U4E PROCUREMENT GUIDELINE FOR SUSTAINABLE DATA CENTERS AND COMPUTER SERVERS

About U4E:

DC Guideline:

7 July 2025 (Bangkok)

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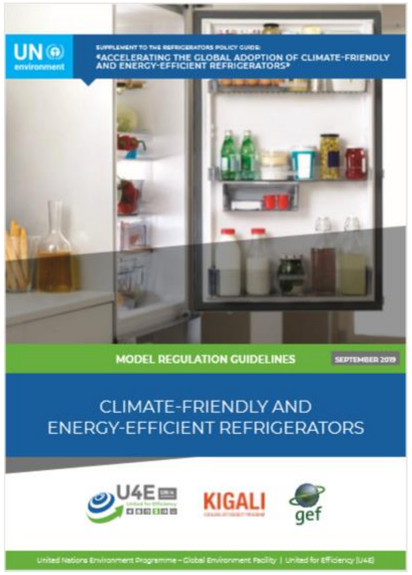
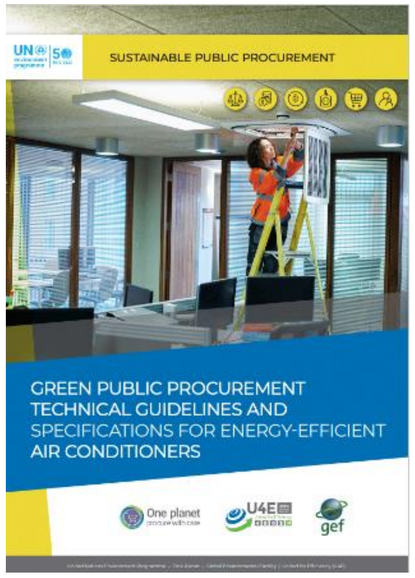
United for Efficiency (U4E)
Climate Change Division

U4E Tools and Guidelines

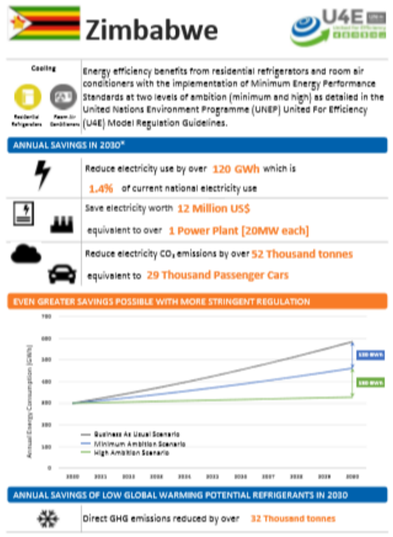
Model Regulations for MEPS and Labels



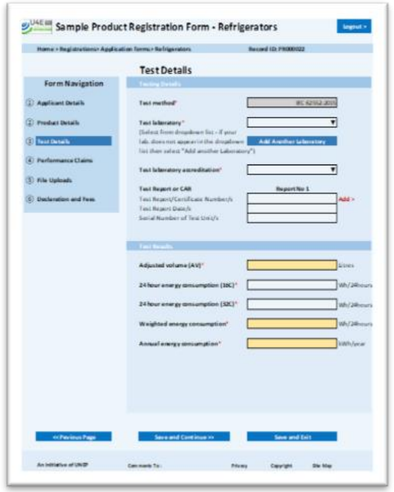
Sustainable Procurement Guidelines



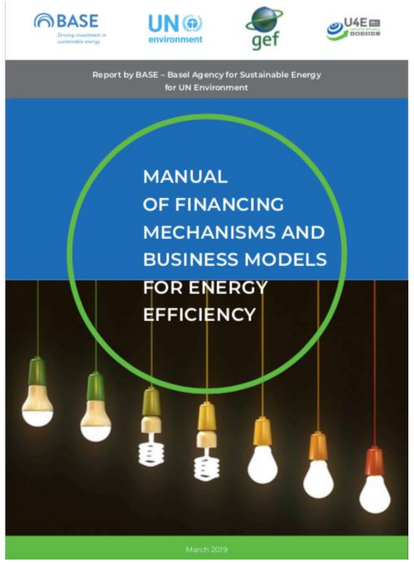
Country Saving Assessments for 156 Countries



Product Registration System Prototype and MVE Guidelines



Financial Mechanisms and more



Motor Systems

Indoor and Outdoor Lighting

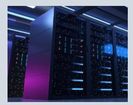
Refrigeration and Cold Chain

Air Conditioners

Distribution Transformers

Ceiling Fans

Heat Pumps



Data Centers

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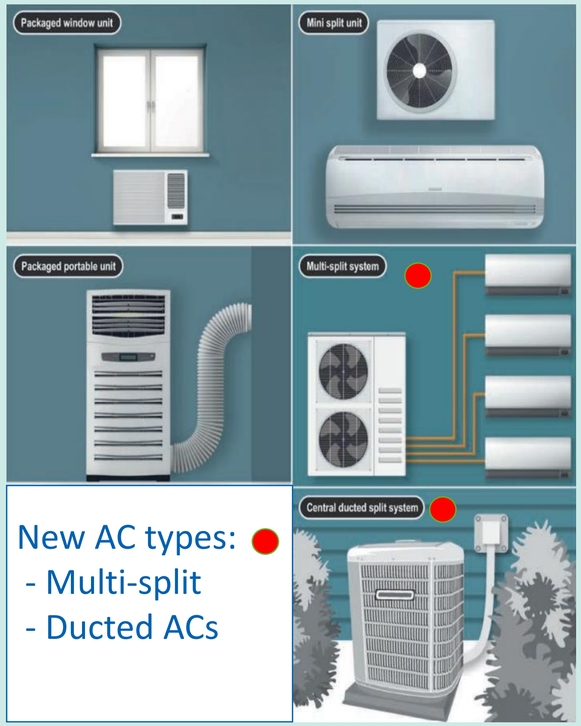
Upcoming Guidelines and Revisions

Finalizing in Q4 2025 New SPG for space heating and hot water systems using HPs and updated Model Regulations Guidelines (MRG) and Sustainable Procurement Guides (SPG) for air-to-air ACs & HPs

Main Model Regulation Updates - Air-to-Air ACs & HPs

- Expanded Scope
  - ✓ Multi-split
  - ✓ Ducted
- Higher Capacity
  - ✓ TBD (currently 16 kW)
- Add HSPF Heating Metric
  - ✓ Currently only APF
- Review efficiency levels
- New Performance Evaluation for Dehumidification
  - ✓ To identify super-efficient RACs
  - ✓ Will be used for higher efficiency tiers (sustainable procurement and endorsement labels, not for MEPS yet)



New AC types:
- Multi-split
- Ducted ACs

New Procurement Guide - Space & Water Heating using HPs

- Will cover water-based HPs (air; water; ground source; or waste heat)
- Includes:
  - ✓ HP requirements (efficiency, refrigerant, safety, warranty, etc.)
  - ✓ System components and conditions: emitters, buffer tank, controls, working temperatures, Life Cycle Cost, etc.

Procurement Guide Updates - Air-to-Air ACs & HPs

- Aligning with MRG revisions
  - ✓ Update efficiency levels
  - ✓ Add HSPF metric
  - ✓ Include Super-efficient RAC criteria

U4E Procurement Guideline for Sustainable Data Centers and Computer Servers

Procurement Guidelines: Data Centers and Servers

Intended for: Public procurers, technical experts, policy makers, and other stakeholders involved in procurement or eco-design of data center infrastructure.

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

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

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

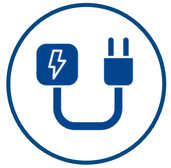
General content: simple set of recommendations on the technical requirements to be considered during any procurement process, to ensure that the overall product and the system installation are sustainable efficient and climate friendly.

How to use it ?

- To support the preparation of tender documents issued by both governments and the private sector — for example, when selecting a data hosting provider or planning the construction of a new data center.
- As a reference for developing policies that incorporate sustainable criteria.

Further reading

Sustainable Challenges for Data Centers



Electricity required to run the **IT equipment** itself typically account for **40% to 70% of total energy used**. Servers operate 24/7, consuming electricity in active and passive mode

Cooling is the second highest energy consumption in DT, **typically accounting for 30% to 50% of total energy used** (including air conditioners, fans, dehumidifiers, and pumps) **and using Refrigerants**. The main goal is to remove waste heat form data centre servers and ancillary equipment

Depending on the cooling system of a Data Center, the facility might require **access to an abundant and secure source of clean water** (some types of cooling systems at around 2 litres per kWh). This high demand could be **challenging for many regions where water is scarce**.

While **transitioning energy sources to renewables is crucial**, it is equally important that the production of **green energy is not monopolized by Data Center operators**.

Energy Requirements Related to Cooling

- Power usage effectiveness (**PUE**)

$$PUE = \frac{Total\ Facility\ E.Consump.}{IT\ E.Consump.}$$

Type of DT	2025	2027	2029	2031
Existent	≤ 1.5 HH : ≤ 1.7	≤ 1.4 HH : ≤ 1.6	≤ 1.3 HH : ≤ 1.5	≤ 1.2 HH : ≤ 1.4
New	≤ 1.4 HH : ≤ 1.6	≤ 1.3 HH : ≤ 1.5	≤ 1.2 HH : ≤ 1.4	≤ 1.1 HH : ≤ 1.3

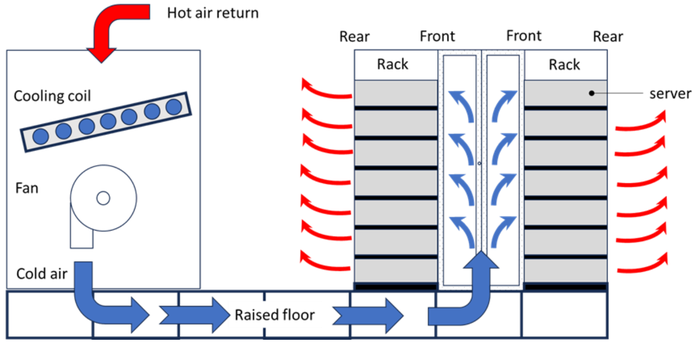
- Cooling effectiveness ratio (**CER**), includes the consumption from fans, pumps, compressors, etc.:

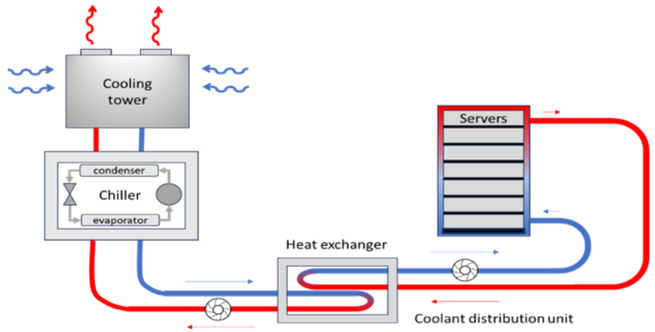
$$CER = \frac{Heat\ Removed.}{Cooling\ Consumption.}$$

Type of DT	2025	2027	2029	2031
Existent	≥ 2.5	≥ 2.9	≥ 3.8	≥ 5.7
New	≥ 2.9	≥ 3.8	≥ 5.7	≥ 10

- Cooling system design technologies, IT room cooling design and efficiencies of individual equipment

Air cooling





Liquid cooling

Energy Requirements Related to Cooling

- Water Usage Effectiveness (**WUE**)

$$WUE = \frac{Water\ Consumption}{IT\ E.Consump.}$$

Type of DT	2025	2027	2029	2031
Existent	≤ 1.5 L/kWh	≤ 1 L/kWh	≤ 0.5 L/kWh	≤ 0.2 L/kWh
New	≤ 1.5 L/kWh	≤ 1 L/kWh	≤ 0.5 L/kWh	≤ 0.2 L/kWh

- Location of Data Centers:
  - ✓ Enables free cooling and improves cooling system efficiency
  - ✓ Water availability
  - ✓ Renewable energy access
- Renewable energy factor (REF)

$$REF = \frac{Renewable\ Energy\ Used}{Total\ Energy\ Consumed}$$

Type of DT	2025	2027	2029	2031
Existent	≥ 50 %	≥ 60 %	≥ 70 %	≥ 80 %
New	≥ 50 %	≥ 60 %	≥ 70 %	≥ 80 %

Refrigerant Requirements

- HFCs are still widely used in Data Centers, including R-134a and R-410A, but alternatives exist
- Ozone Depletion Potential **(ODP) shall be 0**
- It is encouraged that Global Warming Potential (GWP) of **refrigerants used in the Data Center for cooling equipment to be < 10**
- Must comply with the Kigali Amendment and national HFC regulations
- While some refrigerants may comply with GWP limits (e.g., HFO), the Guidelines discourage the use of those that could be classified as polyfluorinated alkyl substances (PFAS) and instead encourage the adoption of **natural refrigerants**

Other Requirements

- IT equipment energy efficiency for servers
- Server efficiency
- Data storage efficiency
- Power supply efficiency (UPS)
- Idle state efficiency
- Waste heat recovery
- Resilience of data centers
- Modularity
- Operating temperature and humidity range for servers
- CPU power management criteria
- Utilization rate of IT equipment (ITEUsv)
- Environmental Sound Management

THANK YOU

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Sustainable Energy Challenges for Data Centers:

Although data centre infrastructure is essential for modern societies, it is **highly energy intensive**.

The primary energy consumption in a data centre is the electricity required to run the IT equipment itself (power servers, network equipment, lighting, air distribution fans, etc), typically **accounting for 40 to 70% of total energy used**.

A server operates 24/7, consuming electrical power in active and passive mode. For countries that lack a stable or adequate electricity supply system, data centre operators are captive to backup and alternative power supply, which increases the cost of operation and CO_2 emissions.

If the Internet was a country, it would be the **sixth biggest** electricity consumer on the planet, **consuming up to 7% of the global electricity consumption**

Several thousand large-scale data centres exist worldwide, with around 67 million hosted servers

They emit **200-250 MtCO2e annually** (which includes production emissions); the use phase is responsible for 90% of the GHG emissions

Data centres **consumed an estimated 460 TWh in 2022, or around 2% of global electricity use. This will be up to 10% by 2030 [needing +700 new large power plants]**

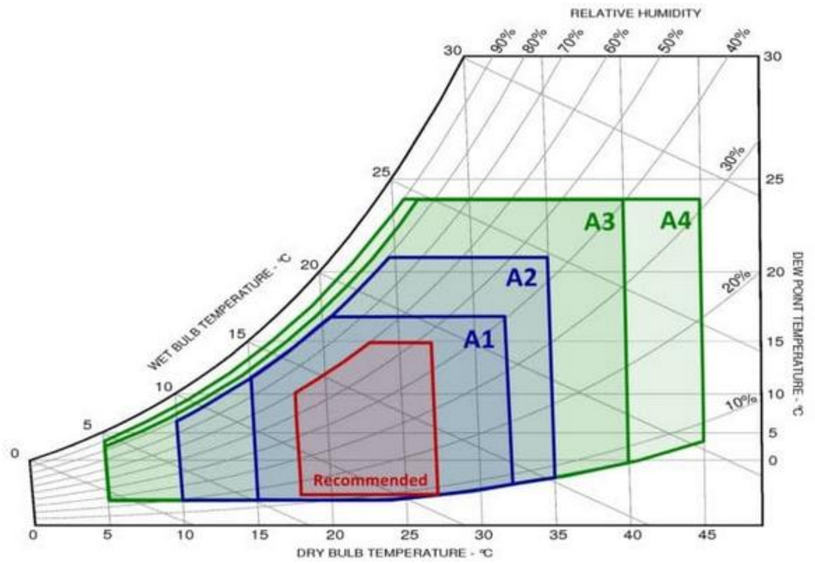
- *In July 2023, the Greater London Authority said that new housing projects in West London could be **blocked for more than a decade**, because data centers have taken up all the electricity capacity.*
- *Data centres **used almost a fifth of Ireland's electricity in 2022**, new figures reveal. This is the same amount used by all urban homes during the same period.*

Sources : *https://www.unep.org/resources/emerging-issues/growing-footprint-digitalisation*
Data centres, energy efficiency, and energy transitions – IEA, 24 November 2021
Electronic Devices and Networks Annex (EDNA), International Energy Agency
Electricity 2024 – Analysis and forecast to 2026, International Energy Agency

The role of cooling systems in Data Centres

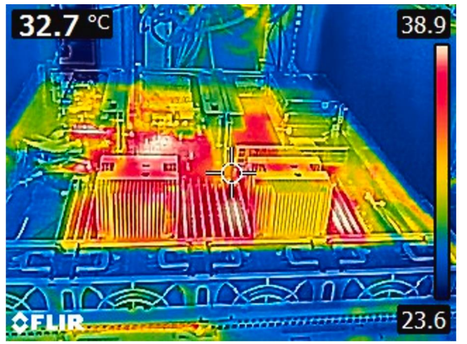
Servers consume electricity to process data, which is ultimately converted into heat.

Servers consist of electronic circuits and processors that are highly sensitive to temperature change and are designed to operate within a specific range of ambient conditions. Therefore, maintaining reliable, controlled ambient temperature and humidity conditions is critical. Outside their design temperature range, servers operate in low, inefficient mode and are subject to failure.

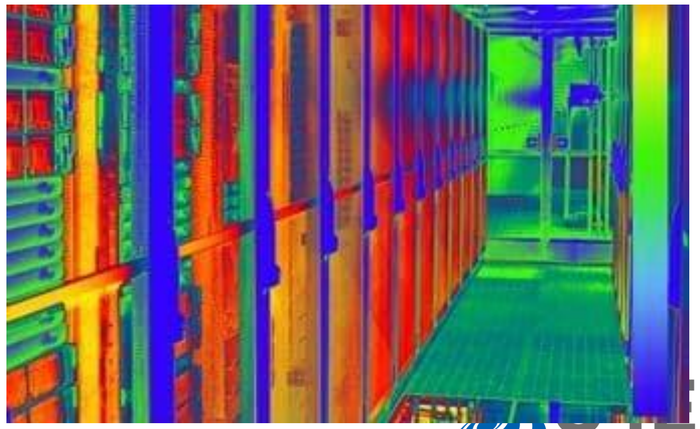


ASHRAE recommendations foir air cooling

Inside servers



At rack level (servers on top of each others)



The cooling system controls the temperature and humidity around the servers.

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Improvements to reduce cooling environmental impact

The most common way today to cool down a server is to blow fresh air on it. That fresh air is produced by a Computer Room Air Conditioning (CRAC) unit (similar to a regular household air conditioner)

1. Increase the temperature operating range of servers (legacy servers are requiring 19°C, newer ones can operate at 25°C)

2. IT room design (hot and cold aisles) to cool only the servers and not the entire IT room. The IT room structure should be modular.

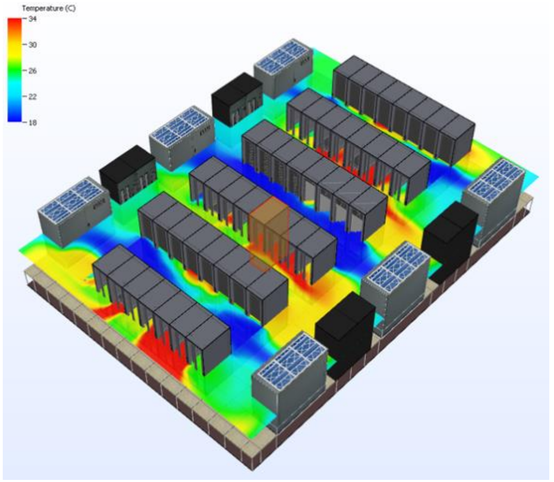
3. Increase the efficiency of existing cooling system (mostly air conditioning)

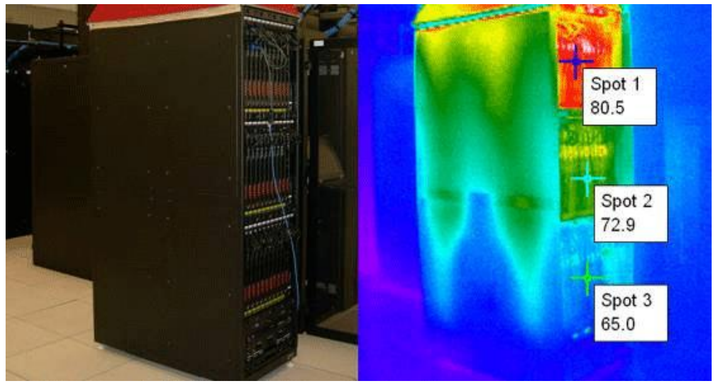
4. Change the cooling system to liquid cooling (if relevant)

5. Change the refrigerant to one with a low global warming potential (GWP)

6. Increase the use of free cooling/chilling with efficient fans

7. Pumps, fans and compressors should be monitored, use very efficient motors (IE4, IE5 or NEMA Super Premium electric motors) and incorporate variable frequency or speed controls (IE2)





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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. The markets driving demand will largely be China, India and Southeast Asian countries, such as Singapore, Indonesia and Malaysia

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. However, Sub-Saharan Africa continues to lag other regions in total capacity: there are more data centres in California than the whole of Sub-Saharan Africa.

Investments in Latin America are predicted to grow at a rate of 7.6 percent through until 2026. In 2019,