SUSTAINABLE PROCUREMENT GUIDELINES ON DATA CENTRES

LAUNCH WEBINAR

8 July 2025

U4E UN environment programme
United for Efficiency

Housekeeping instructions

Please post your questions in the chat during the presentations.

Speakers will answer questions during the Q&A session at the end of the Webinar.

This Webinar will be recorded and posted at U4E´s website, along with the presentations

Thank you for joining! Let's get started. ☺

Agenda

Duration (75 mins)	Agenda item	Presenter/Moderator
13:00 – 13:05	Housekeeping	Camila Luz Communications Specialist, U4E
13:05 – 13:15	Introductory Session	Patrick Blake Programme Manager, U4E
13:15 – 13:25	Presentation of U4E's Sustainable Procurement Guidelines on Data Centres	Soledad Garcia Energy Efficiency Specialist, U4E
13:25 – 13:40	Data Centre Sector Insights	Jay Dietrich Research Director, Sustainability, Uptime Institute Dr. Wei Liu Head of ESG Strategy, Alibaba Group
13:40 – 13:50	Government Perspectives: Advancing Data Centres Energy Efficiency Efforts	Alexandra Albuquerque Maciel Energy Efficiency Project Coordinator, Brazil's Ministry of Mines and Energy
13:50 – 14:10	Q&A	Patrick Blake
14:10 – 14:15	Wrapping up	Patrick Blake

Download the Guidelines

bitly

https://united4efficiency.org/resources/sustainable-procurement-guidelines-for-data-centres-and-computer-servers/

U4E UN environment programme
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Introduction

UNITED FOR EFFICIENCY

Accelerating the Global Transition to Energy-Efficient Lighting, Appliances and Equipment

What is U4E?

United for Efficiency (U4E) is a global initiative led by UNEP supporting developing and emerging economies to leapfrog to energy-efficient and climate-friendly lighting, appliances, and equipment.

Focus Areas:

- Minimum Energy Performance Standards (MEPS) and energy labels
- Policy support and implementation
- Market transformation and financing tools
- Capacity building and regional harmonization

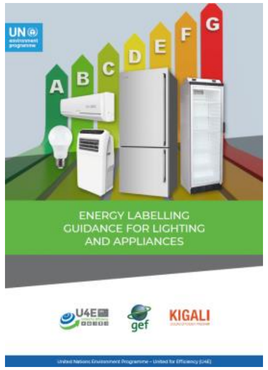
Global Reach:

- Projects in over 30 countries
- Aligned with UN SDGs, NDCs, incorporated in Global Cooling Pledge and Renewable Energy and Energy Efficiency Pledge.

www.united4efficiency.org

U4E Tools: Enabling the Shift to Energy Efficient Products

Country/Regional Savings Assessments

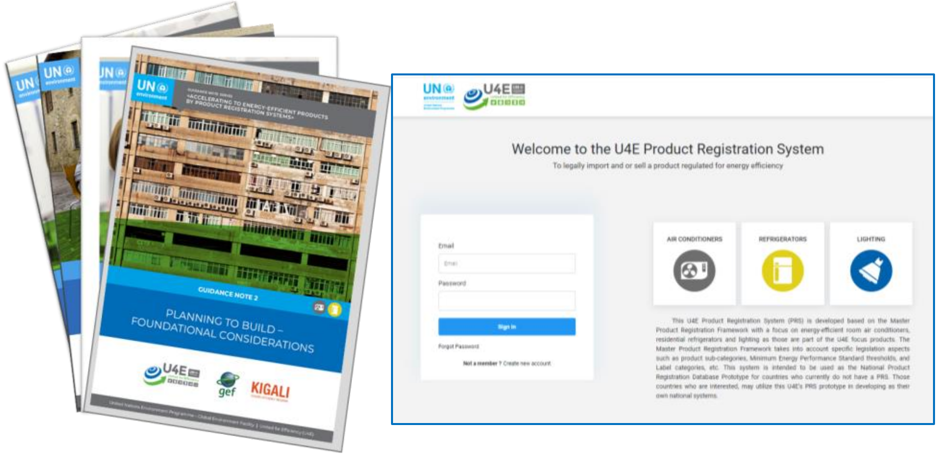


Labelling Guidance

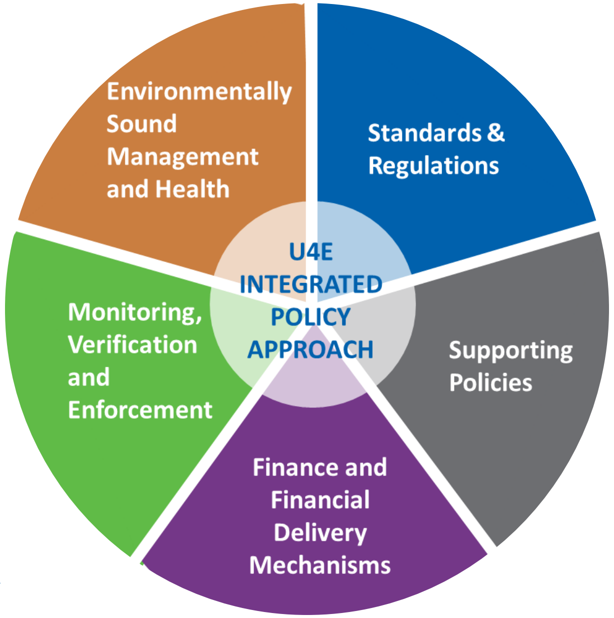
Market Assessment Protocols

Model Regulations

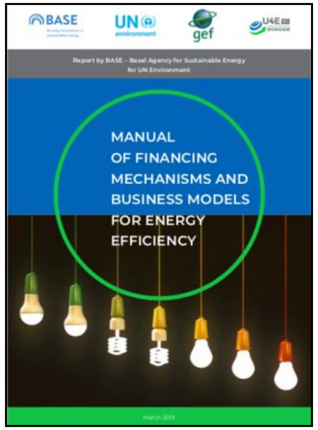
Sustainable Procurement Guidelines



Product Registration System (Guides & prototype)



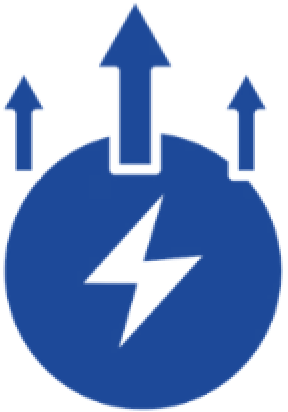
Compliance Guidance



Financial Mechanisms

All resources can be accessed from https://united4efficiency.org/resources/

Data Centres 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].

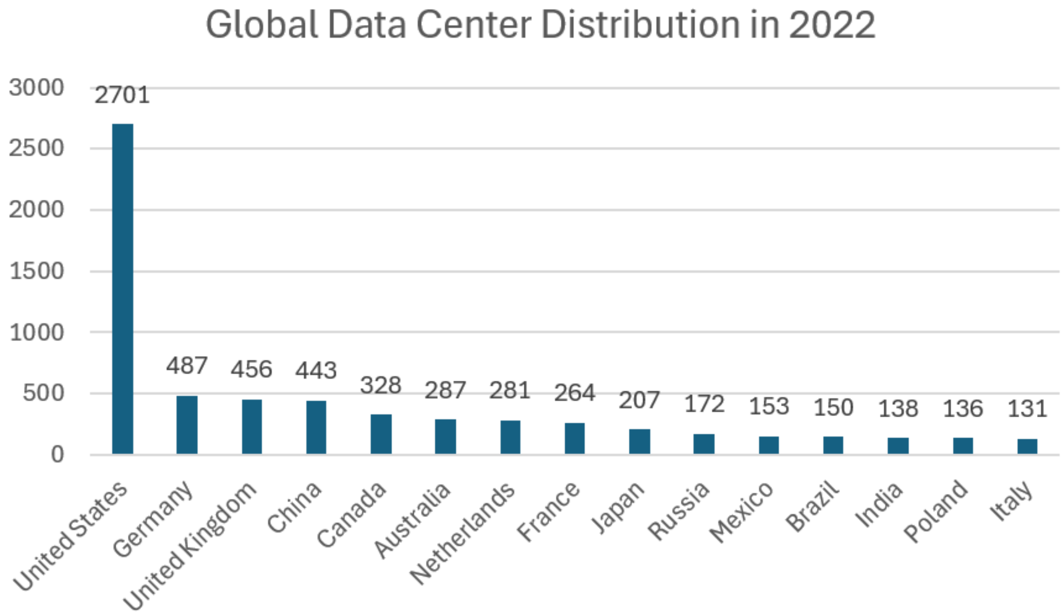
[1] International Energy Agency. Electricity 2024, Analysis and Forecast to 2026. https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks
[2]World Economic Forum. https://www.weforum.org/stories/2024/11/circular-water-solutions-sustainable-data-centres/
[3] International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

Benefits from Sustainable Data Centres

- **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

Current 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.

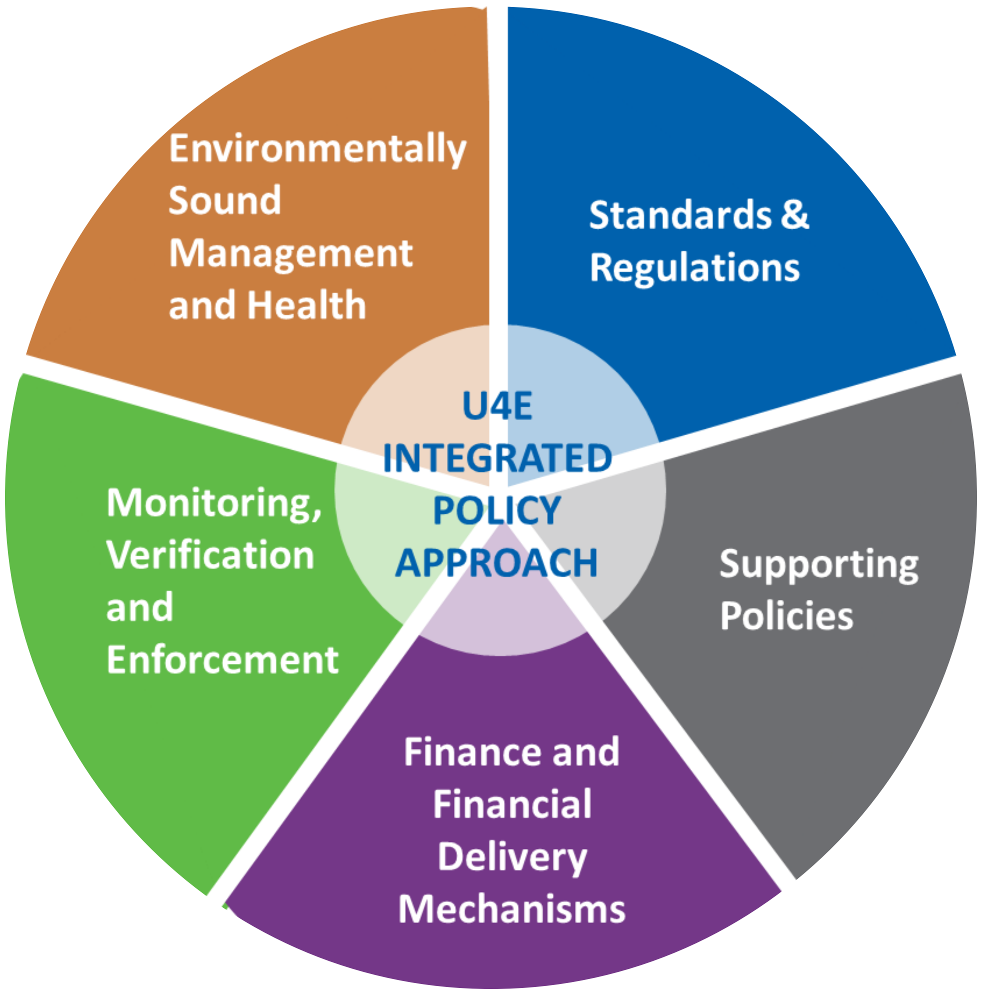


In the **Asia Pacific region**, demand for data centres is likely to **double to 5,880 megawatts (MW)** of installed capacity across the region by 2025.

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.

U4E Integrated Policy Approach – Considerations for Data Centres



Policy Pillar	Adaptation for Data Centres
Standards & Regulations	Set minimum energy performance standards, heat reuse requirements, modular efficient servers
Labels & Outreach	Introduce labelling requirements; recognition schemes (e.g., "low-carbon DC"); awareness campaigns
Finance & Delivery Mechanisms	Incentivise green retrofits, low-interest loans or grants, pay-for-performance contracts
Monitoring, Verification & Enforcement (MVE)	Mandate periodic reporting; third-party audits; penalise non-compliance – ensure credible data
Environmentally Sound Management	Require sustainable e-waste recycling, refrigerant management, safe end-of-life heat reuse plans

'Sustainable Procurement Guidelines for Data Centres and Servers' as our first resource in this space

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 centes 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.

Overview of the U4E Data Centre Guidelines

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.

Content Scope of the SPP Guidelines

Performance criteria for data centres and computer servers	*Operating conditions*
✓ Power usage effectiveness (PUE)	✓ Location of data centres
✓ Water usage effectiveness (WUE)	✓ Renewable energy factor (REF)
✓ Cooling effectiveness ratio (CER)	✓ Resilience of data centres
✓ IT equipment energy efficiency for servers	✓ Modularity
✓ Server efficiency	✓ Cooling design
✓ Data storage efficiency	✓ Operating temperature and humidity range for servers
✓ Power supply efficiency (UPS)	✓ CPU power management criteria
✓ Idle state efficiency	✓ 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

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

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.

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

[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

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.

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 %

Q&A

Learn More about U4E and Explore our Publications

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Find out tools, policy guides and policy briefs, webinars, model regulations, country assessments and news releases on our official website.

https://united4efficiency.org/

U4E Website

Check our Publications

Download our **Model Regulation Guidelines**, **Sustainable Procurement** and other publications.

Model Regulation Guidelines

Sustainable Procurement

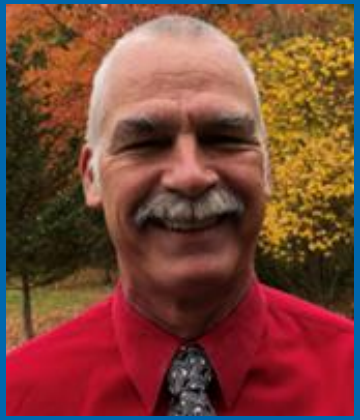
THANK YOU

Contact: unep-u4e@un.org

U4E United for Efficiency

Data Center Sustainability: A Whole Systems View

UNEP Green Procurement Practices Guidance Launch



Jay Dietrich Research Director Sustainability and Energy

July 2025

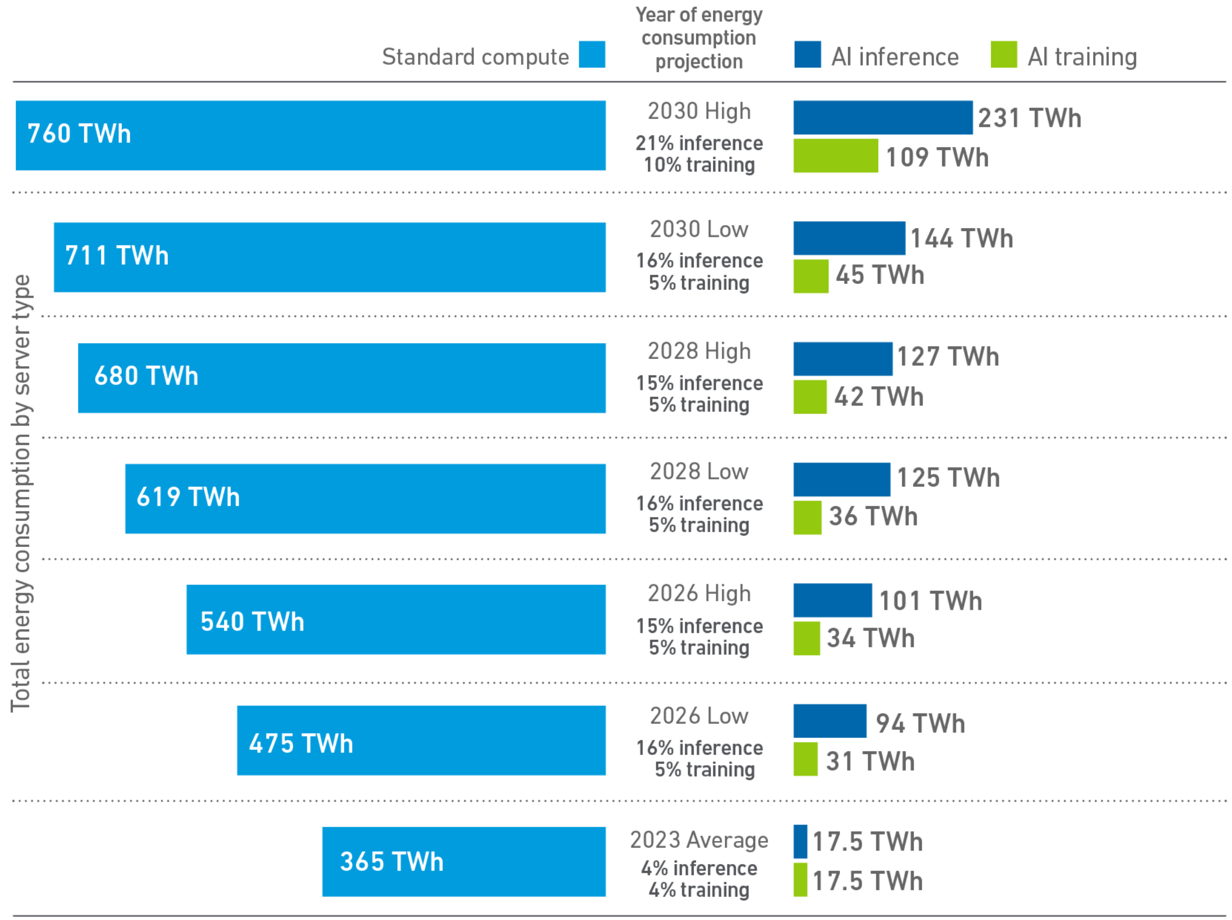
Distribution of Compute Types as DCs Grow

- AI compute represents 20%-30% of energy consumption in 2030
  - 20-25% of AI energy use is for training
  - 75-80% of AI energy use is for inference

- Standard compute and HPC likely represent 70%-80% of 2030 energy consumption

- Approximately 80% of DC energy use will likely support transactional workloads in 2030

Estimates of total global DC energy consumption 2023 to 2030



SOURCE: DELOITTE INSIGHTS, ELECTRIC POWER RESEARCH INSTITUTE, GOLDMAN SACHS, LAWRENCE BERKELEY NATIONAL LABORATORY, SCHNEIDER

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All estimates in this presentation are subject to a high degree of uncertainty

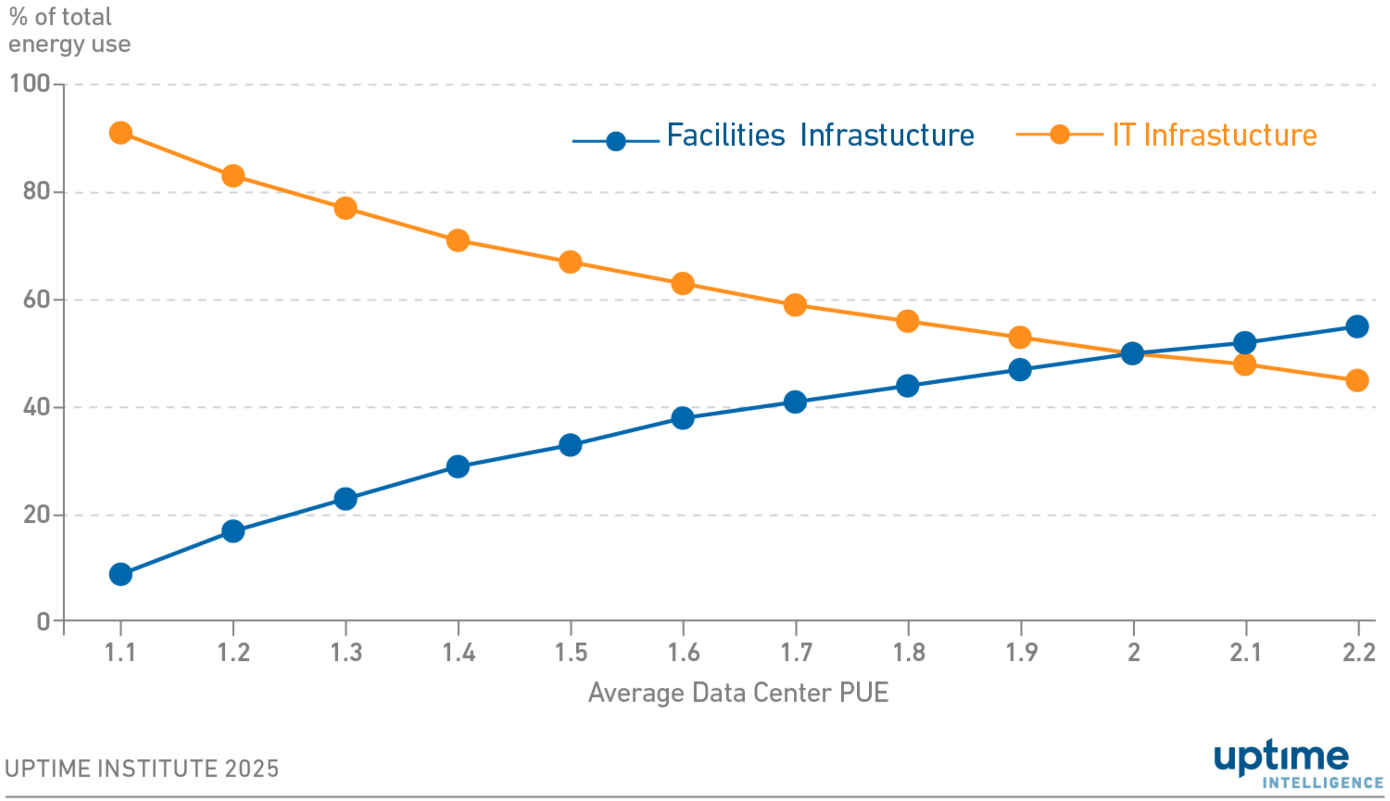
An Efficient Data Center Depends on Efficient IT and Facilities Infrastructure

IT Infrastructure is the majority of data center energy use at PUE<1.3

Efficiency represents a significant untapped energy resource:

- 50% of EU data centers use more energy for cooling than they do to run the IT.
- Over 50% of operators (globally) do not have IT infrastructure utilization objectives

Operators need to get serious about data center efficiency



Facilities Efficiency – Minimize PUE and WUE

Choose data centers with new chiller/cooling system designs

- Maximize use of free cooling (automated, integrated systems) _
- Adiabatic spray or media cooling in water rich locations: WUE of 0.4 l/kwh or less.
- Pumped refrigerant in water-stressed or water-scarce regions

Elevate IT space temperature to as close to 27°C as possible

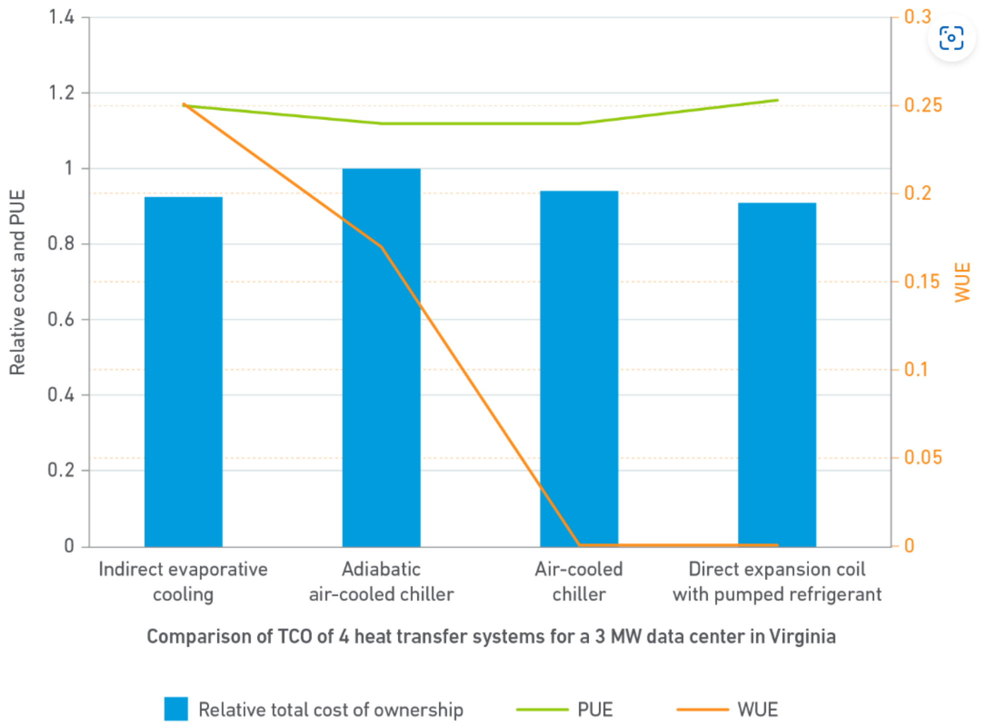
- Automate IT space temperature control where feasible
- Establish hot/cold aisle containment and install blanking plates

High efficiency, modular UPS

- Minimize number of transformers between UPS and IT racks

Cooling and electrical systems should be modular to enable matching cooling and electrical load to IT load

Efficient facilities infrastructure design and operation can save 10-20% on energy consumption



Comparison of TCO of 4 heat transfer systems for a 3 MW data center in Virginia

DATA SOURCE: VERTIV

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IT Efficiency – Maximize Infrastructure Work/Energy Value

Right-size server and storage infrastructure: 10-15% energy savings

- Match configurations (CPU, memory, storage) to workload
- Select the most efficient server (per SERT test) for the workload(s)

Deploy power management functions if compatible with workloads: up to 10% energy savings (ES)

Maximize utilization of server and storage products: up to 50% ES

Initiate a 4- to 5-year refresh cycle: 1 new server to 3 to 5 old

- Utilize automated workload placement/management tools
- Deploy capacity optimization methods on dedicated storage systems

Emphasize software efficiency for software designs and procurement: energy savings up to 20%

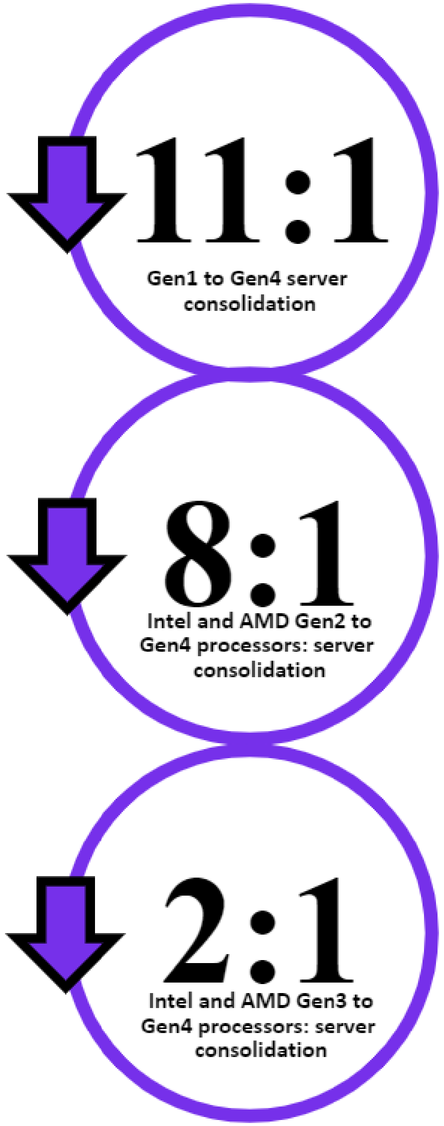
Maximizing the IT infrastructure utilization minimizes energy and water use, expense, capital, and space.

Refresh/Consolidation Ratio

Gen1 to Gen 4 CPU

Gen2 to Gen 4 CPU

Gen3 to Gen 4 CPU



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Advancing Data Centres EE Efforts – Brazil

Alexandra Maciel
Energy Efficiency Project Coordinator
Department of Information, Studies and Energy Efficiency

Impacts in the headquarters

There are currently 163 data centers installed in Brazil (which ranks 13th in the world)

2–3% of national energy consumption

The Energy Research Company (EPE) estimates that only with the new projects registered with the MME, an additional demand of **2.5 GW will be generated by 2037** , which would imply **US$ 23.5 billion** in investments in transmission (30 thousand km of lines and 82,000 MVA) to support these centers without overloading the National Integrated System.

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PUE (Power Usage Effectiveness)

$$PUE = \frac{Energy\ Consume\ of\ the\ entire\ dataCenter}{\text{Energy demand of the Datacenter´s IT equipment}}$$

International standards define 3 categories of PUE depending on where the measurement of the energy consumption of IT equipment is carried out:

- PUE1: The measurement is performed at the UPS output;
- PUE2: Measurement is performed at the output of the power distribution unit (PDU);
- PUE3: Measurement is performed at the PDU rack output.

Ideally, the PUE standard for Datacenter´s energy efficiency requirements should be PUE3.

PUE is a dimensionless indicator of Energy Efficiency, being the most used as a reference for data center´s infrastructure in international experience.

PUE (Power Usage Effectiveness)

- PUE is an efficiency measure focused on DC infrastructure, not IT equipment;
- Currently, DC PUE usually ranges from 2 for older and smaller DCs to 1.2 or less for newer and more modern DCs;
- The PUE depends on the DC processing load. Since this type of infrastructure is usually designed to reach maximum load between 3 and 5 years, the PUE reported by the agents is usually the design PUE, considering maximum load;
- The PUE depends on the bioclimatic region and the DC operating temperature (usually around 20°C). The higher the temperature of the region is in relation to the DC operating temperature, the more efficient the cooling system needs to be.

PUE (Power Usage Effectiveness)

In the reference " *Sustainable Procurement Guidelines for Data Centers and Servers (draft)* " minimum PUE rates are the main recommendation of *United for Efficiency (U4E)* , as can be seen in the table below:

Table 2: **Minimum PUE requirements**

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

In the proposal, the minimum PUE rates for DCs vary according to:

- Year;
- Whether the DC is new or existing;
- For operating time (minimum ramp-up of 3 years);
- Bioclimatic region. If the region is very hot and humid according to international or national classification standards – Hot and Humid (HH) per ASHRAE 169.

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PUE (Power Usage Effectiveness)

Google achieved an average PUE of 1.21 across the six company´s data centers, with the most efficient achieving a PUE of 1.13, with measurements of:

- Demand response;
- Thermal insulation strategies;
- Efficiency of refrigeration equipment; and
- Air renewal.

Diagnosis carried out by CBCS/UFSC for the DEO (Operational Energy Development) Project identified the efficiency in the Data Centers evaluated in SP:

- **Average PUE of 1.52**

ITEEsv (IT Equipment Energy Efficiency for servers)

$$ITEEsv = \frac{\Sigma\, Max\ Server\acute{}s\ performance\ i}{\Sigma\ \mathrm{Max\ Server\acute{}s\ energy}\ consume\ i}$$

ITEEsv metric , established in the ISO/IEC 30134-4 standard, is an important reference for evaluating the **energy efficiency of IT equipment (servers)** within DCs.

ITEEsv 's main intention is to ensure that servers operate with maximum possible energy efficiency, contributing to a more conscious and sustainable use of energy resources.

The higher the measured value of ITEEsv , the more efficient the DC's IT equipment is.

In addition to PUE, it is important to evaluate minimum energy efficiency requirements that use metrics focused on IT equipment, as is the case with ITEEsv

Redata

***Anticipates the benefits of tax reform for data centers, IF*:**

- **All demand for electrical energy met through supply contracts or self-production from generation projects using non-fossil sources ;**
- **Present PUE- Power Usage Effectiveness equal to or less than 1.5 ;**
- **Commitment to adopting strategies and initiatives in favor of the circular economy**

Specific criteria must also be foreseen in the Brazilian Sustainable Taxonomy

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THANKS

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