CODE OF CONDUCT
DATA CENTRES

The European Commission's science and knowledge service

Joint Research Centre

The European Programme for Energy Efficiency in Data Centres:

The Code of Conduct

European Commission

Why Data Centre Energy Consumption Matters?

Table 1. Energy consumption estimations and projections in TWh from a European, American and Global perspective.

Consumption (TWh)	Reporting Year	Reference
	EU consumption	
18.3	2000	Koomey [15]
41.3	2005	Koomey [15] and Whitehead [12]
56	2007	Bertoldi [18]
72.5	2010	Whitehead [12]
104	2020	Bertoldi [18]
	US consumption	
91	2013	Ni [10]
140	2020	Ni [10]
	Global consumption	
216	2007	Van Heddeghem [17]
269	2012	Van Heddeghem [17]

Why Data Centre Energy Consumption Matters?

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- The **ICT** (Information and Communication Technology) sector including data centres generates up to **2% of the global CO2 emissions**, a number on par to the aviation sector contribution and **data centres** are estimated to have the fastest growing carbon footprint from across the whole ICT sector. **ICT** sector nowadays consumes approximately **7% of the global electricity**, and it is forecasted that the share will rise up to **13% by 2030**.

- **Real-time video streaming, online gaming as well as mobile devices** (5G, IoT, etc.) already account for 60% of all data traffic, and it is predicted that this will rise to **80% by 2030**.

- The data centres are estimated to account for **1.4% of the global electricity consumption** and the compound annual growth rate (CAGR) has been estimated as 4.4

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Why the EU DC CoC?

- In **2007** there was no EU regulation or voluntary initiatives addressing the energy efficiency of data centres. This creates risk of confusion, mixed messages and uncoordinated activities.

- Need for independent assessment and coordination – tailored to European conditions such as the climate and energy markets regulation.

- The Code of Conduct provided a platform to bring together European stakeholders to discuss and agree on voluntary actions, which will improve energy efficiency.

EU Data Centre Code of Conduct

- Led by European Commission Joint Research Centre.
- Flexible mechanism to fill policy vacuum.
- Forum for industry, experts and MSs.
- Open and continuous dialogue on market and product performances.
- Identify and focus on key issues and agree solutions
- Set ambitious voluntary standards and commitments

Aims

To ***raise awareness*** among managers, owners, investors, with targeted information and material on the opportunity to improve efficiency.

To provide an ***open process and forum*** for discussion representing European stakeholder requirements.

To create and provide an ***enabling tool for industry*** to implement cost-effective energy saving opportunities.

To develop a set of ***easily understood metrics*** to measure the current efficiencies and improvement.

To produce a ***common set of principles*** in harmonisation with other international initiatives.

To ***support procurement***, by providing criteria for equipment (based on the Energy Star Programme specifications, when available, and other Codes of Conducts), and best practice recommendation for complex systems.

Scope

The CoC covers:

- "DC" of all sizes – server rooms to dedicated buildings
- existing and new
- IT power and Facility power
- Equipment procurement and system design

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Participant

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Endorser

The CoC is for:

- **Participants**: Data centre owners and operators
- **Endorsers**: Vendors, consultants, industry associations

Participant Type

Type	Description
Operator	Operates the entire data centre from the physical building through to the consumption of the IT services delivered.
CoLo provider	Operates the data centre for the primary purpose of selling space, power and cooling capacity to customers who will install and manage IT hardware.
CoLo customer	Owns and manages IT equipment located in a data centre in which they purchase managed space, power and cooling capacity.
Managed service provider (MSP)	Owns and manages the data centre space, power, cooling, IT equipment and some level of software for the purpose of delivering IT services to customers. This would include traditional IT outsourcing.
Managed service provider in CoLo	A managed service provider which purchases space, power or cooling in this data centre.

Participation

- For existing data centres partnership application start with an initial energy measurement, and energy audit to identify the major energy saving opportunities.

- An **Action Plan** must be prepared and submitted, once the Action Plan is accepted the **Participant status** in granted.

- Participant must implemented the Action Plan according to the agreed time table. Energy consumption must be monitored regularly

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Metrics

- PUE represents the ratio of the total amount of energy used by a computer datacenter facility to the energy delivered to computing equipment:

PUE = Total energy entering the datacenter / Energy used by IT equipment inside the datacenter

- DCiE is a metric used to evaluate the power or energy efficiency of a datacenter. DCiE represents the ratio of the total amount of energy consumed by all IT equipment and resources to the entire energy consumption of a datacenter.

DCiE = 1 / PUE

Metrics

- To be a meaningful benchmark, PUE/DCiE should be measured on a regular basis and also on different days of the week and at different times of the day.

- In this way, operators will be able to check if adjustments you **made to your datacenter improved your energy efficiency** or not (here are some examples of online PUE calculators).

Metrics

The **PUE of a datacenter can be affected by some variables** that are specific for each site:

- Utilization rate of the datacenter facility (if the facility houses a lot of IT equipment, it will have lower PUEs than facilities not completely occupied by IT equipment).

- Age and design of the facility (usually, the newer the facility is, the more efficient and modern is the equipment in terms of design and, consequently, of energy consumption).

- Energy efficiency of the IT equipment (usually, newer IT equipment can handle greater workloads while reducing power consumption).

Metrics

The following table gives you an example of the relationship of PUE and DCiE (the typical value of PUE lies between 1.2 and 2.5, and the DCiE is inversely proportional to the PUE value).

PUE	Level of efficiency	DCIE
3.0	Very inefficient	33%
2.5	Inefficient	40%
2.0	Average	50%
1.5	Efficient	67%
1.2	Very efficient	83%

Source: https://www.42u.com/measurement/pue-dcie.htm

Best Practices

Category	Description
Entire Data Centre	Expected to be applied to all existing IT, Mechanical and Electrical equipment within the data centre.
New Software	Expected during any new software install or upgrade
New IT Equipment	Expected for new or replacement IT equipment
New Build or retrofit	Expected for any data centre built or undergoing a significant refit of the M&E equipment from 2011 onwards
Optional Practices	Optional (no background colour)

Best Practice Intent

- Core document of the CoC
- Neither a prescriptive nor exhaustive list of specific technologies
- Focussed on goals and processes
- Structured to allow the addition of new technologies
- Over 90 **mandatory Best Practices** to be implemented.

Best Practices for cooling - 1

Cooling	
Air Flow Management and Design	
5.1.1	Design – Hot / Cold aisle
5.1.2	Design – Contained hot or cold air
5.1.3	Design – Contained hot or cold air – Retrofit
5.1.4	Rack air flow management – Blanking Plates
5.1.5	Rack air flow management – Other Openings
5.1.6	Provide adequate free area on rack doors
5.1.7	Raised floor air flow management
5.1.8	Raised floor air flow management – obstructions
5.1.9	Design – Return plenums
5.1.10	Design – Raised floor or suspended ceiling height
5.1.11	Equipment segregation
5.1.12	Separate environmental zones
5.1.13	Separate environmental zones – Colocation or Managed Service Provider
5.1.14	Control of supplied air flow volumes
5.1.15	Installation of "Free Cooling"

Best Practices for cooling - 2

Cooling Management	
5.2.1	Scalable or modular installation and use of cooling equipment
5.2.2	Shut down unnecessary cooling equipment
5.2.3	Review of cooling before IT equipment changes
5.2.4	Review of cooling strategy
5.2.5	Review CRAC / AHU Settings
5.2.6	Dynamic control of building cooling
5.2.7	Effective regular maintenance of Cooling Plant

Best Practices for cooling - 3

Temperature and Humidity Settings	
5.3.1	Review and if possible raise target IT equipment intake air temperature
5.3.2	Review and increase the working humidity range
5.3.3	Expanded IT equipment inlet environmental conditions (temperature and humidity)
5.3.4	Review and if possible raise chilled water temperature
5.3.5	Consider technical areas of data centres as industrial space

Best Practices for cooling - 4

High Efficiency Cooling Plant	
5.4.2.1	Chillers with high COP
5.4.2.2	Cooling system operating temperatures
5.4.2.3	Efficient part load operation
5.4.2.4	Variable speed drives for compressors, pumps and fans
5.4.2.5	Select systems which facilitate the use of economisers
5.4.2.6	Do not share data centre chilled water system with comfort cooling
5.4.2.7	Do not allow non IT equipment to dictate cooling system set-points
5.4.2.8	Chilled water pump control strategy
5.4.2.9	Direct liquid cooling of IT devices

Best Practices for cooling - 5

Free and Economised Cooling	
5.4.1.1	Direct air free cooling
5.4.1.2	Indirect air free cooling
5.4.1.	Indirect water free cooling with CRAH and dry cooler or cooling tower
5.4.1.4	Indirect water free cooling with CRAC with integrated free cooling coil.
5.4.1.5	Indirect water free cooling with CRAH and free cooling chiller.
5.4.1.6	Indirect water free cooling with condenser water cooling chilled water
5.4.1.7	Alternative cooling sources

Best Practices for cooling - 6

Computer Room Air Conditioners	
5.5.1	Variable Speed Fans
5.5.2	Control on CRAC / CRAH unit supply air temperature.
5.5.3	Run variable speed CRAC units in parallel
5.5.4	Sequencing of CRAC units
5.5.5	Do not control humidity at CRAC unit
5.5.6	Cooling unit sizing and selection

This group has been created to accommodate the Code of Conduct for Data Centres Energy Efficiency.

The Data Centres Energy Efficiency CoC has been established in response to increasing energy consumption in data centres and the need to reduce the related environmental, economic and energy supply security impacts. The aim is to inform and stimulate data centre operators and owners to reduce energy consumption in a cost-effective manner without hampering the mission critical function of data centres. The Code of Conduct aims to achieve this by improving understanding of energy demand within the data centre, raising awareness, and recommending energy efficient best practice and targets.

This Code of Conduct is a voluntary initiative aimed to bring interested stakeholders together, including the coordination of other similar activities by manufacturers, vendors, consultants and utilities. Parties signing up will be expected to follow the intent of this Code of Conduct and abide by a set of agreed commitments.

For more information on *The European Code of Conduct for Energy Efficiency in Data Centre* download the brochure.

ICT CoC Data Centres Applicants

Participants Endorsers

Group Content

2020 Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency

Request group membership

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Results

__413__ DCs have requested Participant Status

__398__ DCs have been approved as Participant

__154__ organisations have at least one DC approved as Participant

In Europe we have DC Participants in 22 countries: Portugal, Spain, France, Italy, Switzerland, Austria, Romania, Greece, Hungary, Poland, Malta, Finland, Sweden, Denmark, Netherlands, Germany, Belgium, Luxemburg, UK, Norway, Turkey and Ireland.

Participants outside Europe: US, Mauritius

Geographical distribution

Geographical Zones	Countries	Temperature range (ºC)	RH range (%)	Average PUE	Nº of Data Centres
Nordic countries	Denmark, Finland, Norway, Sweden	18-26	20-80	**1.71**	13
UK and Republic of Ireland	England, Scotland, Wales, Northern Ireland, Republic of Ireland.	17-30	8-80	**1.83**	116
Northern/Central Europe	Austria, Belgium, France, Germany, Hungary, Luxembourg, Netherlands, Portugal, Poland, Switzerland	14-28	16-75	**1.72**	122
S. Europe/ Mediterranean	Gibraltar, Greece, Italy, Malta, Spain, Turkey, Monaco, Romania, Bulgaria	16-26	20-80	**2.00**	30
Non EU	Republic of Mauritius, US	-	-	**-**	5

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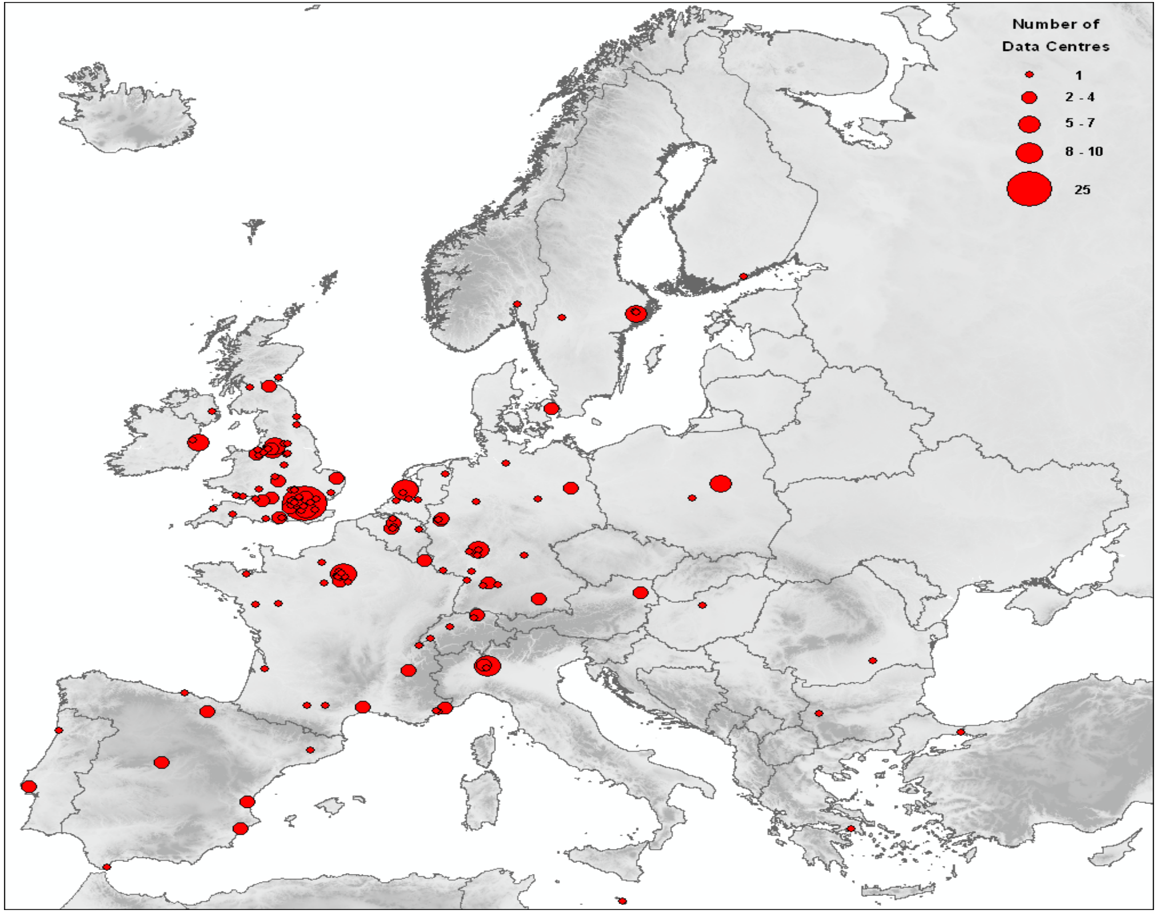
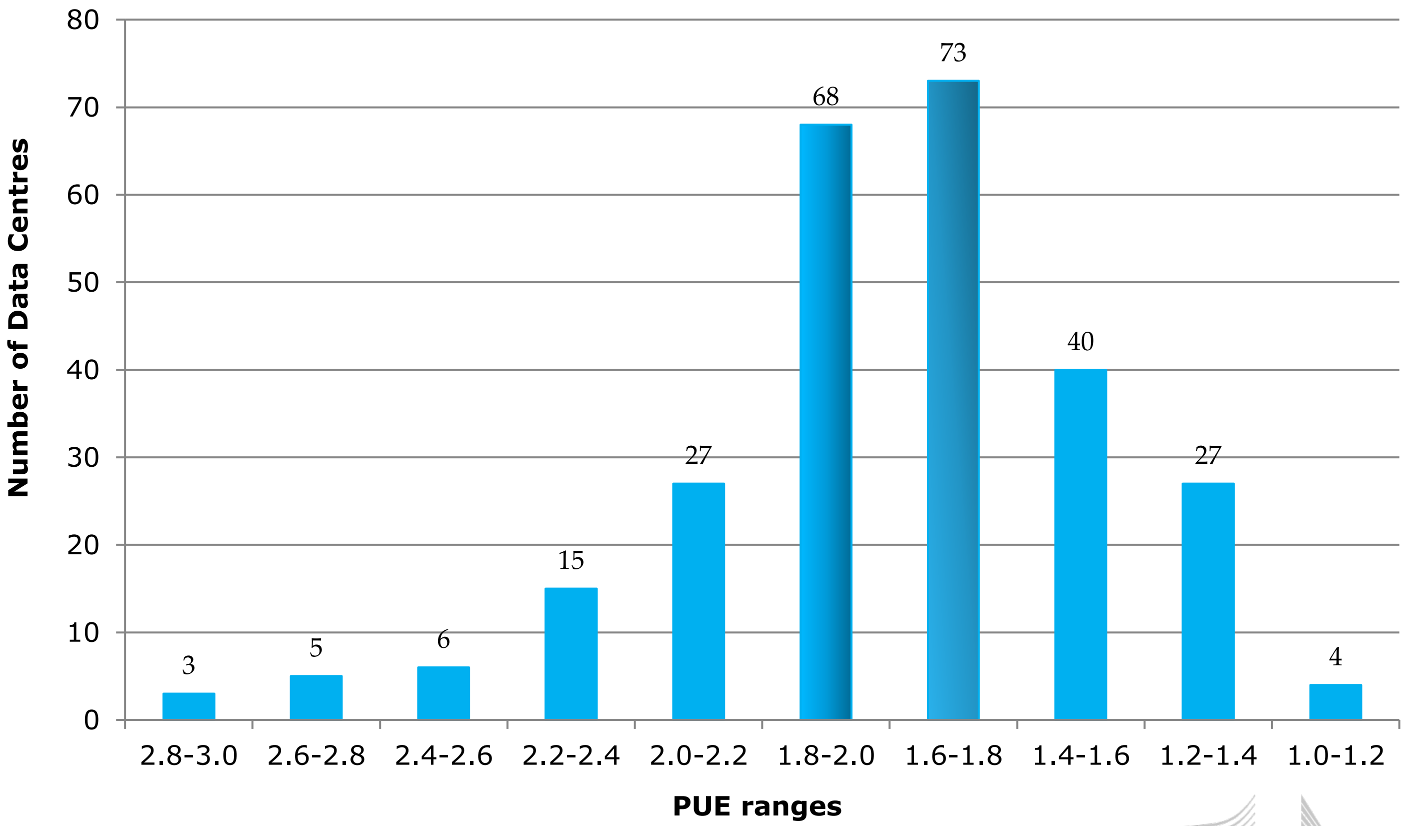

Number of
Data Centres
1
2 - 4
5 - 7
8 - 10
25

Data Centres per PUE range



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Conclusions

- Declining PUE year after year
- Encouraging results: PUE reaching an average of 1.8
- Some DCs below 1.2
- DCs located in Scandinavia and small and larger DCs performing better

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Thank You for Your Attention

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or visit

https://e3p.jrc.ec.europa.eu/communities/data-centres-code-conduct

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