Source: Analysis based on reports from McKinsey, IEA and Goldman Sachs;

Pillars of Sustainability in a Data Center

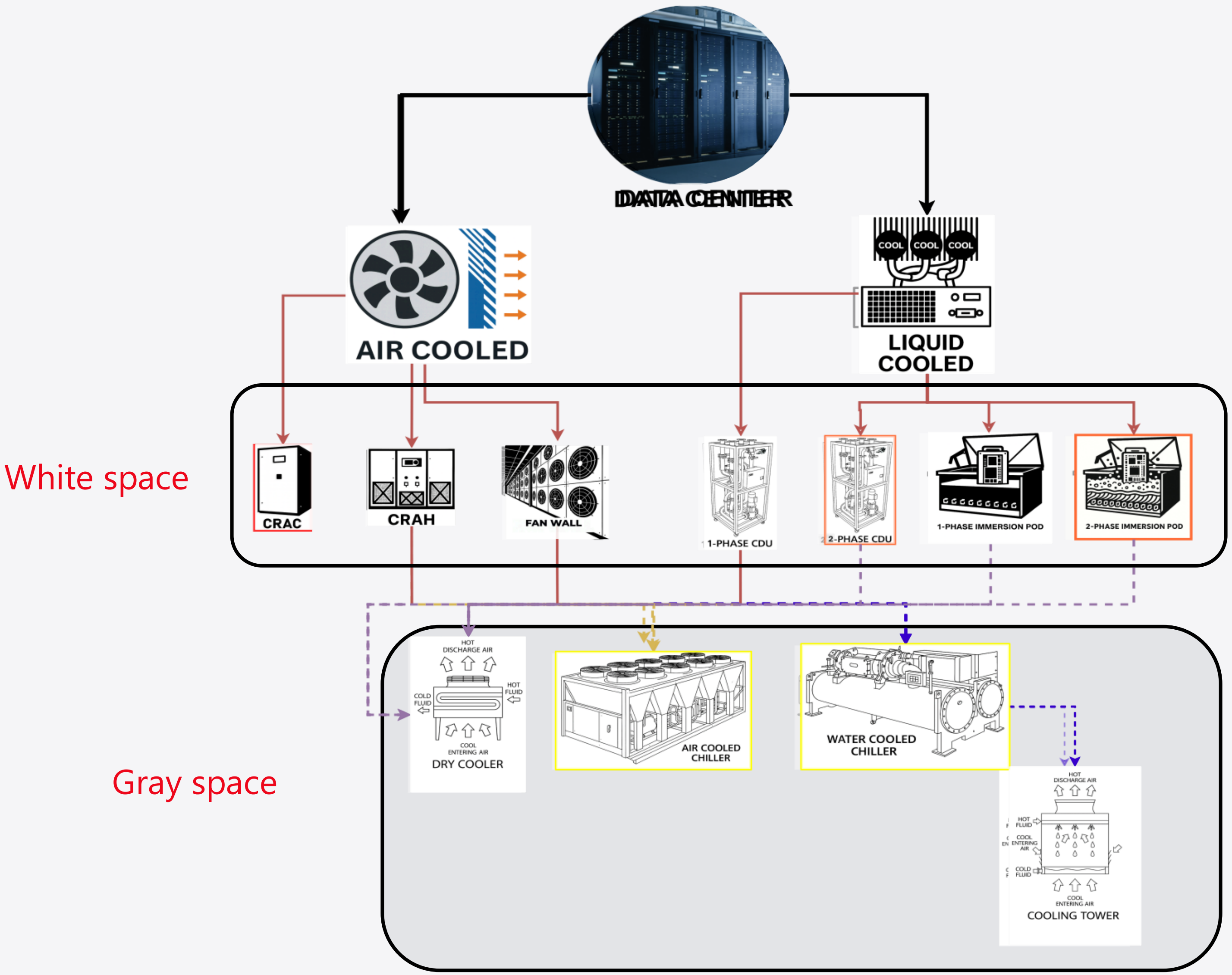
Power Requirements

Cooling Infrastructure



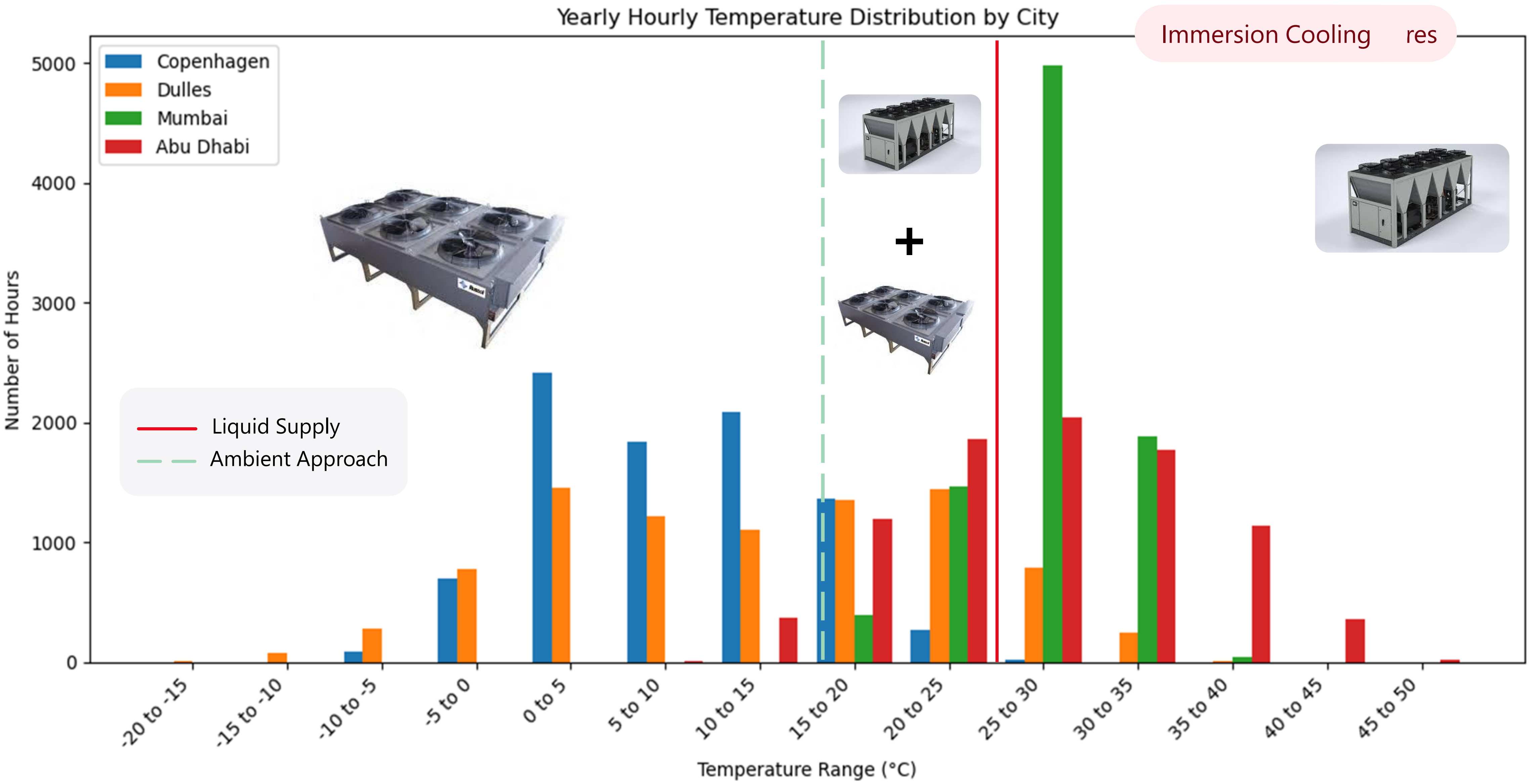
Waste Heat Recovery

Cooling Technology



Notes:
1. Potential for no refrigerant in the graysopace
2. Immersion pod will contain refrigerant - care need to be taken to contain it
3. No candidate as of now
refrigerants

Impact of Higher IT Temperatures & Liquid Cooling



Direct-to-Chip Liquid Cooling

Coolant Distribution Unit (CDU): Heart of DTC Liquid cooling. Objective is to deliver a required flow at a required temperature to the racks.

Facility Water System (FWS)

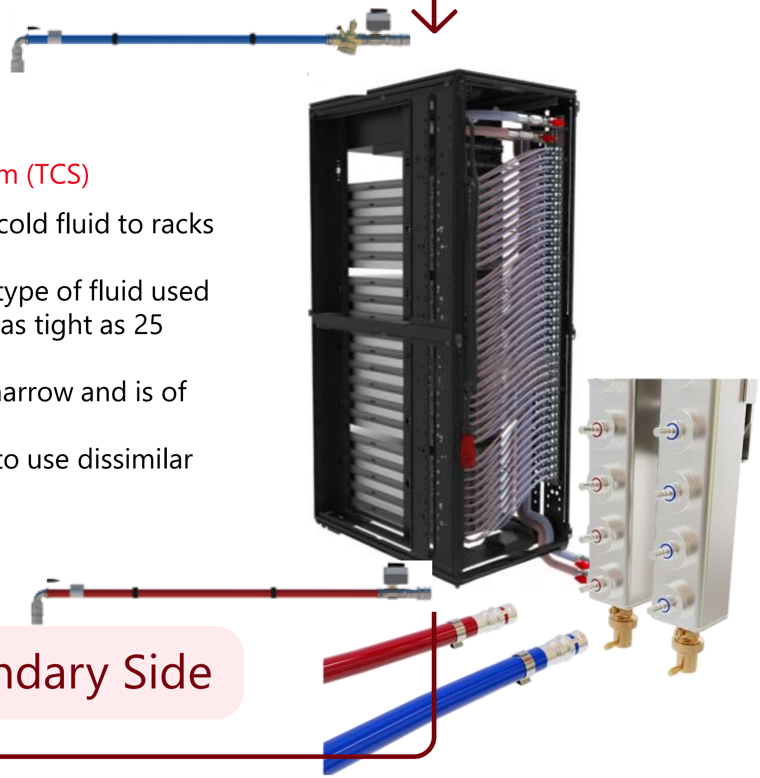
- Also called Facility Water Loop (FWL)
- Chilled water loop between Chiller/Dry cooler and CDU
- Filtration needs similar to regular chilled water system
- Wetted material list allows more material to be used
- No requirement on kind of fluid used in the loop

FWS → Primary Side

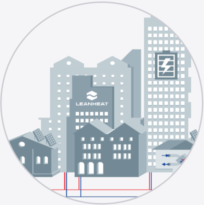
Technology Cooling System (TCS)

- Closed loop delivering cold fluid to racks and back to CDU
- Strict requirements on type of fluid used
- Filtration requirements as tight as 25 microns
- Wetted material list is narrow and is of great significance
- Care need to be taken to use dissimilar metals in the loop

TCS → Secondary Side



Heat Recovery – How?



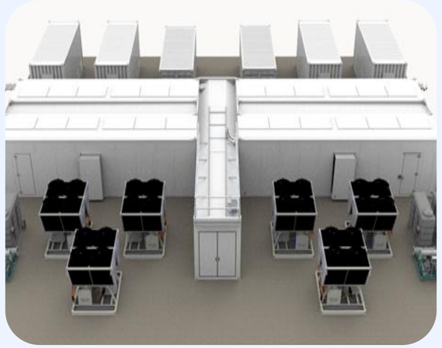
Heating end use

Cooling end use

Power generation – ORC

Data Center Free Cooling / Food Production Heat Reuse

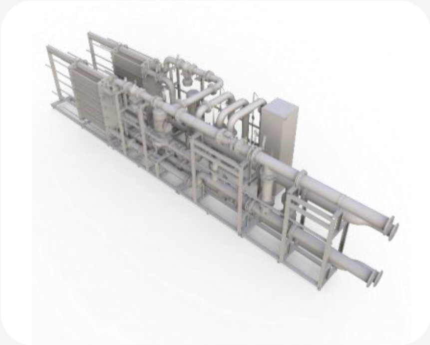
Data Center
Liquid / On-Chip Cooling



35°C ←

43°C →

Energy Station
Free Cool / Heat Recov.



33°C ←

41°C →

Greenhouse Farming
Supply Air Heat

Indoor Fish Farms
Supply Water Heat

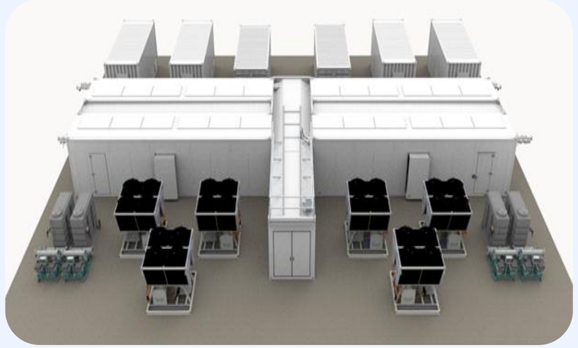
Free Cooling
~20 COP

- Greenhouse farms and indoor horticulture as potential heat recovery customers, collocated with data center
- Symbiotic efficiency relationship with data center – Directly use available heat without heat pump boost

Free Heating
~20 COP

Heat Pumps for High Temperature Heat Recovery

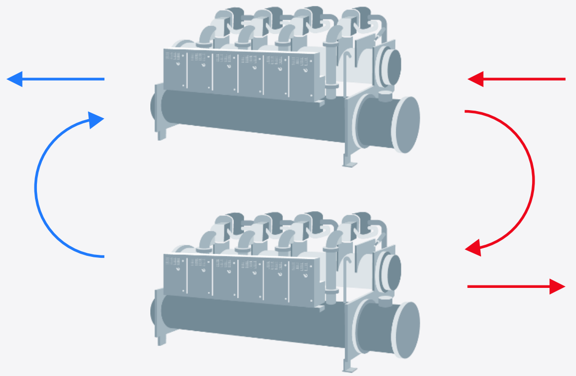
Data Center
Chilled Water / Air Cooling



20°C

28°C

Heat Pump
Series-Series Counterflow

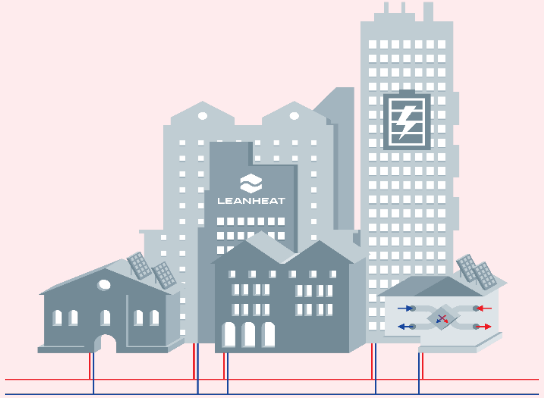


40°C

67°C

District Energy
4th Generation Heating

Lower Return Temp



4.8 COP
Cooling

- Heat recovery to high temperature uses need a heat pump
- Heat pumps with low GWP refrigerants (HFO, GWP ~1) are already available
- Natural refrigerants such as CO_2 is ideal for high temperature heat pump

5.8 COP
Heating

Key Takeaways

- Sustainability is NOT optional!
- Three pillars of sustainability
  - Power – Behind the Meter approach
  - Cooling – Higher ITE temperatures and Liquid cooling
  - Recovery – Completes the cycle of sustainability
- Trends in Power & Cooling render Data Center ecosystem to more heat recovery options
- Refrigerant transition to Low GWP refrigerants is slow due to criticality of application.
- Pathway to Low GWP refrigerant is obvious
- Heat recovery need to be implemented to attain sustainability
- Heat pump technology is central to realize many of heat recovery scenarios
- Integral urban planning is key to sustainability.

Policy Drivers & Performance Indicators for Sustainable Datacenters

Andrea Voigt, VP Public Affairs & Sustainability
Danfoss Climate Solutions

Policy Drivers and Performance Indicators

5 November 2025

The upcoming EU Data Center Energy Efficiency Package

The **EU Energy Efficiency Directive (EED)** establishes a common framework to boost energy efficiency across sectors, including data centers, aiming for **11.7% reduction in final energy consumption by 2030** (based on 2020 projections)

At the IEA Conference in Brussels last June, EU Commissioner for Energy and Housing, Dan Jørgensen, announced an upcoming **Data Center Energy Efficiency Package**, signaling stronger action to make the sector more sustainable and aligned with EU climate goals

Source: New impetus for energy efficiency - European Commission

EU: Introducing a common Union rating scheme for data centers: a step-by-step approach

Reporting requirements

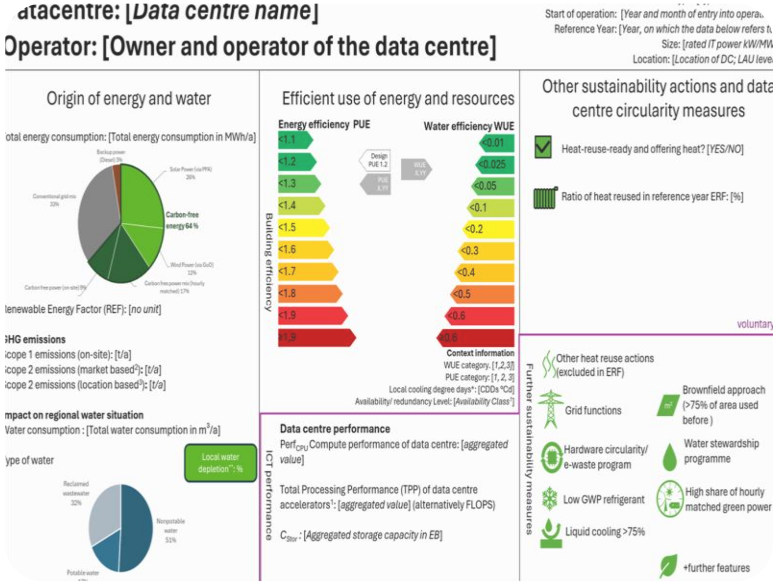
Introduced in 2024 to provide reliable data on energy and water consumption in data centers needed to assess their true environmental impact

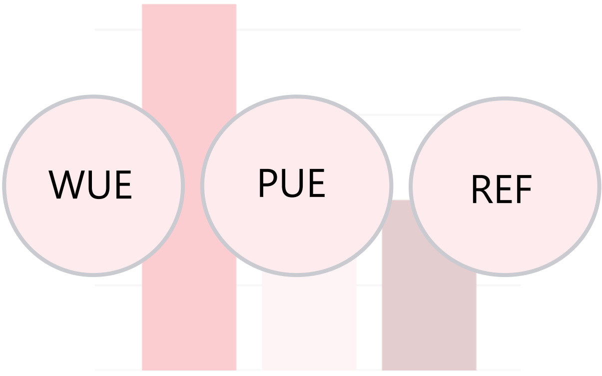
Sustainability label

Based on the available data, to incentivize and reward sustainability initiatives implemented by data centers

Minimum performance standards

Mandatory performance standards for specific KPIs to raise the level of ambition and drive continuous improvement





Reporting requirements

Getting **accurate data** on **energy** and **water** performance of European data centers

- Reporting requirements are mandatory for ≥ **500 kW** data centers
- Data to be reported annually to a common **European database**
- **Energy consumption**, **water use**, **heat reuse**, **waste heat temperature**, among the relevant data to be reported

Sustainability indicators calculated based on the reported data:

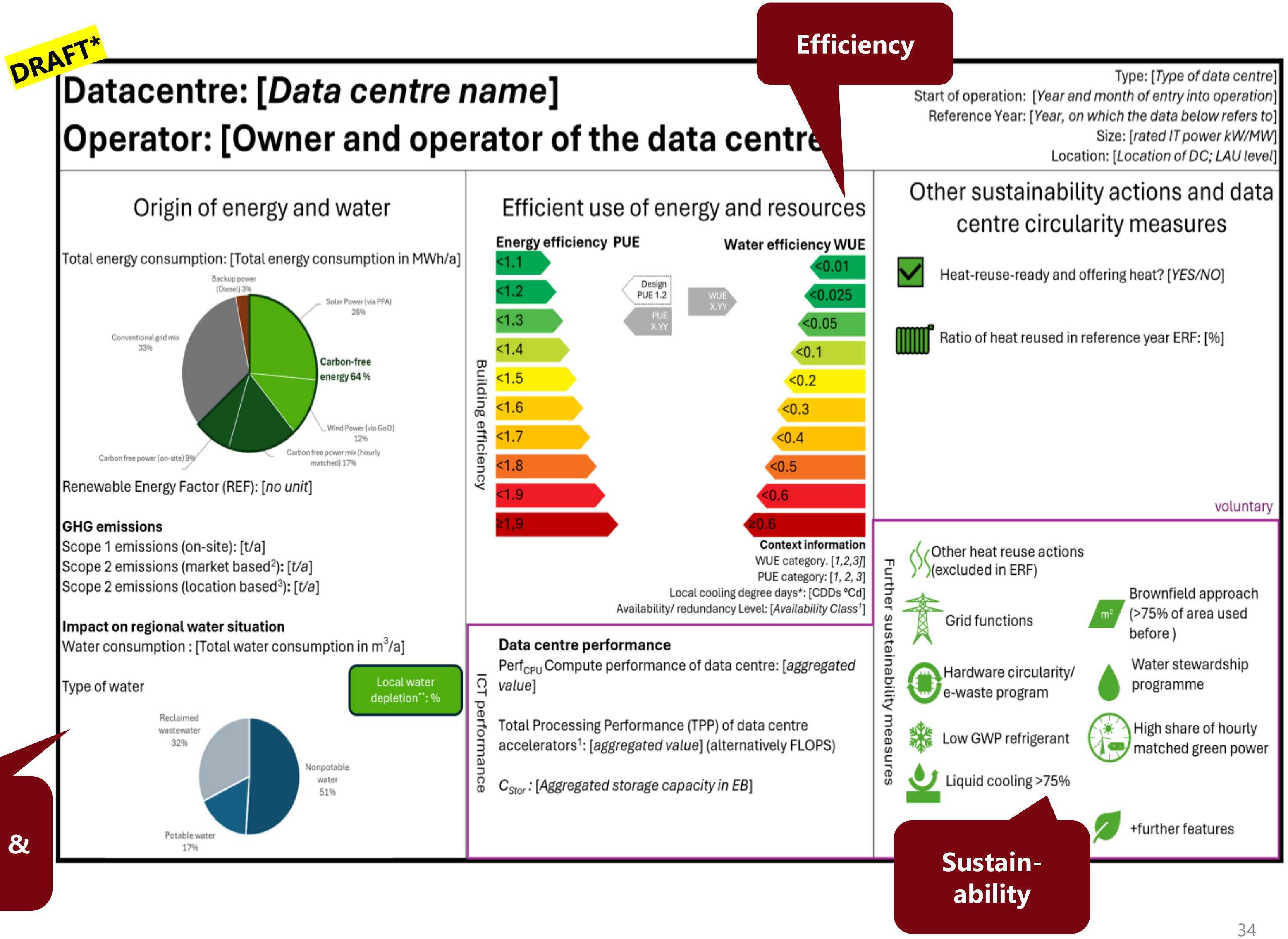
- **PUE** (Power Usage Effectiveness)
- **WUE** (Water Usage Effectiveness)
- **ERF** (Energy Reuse Factor)
- **REF** (Renewable Energy Factor)

Sources:
- Directive - 2023/1791 - EN - EUR-Lex (Energy Efficiency Directive recast), in particular articles 12, 33.3 and Annex VII.
- Delegated regulation - EU - 2024/1364 - EN - EUR-Lex

Sustainability label

Based on the data from the reporting

- Applies always to ≥ **500 kW DCs** but recommended for smaller facilities
- Helps organizations choose **where to run their digital services** based on sustainability performance
- Includes **ICT performance metrics** and **extra sustainability initiatives as voluntary** enhancements



*Source: Assessment of next steps to promote the energy performance and sustainability of data centres in EU, including the establishment of an EU-wide rating scheme - Publications Office of the EU

Minimum Performance Standards

Potentially introducing EU-level **Minimum Perfomance Standards (MPS)** to raise the level of ambition

- Suggested for **PUE**, **WUE** and **REF**, based on the data from the reporting system
- MPS for **ERF** (energy reuse) recommended to be set at national level
- The proposed MPS are considered achievable across all European climate zones

*DRAFT

Power Usage Effectiveness = Total Power **/** IT Power

Water Usage Effectiveness = Water usage **/** IT Power

Renewable Energy Factor = Total Power **/** Renewable Power

Based on the reported data and considering the stakeholders' input, both obtained by 24. 04. 2025, the following MPS were suggested:

PUE

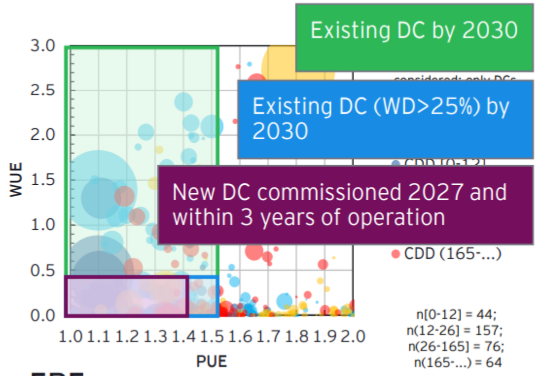
- Operational PUE < 1.5 for existing DC by 2030
- Design PUE < 1.3 for DC commisioned 2027 and later, operational PUE < 1.4 achieved within 3 years of operation

WUE

- WUE < 0.4 m³/MWh for DCs in areas with water depletion > 25% by 2030
- WUE < 0.4 m³/MWh for DCs in areas with water depletion > 25% commisioned 2027 and after
- Further encourage using non-potable water and efficiency
- Only Category 2 reporting from 2030

REF

- REF = 100% for all DC (regardless of origin) by 2030
- Further focus on the origin of renewable energy (encourage hourly matching)



ERF

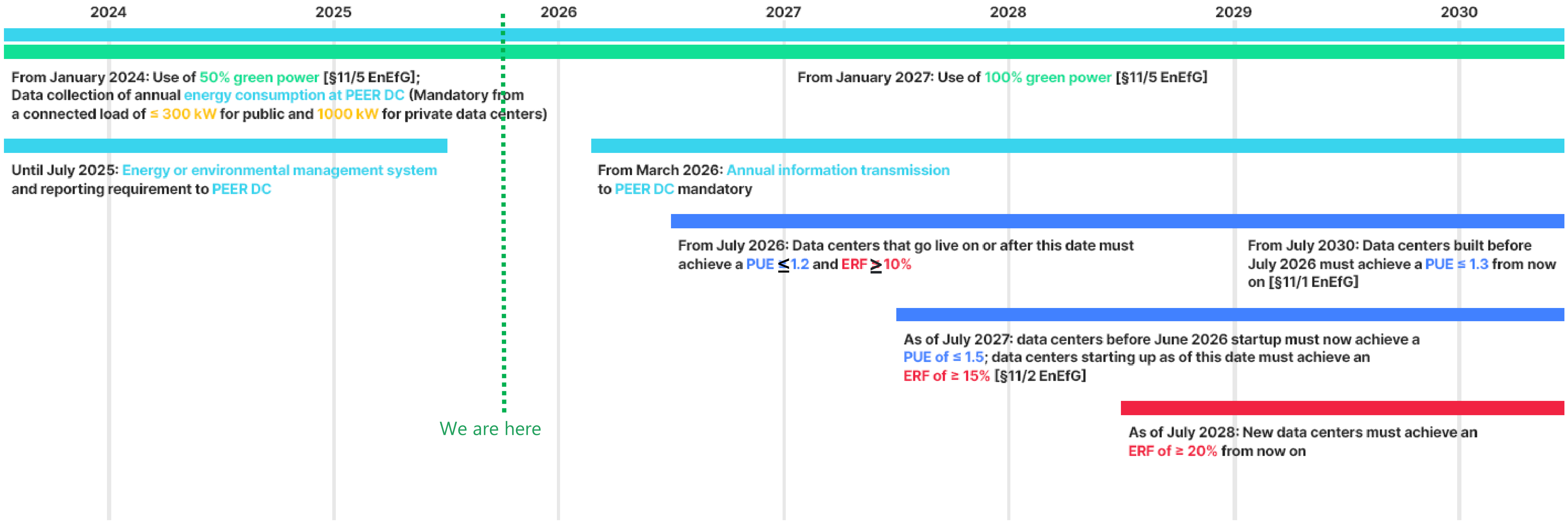
We do not believe that mandating a EU-wide criterion is feasible – we propose for it to be assessed locally.

For all MPS, we encourage policy makers to introduce stricter regulations on national level, where deemed necessary and feasible.

*Sources: Assessment of next steps to promote the energy performance and sustainability of data centres in EU, including the establishment of an EU-wide rating scheme - Publications Office of the EU, and stakeholder workshops held in H1 2025

National legislation can exceed EU legislation
Example: Germany

National implementation of EED lead to **stricter** legislation than on EU level:



green power: Proportion of electricity procured from renewable energies
PEER DC: Public energy efficiency register for data centers
PUE: Power Usage Effectiveness, value for energy consumption effectiveness
ERF: Energy Reuse Factor, value of waste heat used

https://datacenter-group.com/en/company/sustainability/energy-efficiency-act/

Global trends in data center sustainability

Regulatory and reporting

- Australia, China, and some parts of UK and US have energy reporting frameworks in place (some mandatory, some voluntary)
- MPS for **PUE** exist in several countries (e.g. Australia, China, Japan)
- Performance mandates for **WUE** are on the rise (e.g. China)

Heat reuse interest is rising

- Highly encouraged, not yet mandatory (in the EU, ≥1 MW DCs shall conduct a cost-benefit-analysis for excess heat recovery & reuse)
- **Waste heat (WH) recovery** as a critical opportunity to decarbonize (colocation with industrial offtakers or district heating)

Opportunities in emerging economies

- Innovative **business models** (e.g. Energy-as-a-Service, AI-as-a-Service, outcome-based pricing) and **targeted financial instruments** (e.g. green bonds, Super Energy Service Company (ESCO), and blended finance) can promote efficiency and unlock investments

Table 5.2 ▷ Policy landscape in selected economies

Economy	National strategy	Government financial support			Reporting requirements		Performance mandates	
		R&D	Data centres	Chips	Emissions	Electricity consumption	PUE	WUE
Argentina	●							
Australia	●	●	●		●	●	●	
Brazil	●	●	●	●				
Canada	●	●	●	●	○	○		
China	●	●	●	●		●	●	●
European Union	●	●	●	●	●	●		
France	●	●		●	●		●	
Germany	●	●		●	●	●	●	
India	●	●	○	●				
Indonesia	●	●	●	●				
Italy	●	●		●	●			
Japan	●	●	●	●	●	●	●	
Korea	●	●	●	●				
Mexico	●							
Russian Federation	●	●	●		●			
Saudi Arabia	●	●	●	●				
South Africa	●	●						
Türkiye	●	●	●	●	●			
United Kingdom	●	●	●	●	●	●		
United States	●	●	●	●	○	○	○	

Notes: ○ = subnational only; PUE = power usage effectiveness; WUE = water usage effectiveness.

Table 5.1 ▷ Data centre energy efficiency mandates for selected economies

Region	PUE (2023)	PUE mandate
Australia	1.44	1.4 by 2025
China	1.56	1.5 by 2025
France	1.36	40% building energy use reduction by 2030
Germany	1.42	1.2 by 2026 (new), 1.3 by 2030 (existing)
Japan	1.53	1.4 by 2022
California (United States)	1.21	1.5 by 2014
Global	**1.43**	-

Note: PUE = power usage effectiveness.
Sources: Based on government websites and Masanet (2024).

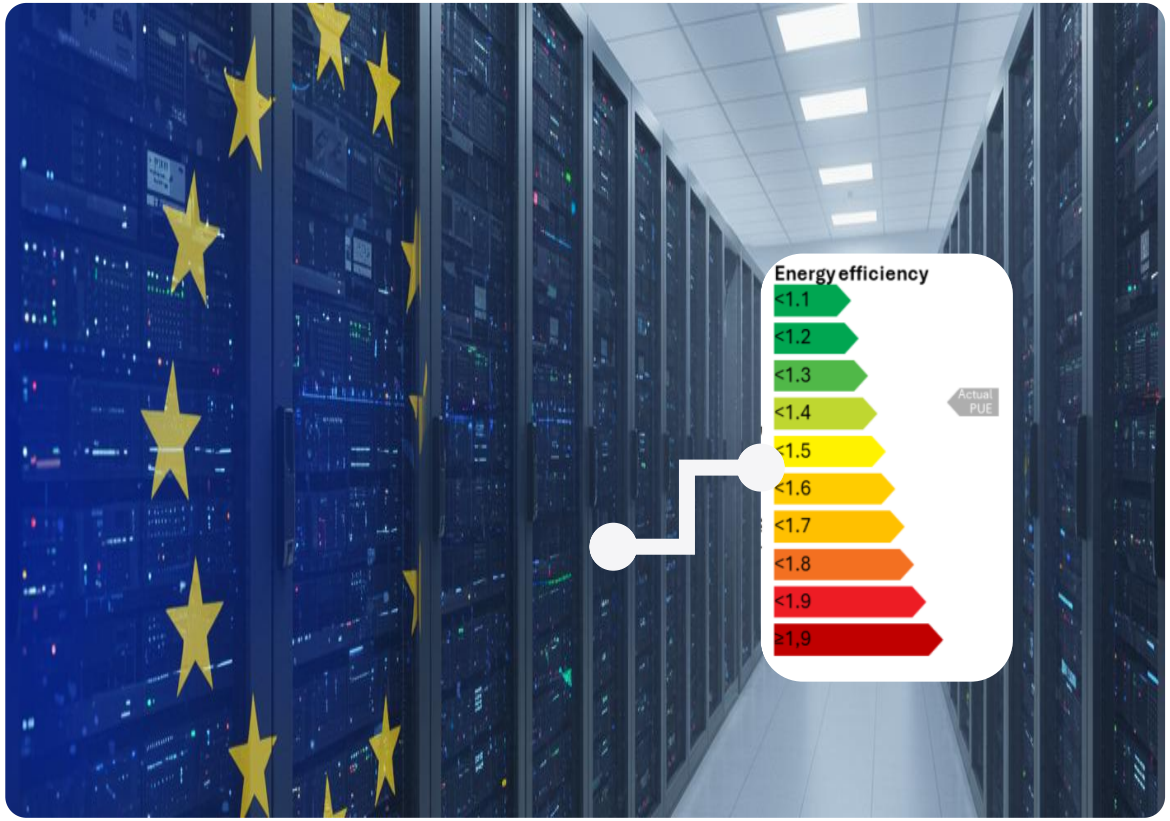
Sources:

- Energy & AI Special Report 2025, IEA
- Business Models and Finance to Enhance Energy Efficiency in AI and Data Centres in Emerging Economies – UNEP-CCC

Conclusions: policy drivers for sustainable data centers

Why it matters:

- ✓ Key policy initiatives, like the upcoming EU rating scheme, support the **adoption of energy efficiency solutions** across data centers, aligned with energy & climate goals



Key benefits:

- ✓ Achieve **low PUE and WUE** for optimized energy and water use.
- ✓ **Reuse excess heat** instead of wasting it, supporting **local decarbonization** (e.g., district heating)
- ✓ **Transparency through standardized reporting** builds trust and accountability
- ✓ **MPS drives retrofitting** of existing facilities to meet new standards
- ✓ **Global impact:** Success in Europe sets a benchmark for other regions

Sustainable Procurement Guidelines for Datacenters & Servers

Patrick Blake, UNEP, Climate Change Division

Policy and Technology Pathways for Sustainable Data Infrastructure

UNEP-U4E Sustainable Procurement Guidelines on Data Centres

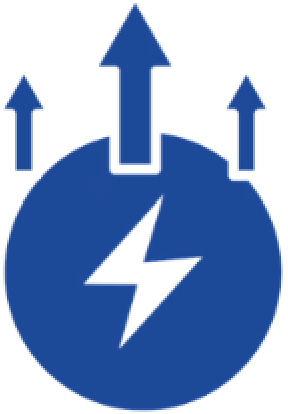
Patrick Blake, UNEP, Climate Change Division

5 November 2025

Danfoss Climate Solutions MOP37 Side Event
Nairobi, Kenya

U4E UN environment programme
United for Efficiency

Data Centers Impact in a Nutshell



In 2022, estimations revealed that global data centres used 460 TWh—approximately **2% of global electricity use**. This demand could double by 2026 without urgent efficiency action [1].

Many data centres use significant volumes of water: 1 megawatt (MW) data centre can consume as much as **25.5 million litres of water each year only for cooling**, comparable to the daily water use of around 300,000 people [2].

Data centres and data transmission networks were responsible for approximately 330 Mt CO2 equivalent in 2020. This represents about **0.9% of energy-related greenhouse gas emissions**, or 0.6% of total global GHG emissions [3].

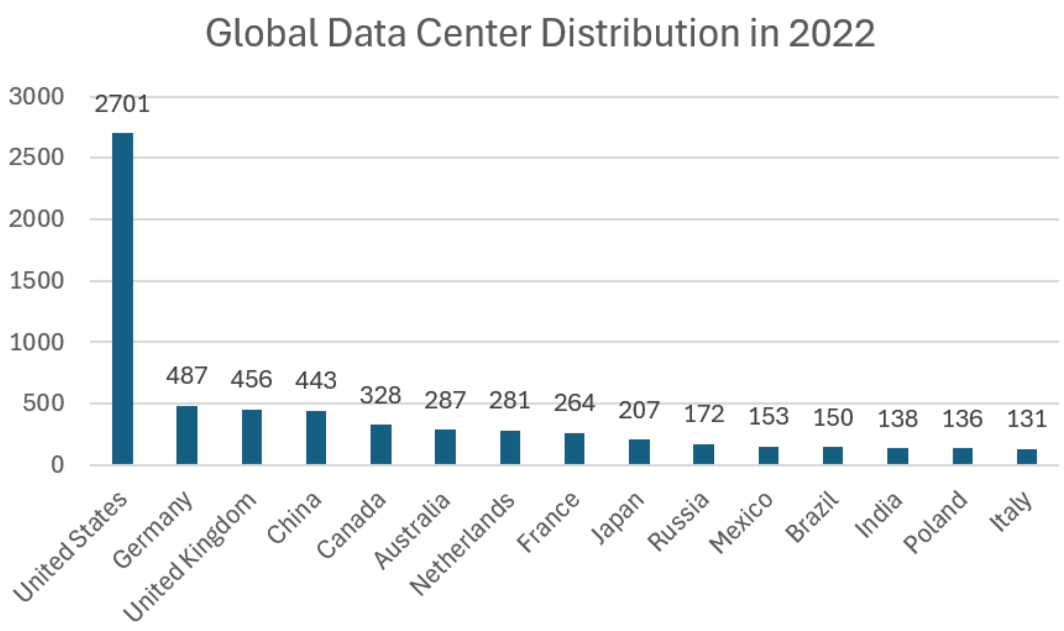
[1] International Energy Agency. Electricity 2024, Analysis and Forecast to 2026. https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks
[2]World Economic Forum. https://www.weforum.org/stories/2024/11/circular-water-solutions-sustainable-data-centres/
[3] International Energy Agency. https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks

Benefits from Data Center green regulation

- **Reduce energy consumption** by improving the energy efficiency of date centres (-30%),
- **Reduction in water usage** by setting specific consumption targets (-90%),
- **Expand internet access** at a reasonable price though local energy efficient data centres and IXPs,
- **Increase the use of renewable energy** by increasing the share used by data centers (+50%),
- **Foster waste heat reuse** by selecting the appropriate cooling technology and providing incentives (+30%),
- **Lower material impact** by increasing the utilization rate of servers, thereby reducing their number,
- **Control the country´s development** by lowering the impact of data centres on the electricity grid and water supply.

Situation in developing and emerging economies

The number of data centres in developing countries is expected to grow rapidly due to the economic growth linked to an increased demand for data (most of it in edge computing) and a growing demand for sovereignty in data processing and storage.



In the Asia Pacific region, demand for data centres is likely to double to 5,880 megawatts (MW) of installed capacity across the region by 2025.

Sub-Saharan Africa had the fastest growth in bandwidth of any region over the 2015–19 period. It grew by 53% per year, reflecting a large increase in capacity because of the deployment of new submarine cables.

Investments in Latin America are predicted to grow at a rate of 7.6 percent through until 2026.

Sustainable Procurement Guidelines for Data Centres and Servers

Intended for: Public Procurers, Technical Personnel, Policy Makers and related officers involved in procurement activities.

Scope: Data Centres, computer servers and data storage products.

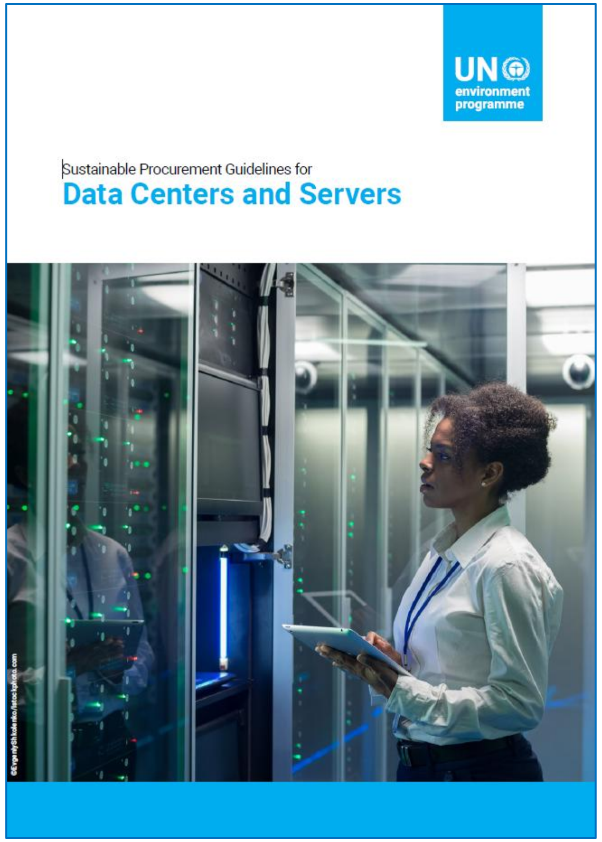
Methodology: Developed through a collaborative/consultative approach with key service providers and institutions from the sector:

- *Uptime Institute, France Datacenter, The French Alliance of Digital Industries, EQUINIX, GIMELEC, Google, Microsoft, LBNL, etc.*

General content: simple set of technical recommendations on the key performance criteria and operational conditions that matter most when selecting energy-efficient data centers and computer servers, to be considered during any procurement process.

Best practices: recommendations aligned with international best practices (e.g., EU Code of Conduct series, Energy Star, ISO/IEC 30134, among others).

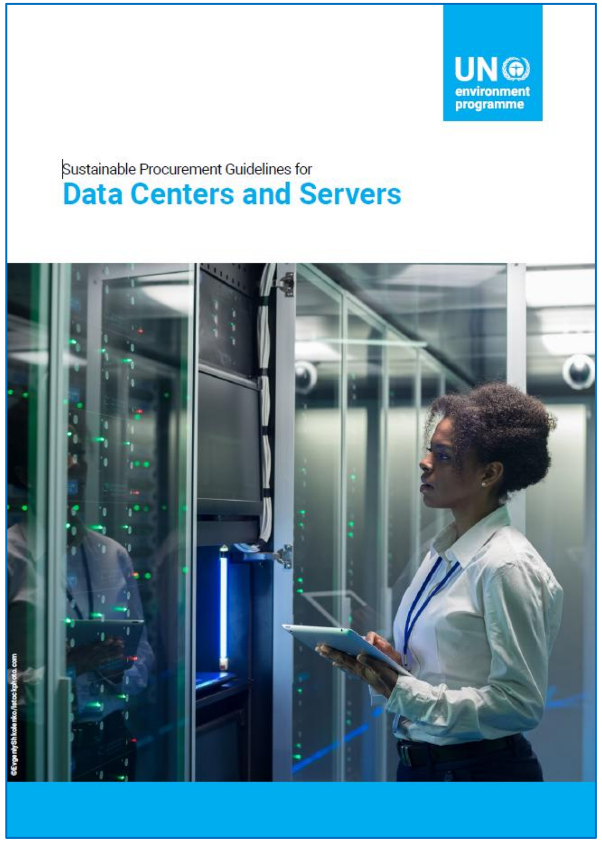
However, assessing local conditions and consulting stakeholders remain essential to ensure they are appropriately tailored.



Sustainable Procurement Guidelines for Data Centres and Servers

How to use it ? These guidelines are intended to support the preparation of tender documents issued by governments and state or semi-state-owned enterprises for servers and data storage products. Adaptable to national and regional contexts, the guidelines can be used to:

- Support the selection and/or **approval of data hosting solutions** (e.g., choosing a colocation data centre);
- Guide the development of proposals **for building new data centres**;
- Inform decisions to **authorize the establishment** of new data centre facilities;
- Specify technical and environmental requirements when **procuring servers** (draft of tender documents);
- Serve as a reference when **establishing Minimum Energy Performance Standards** (MEPS);
- Inform the development of energy **labelling schemes** for servers and data storage products;
- Define performance requirements within **Service Level Agreements** (SLAs) between cloud providers and public authorities.



Scope of content the SPP Guideline

Performance criteria for data centres and computer servers

- ✓ Power usage effectiveness (PUE)
- ✓ Water usage effectiveness (WUE)
- ✓ Cooling effectiveness ratio (CER)
- ✓ IT equipment energy efficiency for servers
- ✓ Server efficiency
- ✓ Data storage efficiency
- ✓ Power supply efficiency (UPS)
- ✓ Idle state efficiency

Operating conditions

- ✓ Location of data centres
- ✓ Renewable energy factor (REF)
- ✓ Resilience of data centres
- ✓ Modularity
- ✓ Cooling design
- ✓ Operating temperature and humidity range for servers
- ✓ CPU power management criteria
- ✓ Utilization rate of IT equipment (ITEUsv)

- **Other aspects to be considered: Lighting, motors, refrigerant used for cooling, transformers**

PUE - Power Usage Effectiveness

$$PUE = \frac{Total\ facility\ energy\ consumption}{IT\ energy\ consumption} = \frac{IT\ energy\ consumption + cooling + \ auxiliaries}{IT\ energy\ consumption}$$

Group for hot and humid climate (HH) - 0A, 1A, 2A and 3A countries

Year	2025	2027	2029	2031
Existing colocation data centre to host data	PUE ≤ 1.5 **PUE for HH ≤ 1.7**	PUE ≤ 1.4 **PUE for HH ≤ 1.6**	PUE ≤ 1.3 **PUE for HH ≤ 1.5**	PUE ≤ 1.2 **PUE for HH ≤ 1.4**
New data centre building	*By design:* PUE ≤ 1.4 **PUE for HH ≤ 1.6** *During ramp up period of operation (min 3 years):* PUE ≤ 1.5 **PUE for HH ≤ 1.7**	*By design:* PUE ≤ 1.3 **PUE for HH ≤ 1.5** *During ramp up period of operation (min 3 years):* PUE ≤ 1.4 **PUE for HH ≤ 1.6**	*By design:* PUE ≤ 1.2 **PUE for HH ≤ 1.4** *During ramp up period of operation (min 3 years):* PUE ≤ 1.3 **PUE for HH ≤ 1.5**	*By design:* PUE ≤ 1.1 **PUE for HH ≤ 1.3** *During ramp up period of operation (min 3 years):* PUE ≤ 1.2 **PUE for HH ≤ 1.4**

Cooling efficiency ratio (CER)

The cooling efficiency ratio (CER) is noted as R_{CE} is the ratio of the total amount of heat removed annually from the data centre in kWh and the energy consumption (annually) of the cooling systems in kWh

$$R_{CE} = \frac{Q_{removed}}{E_{cooling}} = \frac{E_{heat}}{E_{cooling}} = \frac{E_{IT}+E_{losses}}{E_{cooling}} \quad [\%]$$

E_{losses}: include all electrical losses (electrical energy of UPS, energy storage, transformers, power cables, lighting) and the equipment use to transfer the heat outside of DC boundaries in case of waste heat reuse.

	Year	2025	2027	2029	2031
Existing colocation Data Centre to host data	CER or RCE	≥ 2.5	≥ 2.9	≥ 3.8	≥ 5.7
New Data Centre building	By design	≥ 2.9	≥ 3.8	≥ 5.7	≥ 10
	During ramp up period of operation (min 3 years)	≥ 2.5	≥ 2.9	≥ 3.8	≥ 5.7

Water Usage Effectiveness (WUE)

Data centers typically use water for their cooling systems and to a lesser extent, for air humidification, which is often necessary to maintain the required environmental conditions around the servers.

For cooling systems, water consumption is particularly high at data centers with adiabatic cooling.

$$WUE = \frac{Water\ consumption\ of\ the\ data\ center}{energy\ consumption\ of\ IT\ equipment}$$

[Liter / kWh]

Year	2025	2027	2029	2031
Water usage effectiveness	≤ 1.5 L/kWh	≤ 1 L/kWh	≤ 0.5 L/kWh	≤ 0.2 L/kWh

KPI values

		2025	2027	2029	2031
Existing colocation Data Centre to host data	**PUE**	≤ 1.5 HH : ≤ 1.7	≤ 1.4 HH : ≤ 1.6	≤ 1.3 HH : ≤ 1.5	≤ 1.2 HH : ≤ 1.4
	WUE	≤ 1.5 L/kWh	≤ 1 L/kWh	≤ 0.5 L/kWh	≤ 0.2 L/kWh
	REF	≥ 50 %	≥ 60 %	≥ 70 %	≥ 80 %
	CER	≥ 2.5	≥ 2.9	≥ 3.8	≥ 5.7
	ITEUsv	≥ 50 %	≥ 60 %	≥ 70 %	≥ 80 %
New data centre building - By design / after 3 years of operation	**PUE**	≤ 1.4 / ≤ 1.5 HH : ≤ 1.6 / ≤ 1.7	≤ 1.3 / ≤ 1.4 HH : ≤ 1.5 / ≤ 1.6	≤ 1.2 / ≤ 1.3 HH : ≤ 1.4 / ≤ 1.5	≤ 1.1 / ≤ 1.2 HH : ≤ 1.3 / ≤ 1.4
	WUE	≤ 1.5 L/kWh	≤ 1 L/kWh	≤ 0.5 L/kWh	≤ 0.2 L/kWh
	REF	≥ 50 %	≥ 60 %	≥ 70 %	≥ 80 %
	CER	≥ 2.9 / ≥ 2.5	≥ 3.8 / ≥ 2.9	≥ 5.7 / ≥ 3.8	≥ 10 / ≥ 5.7
	ITEUsv **after 3 years**	≥ 50 %	≥ 60 %	≥ 70 %	≥ 80 %

HH : Hot and Humid climate (ASHRAE climate zones 0A,1A, 2A, 3A)

Award criteria

Scenario #1: In some countries the public authority specifies the **minimum performance threshold** for an offer to be eligible and the choice is then **driven by the price →** The minimum performance values are those recommended in the Guideline.

Scenario #2: For other countries, the performances can be surpassed by minimum values, making offers competitive → In that case, the policymakers could make use of the award criteria set in *Annex 2: Award criteria for tenders*.

KPI	Points	Weighting
Energy management **(PUE)**	From 2 to 1.2 scored on 5 points	30 %
Cooling efficiency ratio **(CER)**	From 2.5 to 10 scored on 5 points	20 %
Water consumption **(WUE)**	From 2 to 1.2 L/kWh scored on 5 points	20 %
Renewable energy ratio **(REF)**	From 50% to 90% scored on 5 points	20 %
Utilization ratio of servers: **IT equipment utilization for servers (ITEUsv)**	From 30% to 70% scored on 5 points	10 %

THANK YOU

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Energy Reused Factor (ERF – Waste Heat Recovery)

The KPI used for waste heat is the Energy Reuse Factor (ERF) defined in the standard ISO/IEC 30134-6.

Data centres shall measure the heat that is used or reused outside of the data centre boundary, and which substitutes partly or totally energy needed outside.

When waste heat recovery is in place, the ERF should meet the requirements :

Year	2025	2027	2029	2031
Energy reused factor	≥ 30%	≥ 40%	≥ 50%	≥ 60%

An assessment of the waste heat recovery possibility should be conducted for data centres with an installed or planned electrical power capacity of more than 1 MW, in order to evaluate the economic feasibility of the system.

Renewable energy factor (REF)

The renewable energy factor (REF) measures the ratio of renewable energy consumption over the total energy consumed by the data centre

$$REF = \frac{E_{ren}}{E_{DC}} = \frac{annual\ renewable\ energy\ consumption\ in\ kWh}{total\ annual\ energy\ consumption\ of\ the\ data\ centre\ in\ kWh} \quad [\%]$$

Year	2025	2027	2029	2031
Renewable energy factor	≥ 50%	≥ 60%	≥ 70%	≥ 80%

Note: this KPI should not be considered when assessing the resilience of a data centre to power outage. Indeed, locally produced renewable electricity is compatible for the REF KPI, as is renewable electricity from the electricity grid.

Utilisation rate of the IT equipment

Servers are far from being used all the time, leading to unnecessary purchase of new servers, inefficiency of the whole system and unnecessary materials. To maximise the running time of a server and its utilization rate, technics like virtualization may be used.

ITEUsv(t) is the average CPU utilization of all servers or a group of servers in a data centre at time t :

$$ITEU_{SV}(t) = \sum \frac{CUS_i(t)}{N}$$

CUSi(t) is the CPU utilization ratio of server i at time t (%);

N is the number of servers in a data centre or in a group running at time t.

	Year	2025	2027	2029	2031
Existing colocation Data Centre to host data	ITEUsv	≥ 50%	≥ 60%	≥ 70%	≥ 80%
New data centre building	After 3 years	≥ 50%	≥ 60%	≥ 70%	≥ 80%

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