This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649972.

# EURECA Training

## Module 8: The EU Code of Conduct for Energy Efficiency in Data Centres

Target Audience: Technical/DC

DATA CENTER eureca PROJECT

Version 2.0, 28 July 2017, Contact: https://www.dceureca.eu

# Agenda

- Starting questions
- Structure of the EURECA courses
- Learning outcomes
- Course contents
  - Introduction
  - EUCOC Documentation & Reporting Requirements
  - Endorser Application Process
  - Participant Application Process
  - Best Practices
  - Energy Saving Opportunities with PPI
- Starting questions to be answered
- References and further reading

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# Starting Questions

1. What timescales do the EU-JRC specify for confirmation of both “Endorser/Participation Applications?…

A. 10 Days/10 Days
B. 10/15 Days
C. 20/25 Days
D. 40/45 Days

2. How many best practices are there?

A. 54
B. 98
C. 153
D. 400

# Starting Questions

3. How different roles are there?

A. 10
B. 7
C. 5
D. 3

4. How many types of “data centre” are available on the EUCOC Participation Application Reporting Form?

A. 10
B. 7
C. 5
D. 15

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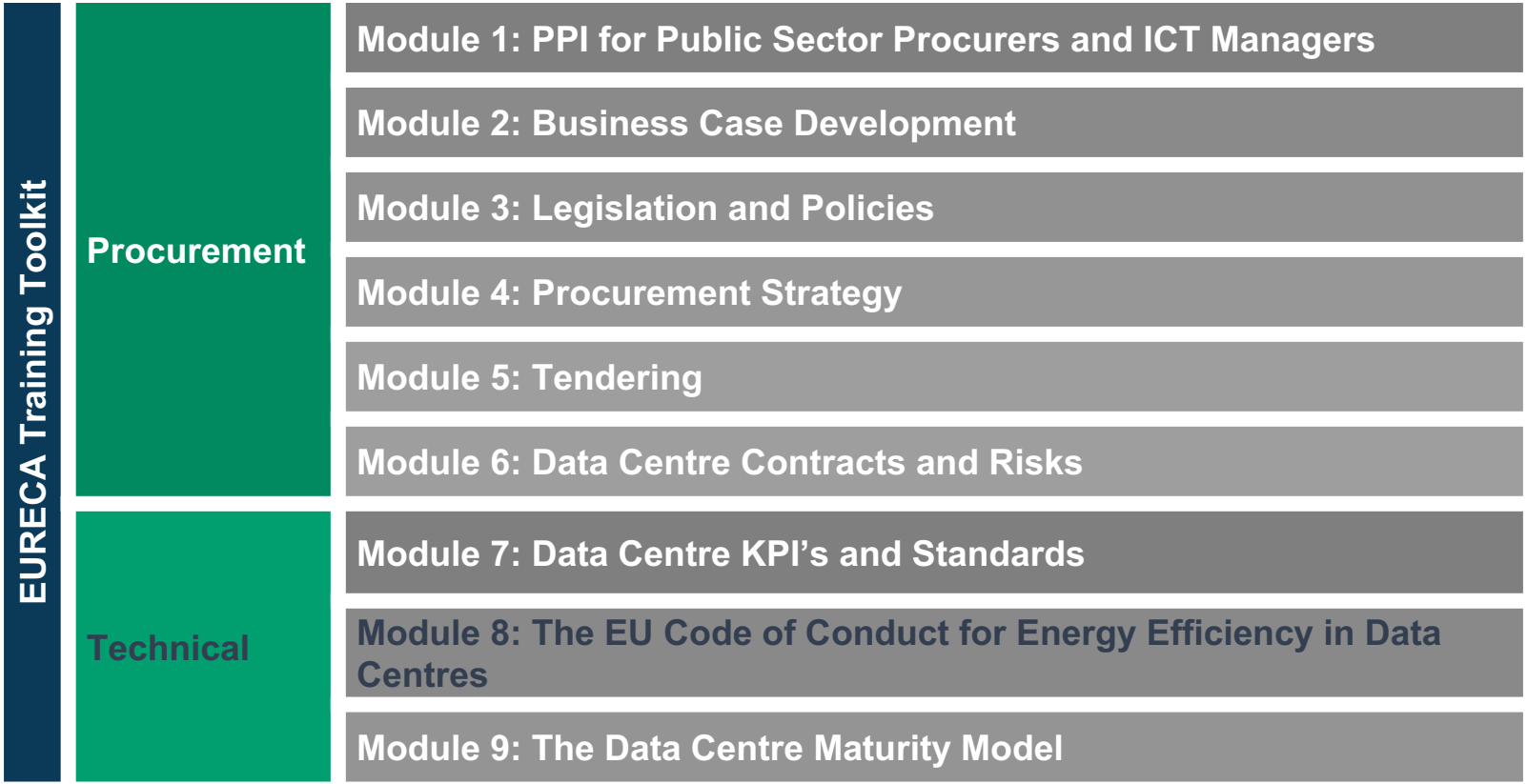
# Overview EURECA training KIT



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# Learning Outcomes

- Overview of EU Code of Conduct for Data Centres Website
    - Participant/Endorser Buttons
    - Location of EUCOC Documentation
- Review and Walkthrough of Endorser Application
- Review and Walkthrough of Participant Application
- Review and Walkthrough of Participation Application Spreadsheet
- Review of Potential PPI aspects of EUCOC

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  - Introduction
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  - Participant Application Process
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- Structure of the EURECA courses
- Learning outcomes
- **Course contents**
  - **Introduction**
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# Introduction

## EUCOC – Website Address:

http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/data-centres-energy-efficiency

# EUCOC – Participant/Endorser Lists

Red Bubble
Participants = List of Data Centres.
Endorsers = Supply Chain

# Introduction

Blue Bubble = Location of Documentation

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  - Introduction
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# EUCOC Documentation List

You can download a full set of EUCOC documentation as follows:

- Introductory Guide v3.1.2
- Reporting Form v7.2 OR v8.1 (Once Published)
- Endorser Guidelines v3.0.0
- Participant Guidelines v2.0
- 2016/2017 Best Practices Guidelines v7.1.2 or v8.1.0 (Once Published)
- These documents are free on the EUCOC website
- http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/data-centres-energy-efficiency

# Note on EN50600

- The EUCOC is also available as a technical report in the EN50600 series of Data Centre Design and Management Standards, this technical report is EN50600 TR 99-1
- Available from your national standards body shops (paid for)
- UK - http://shop.bsigroup.com/ProductDetail/?pid=000000000030334638
- DE: Not Available (5th Jan 2017)
- FR: Not Available (5th Jan 2017)
- NL: Not Available (5th Jan 2017)

# Types of EUCOC Involvement


- Participant
  - Data Centre owners and operators.
  - Coverage agreed to include defined location(s).
  - Commitment level (nature) specified at each location.
- Endorsers
  - Vendors, Consultants, Utilities, Government, Trade and Standards Bodies, Education Institutions…..
- Partial Participants

# Participant

- Existing DC's
  - 3 year Action Plan (To Implement Best Practices)
  - Audit to identify improvement opportunities
  - Provide Initial Energy consumption measure over 3 Months


- New DC's
  - ALL EXPECTED BEST PRACTICES TO BE IMPLEMENTED
  - Description of Best Practices to be adopted to achieve "*Best in Class*"

- *DG JRC will advise approval/rejection within **40** days*

# Participant


- Abide by General Principles as laid out in Annex A
- Measure, Monitor and Report as per Annex B
- Take actions in line with Annex C and the Best Practice Guidelines

# Annex A (1)

- A1.Data Centres are designed to minimise energy consumption whilst not impacting business performance.
- A2. Data Centre equipment is designed to allow the optimisation of energy efficiency while meeting the operational or service targets anticipated.
- A3. Data Centres are designed to allow regular and periodic energy monitoring.
- A4. Energy consumption of data centres is monitored; where data centres are part of larger facilities or buildings, the monitoring of the specific data centre consumption may entail the use of additional energy and power reporting equipment.

# Annex A (2)

- A5.Data Centres and their equipment are designed, specified and procured on the basis of optimising the Total Cost of Ownership (TCO) within the requirements for reliability, availability and serviceability.
- A6. When the Energy Star programme has set specifications for servers and other IT equipment, these specifications should be followed by Participants when procuring equipment. For UPS the specifications of the EU Code of Conduct on Energy Efficiency and Quality of AC Uninterruptible Power Supplies.
- A7.Data Centres should be designed to minimise the energy used, if any, to remove heat from the facility.

# Annex B2

- Participants of this Code of Conduct shall endeavour and make all reasonable efforts to ensure the following obligations:
- The following data should be collected monthly and reported annually in a data sheet to the European Commission DG JRC by 28th February at the latest for the previous year:
  - Energy Consumption for main IT equipment, if meters to provide the level of detail indicated in the definition (B1), Energy consumption at the UPS may be reported. A description of equipment included in the measured IT energy consumption should be provided.
  - Total Facility Energy Consumption. If more meters are installed, data should also be reported for these including a description of equipment included in the energy consumption.

# Annex B2

- Participants of this Code of Conduct shall endeavour and make all reasonable efforts to ensure the following obligations:

- IT Rated electrical load capacity of the facility
- Target inlet temperature for IT Equipment (Optional)
- External monthly average ambient temperature (Optional)
- External monthly average dew point temperature (Optional)

- B2. Input is provided for supporting the development of an IT productivity metric and a total energy productivity metric

# Annex C

- C.1 Role of Best Practices.
  - The Best Practice Guidelines is a full list of the identified and recognised data centre energy efficiency best practices within the Code of Conduct. The best practice list provides a common terminology and frame of reference for describing an energy efficient best practice, to assist *Participants and Endorsers* in avoiding doubt or confusion over terminology. Customers or suppliers of IT Services may also find it useful to request or provide a list of Code of Conduct practices implemented in a data centre to assist in procurement of services that meet their environmental or sustainability standards.
- C.2. Expected Minimum Practices
  - To help ensure that *Participants* to the Code of Conduct are recognised as having committed to a useful and substantial level of energy saving effort, a subset of the best practices are identified in the Guidelines as being the expected minimum level of energy saving activity for *Participation* status

# Endorser Approval

- General requirements:
  - Promote the Code
  - Promote the Best Practices
  - Develop products and solutions using the best practices
  - Utilise the Code to develop products and solutions to assist operators to meet the Code requirements.

- *DG JRC will provide approval/rejection notification within **45** days*

# Endorser Commitment

- Take on-going actions to contribute to improving energy efficiency by:
  - Manufacturers develop and introduce high efficiency products
  - Consultancies might develop guidelines to ensure that energy consumption is taken into account during the design process.
  - A trade association may develop an" Energy Efficiency Charter"
  - Vendors may develop guidelines to ensure that energy efficiency is designed into products
  - An educational establishment may promote awareness of the Code in training courses.

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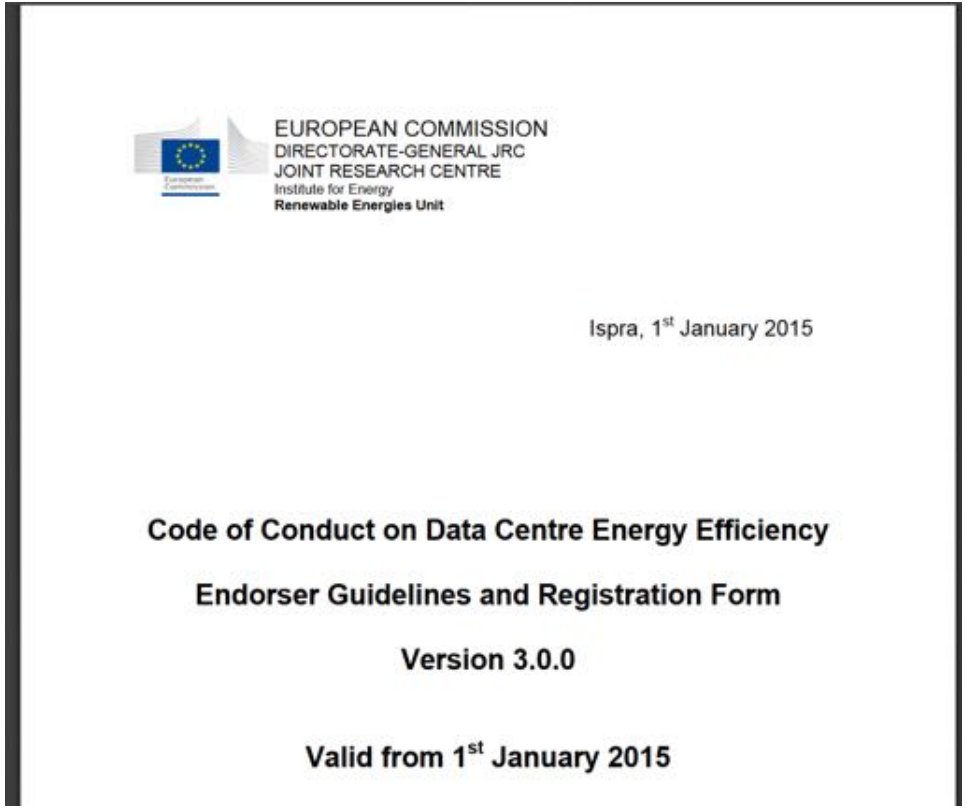
# EUCOC – Endorser Application Form (1)



EUROPEAN COMMISSION
DIRECTORATE-GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Energy
**Renewable Energies Unit**

Ispra, 1st January 2015

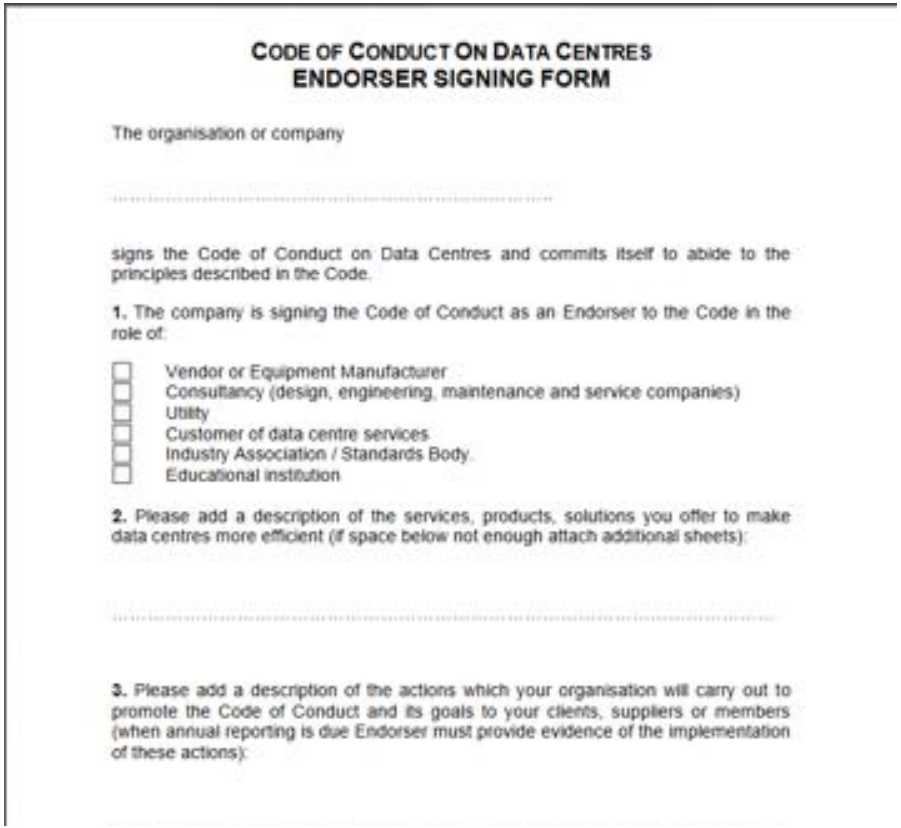
**Code of Conduct on Data Centre Energy Efficiency**

**Endorser Guidelines and Registration Form**

**Version 3.0.0**

**Valid from 1st January 2015**

# EUCOC – Endorser Application Form (1)



**CODE OF CONDUCT ON DATA CENTRES**
**ENDORSER SIGNING FORM**

The organisation or company

.....

signs the Code of Conduct on Data Centres and commits itself to abide to the principles described in the Code.

**1.** The company is signing the Code of Conduct as an Endorser to the Code in the role of:

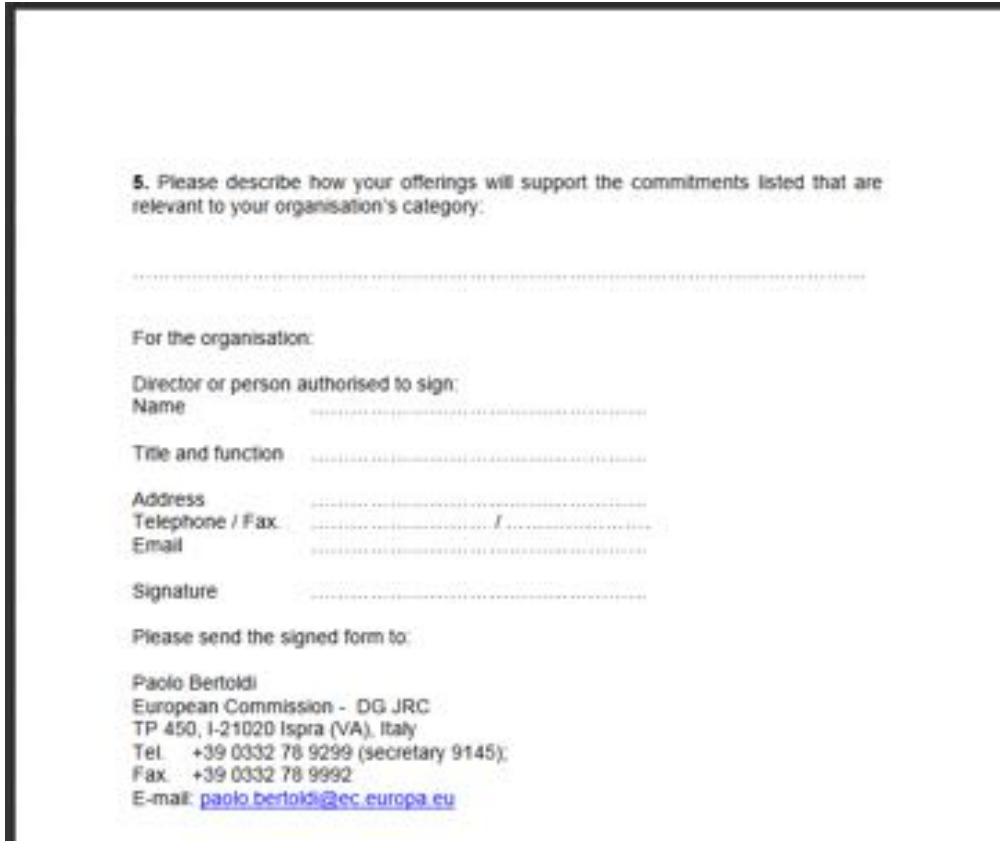
- ☐ Vendor or Equipment Manufacturer
- ☐ Consultancy (design, engineering, maintenance and service companies)
- ☐ Utility
- ☐ Customer of data centre services
- ☐ Industry Association / Standards Body
- ☐ Educational institution

**2.** Please add a description of the services, products, solutions you offer to make data centres more efficient (if space below not enough attach additional sheets):

.....

**3.** Please add a description of the actions which your organisation will carry out to promote the Code of Conduct and its goals to your clients, suppliers or members (when annual reporting is due Endorser must provide evidence of the implementation of these actions):

# EUCOC – Endorser Application Form (1)



**5.** Please describe how your offerings will support the commitments listed that are relevant to your organisation's category:

.....

For the organisation:

Director or person authorised to sign:
Name .....

Title and function .....

Address .....
Telephone / Fax .....
Email .....

Signature .....

Please send the signed form to:

Paolo Bertoldi
European Commission - DG JRC
TP 450, I-21020 Ispra (VA), Italy
Tel. +39 0332 78 9299 (secretary 9145);
Fax. +39 0332 78 9992
E-mail: paolo.bertoldi@ec.europa.eu

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# EUCOC – Participant Application Form (1)

EUROPEAN COMMISSION
DIRECTORATE-GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Energy
**Renewable Energies Unit**

Ispra, 20 November 2009

**Code of Conduct on Data Centres Energy Efficiency**
**Version 2.0**

**Participant Guidelines and Registration Form**

**Valid as from 1.1.2010**

# EUCOC – Participant Application Form (2)

## CODE OF CONDUCT ON DATA CENTRES
### SIGNING FORM

The organisation/company

.....

signs the Code of Conduct on Data Centres and commits itself to abide to the principles described by the Commitments and Monitoring section for the data centre it owns or operates. The company attach a detailed description of the efficiency best practices adopted, and the technical or economic justification why any expected practices cannot be adopted. The company is signing the Code of Conduct:

1. For a specific data centre located at:.....

Or

2. At corporate level, committing to have at least 40% of its data centres[16] to fulfil the present Code of Conduct.

The organisation, through regular update reports, will keep the European Commission DG JRC informed on the implementation of the Code of Conduct on Data Centres.

For the organisation
Director or person authorised to sign:
Name: .....

Managerial function: .....

Address .....
Tel. / Fax. ...../.....
Email .....

Signature .....

Please send the signed form to:
Paolo Bertoldi
European Commission - DG JRC

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  - Introduction
  - EUCOC Documentation & Reporting Requirements
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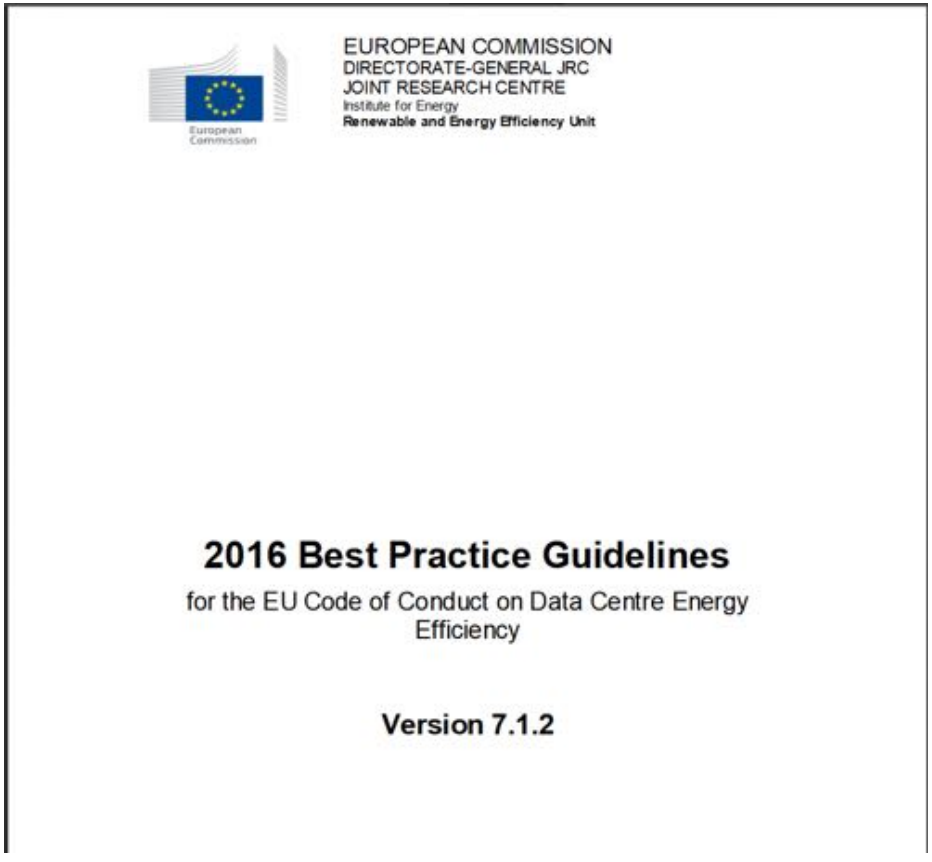
# Objectives – Best practices

At the end of this module you will be able to:

- Explain the format and purpose of the Best Practice Supplement
- State the minimum levels of energy management processes expected
- Describe the expected level of efficiency improvements and recommended timescales for the implementation of the best practices
- Continue the application process

# Best Practice Supplement



EUROPEAN COMMISSION
DIRECTORATE-GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Energy
**Renewable and Energy Efficiency Unit**

**2016 Best Practice Guidelines**

for the EU Code of Conduct on Data Centre Energy Efficiency

**Version 7.1.2**

# Best Practice Supplement

- A key part of the Code of Conduct.
- The full list of identified best practices.
- Applies to both *Participants & Endorsers.*
- Some Participants will also be *Endorsers.*

# Areas of Responsibility

- Not all applicants will be responsible for everything.
- Can Mark Y, N or Partial

| Area | Description |
|---|---|
| **Physical building** | The building including security, location and maintenance. |
| **Mechanical and electrical plant** | The selection, installation, configuration, maintenance and management of the mechanical and electrical plant. |
| **Data floor** | The installation, configuration, maintenance and management of the main data floor where IT equipment is installed. This includes the floor (raised in some cases), positioning of CRAC units and PDUs, basic layout of cabling systems (under floor or overhead). |
| **Racks** | The installation, configuration, maintenance and management of the racks into which rack mount IT equipment is installed. |
| **IT equipment** | The selection, installation, configuration, maintenance and management of the physical IT equipment. |
| **Operating System / Virtualisation** | The selection, installation, configuration, maintenance and management of the Operating System and virtualisation (both client and hypervisor) software installed on the IT equipment. This includes monitoring clients, hardware management agents etc. |
| **Software** | The selection, installation, configuration, maintenance and management of the application software installed on the IT equipment. |
| **Business practices** | The determination and communication of the business requirements for the data centre including the importance of systems, reliability availability and maintainability specifications and data management processes. |

# Applicant Roles

| Type | Description |
|---|---|
| Operator | Operates the entire data centre form 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 the IT Hardware. |
| CoLo Customer | Owns and manages the IT equipment located in a data centre in which they have purchased 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. |

# Applicant Roles

| | OO | CoLo P | CoLo C | MSP in Colo | MSP |
|---|---|---|---|---|---|
| Physical Building | Imp | Imp | Endorse | Endorse | Imp |
| M&E | Imp | Imp | Endorse | Endorse | Imp |
| DF/AF | Imp | Imp/End | Imp/End | Imp | Imp |
| R/RAF | Imp | Imp/End | Imp/End | Imp | Imp |
| IT Eqmt | Imp | End | Imp | Imp | Imp |
| OS/V | Imp | End | Imp | Imp | Imp |
| S/W | Imp | End | Imp | Imp/End | Imp/End |
| Business Practices | Imp | End | Imp | End | End |

# Potential Efficiency Improvements

- Data Centre Utilisation, Management & Planning
- IT Equipment & Services
- Cooling
- Data Centre Power Equipment
- Other Data Centre Equipment
- Data Centre Building
- Monitoring & Reporting
- Practices to become minimum expected
- Items under consideration

# Agreed Best Practices

- The Code recognises that not everything can be done immediately.
- Expected Minimum levels are colour coded

| 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 2010 onwards |
| Optional practices | Practices without a background colour are optional for participants |

# Agreed Best Practices

- A value is assigned.
- This not a SCORE!

| No | Name | Description | Expected | Value |
|---|---|---|---|---|
| 3.1.1 | Group involvement | Establish an approval board containing representatives from all disciplines (software, IT, M&E). Require the approval of this group for any significant decision to ensure that the impacts of the decision have been properly understood and an effective solution reached. For example, this could include the definition of standard IT hardware lists through considering the M&E implications of different types of hardware. This group could be seen as the functional equivalent of a change board. | Entire Data Centre | 5 |

# Status of Practices

- Applicants should state what the status is of each practice on the application form.

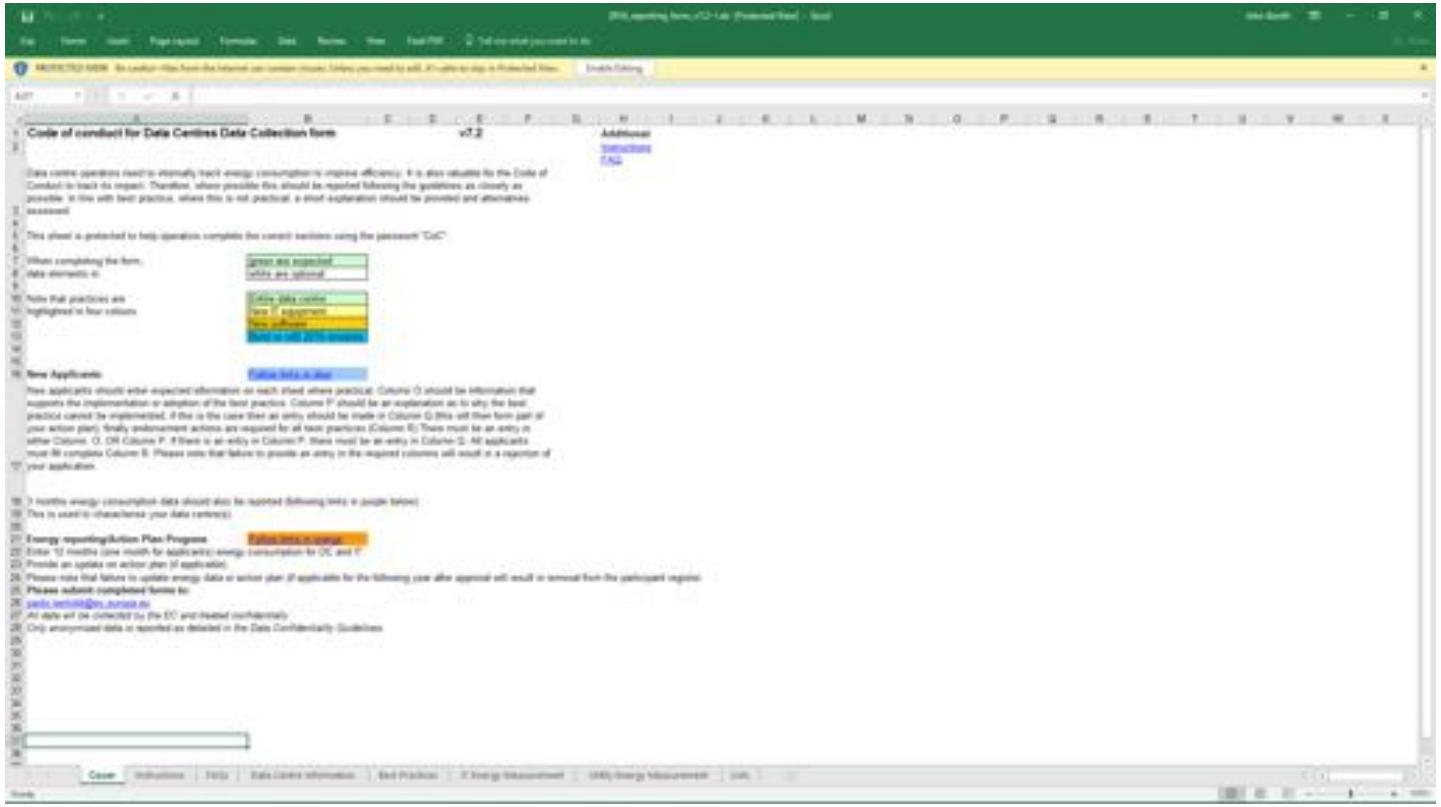
| Mark | Description |
|---|---|
| **No mark** | Not implemented, a reason why the practice is not applicable to the applicant should be provided if this is an expected practice. |
| **Committed Date** | Not yet implemented but a program is in place to implement the practice by the specified date. This should be within 36 months of the application date. |
| **I** | Implemented practice. |
| **E** | Endorsed practice, this practice cannot be implemented by the applicant as it is outside their area of responsibility but is endorsed to their suppliers or customers. |
| **I & E** | This practice is partially within the control of the applicant. The applicant has implemented the practice as far as practical and endorsed the practice to their customers or suppliers. Include a description of the actions taken to endorse the practice. |

# Minimum Energy Measurement

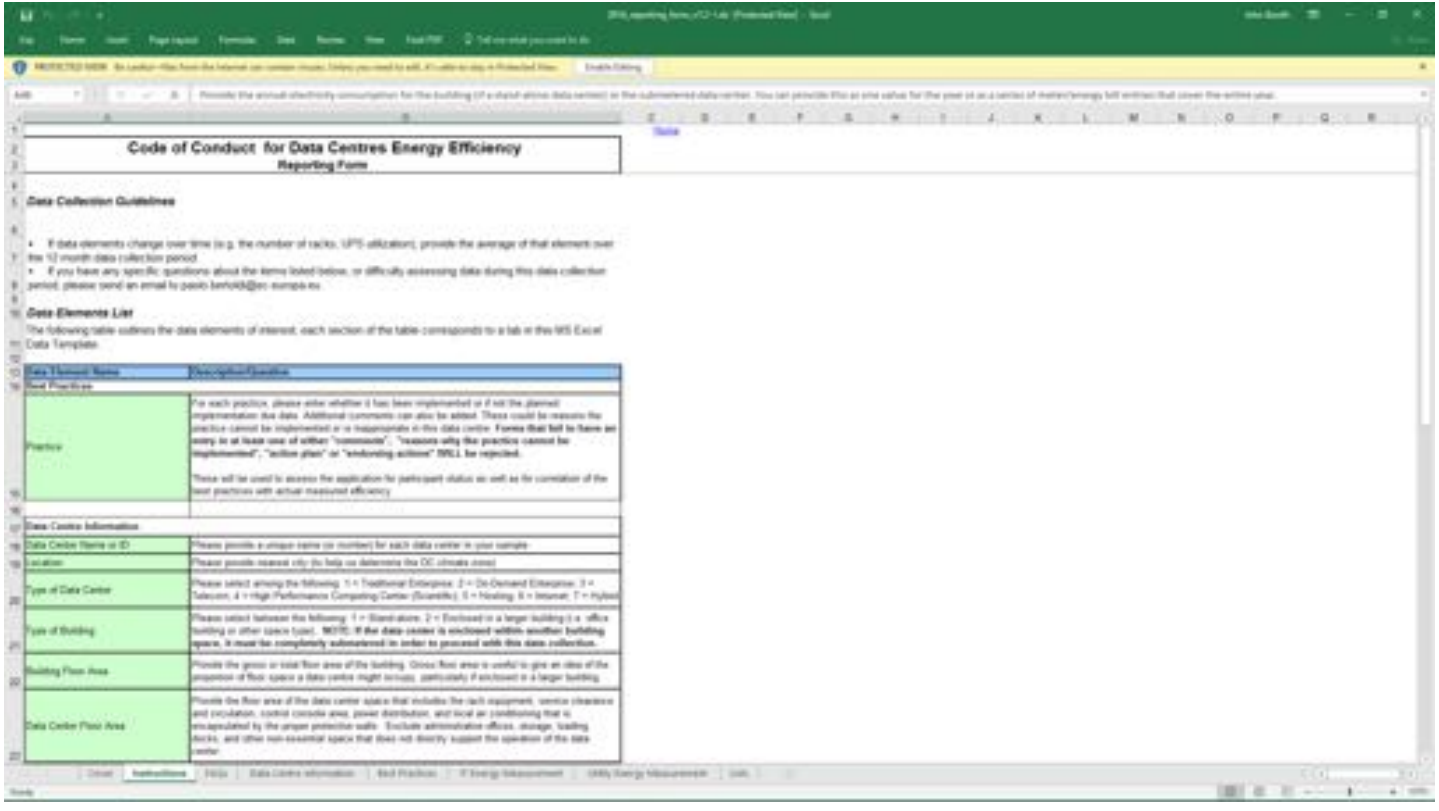
| No | Name | Description | Expected | Value |
|---|---|---|---|---|
| 9.1.1 | Incoming energy consumption meter | Install metering equipment capable of measuring the total energy use of the data centre, including all power conditioning, distribution and cooling systems. This should be separate from any non data centre building loads. Note that this is required for CoC reporting | Entire Data Centre | 3 |
| 9.1.2 | IT Energy consumption meter | Install metering equipment capable of measuring the total energy delivered to IT systems, including power distribution units. This may also include other power feeds where non UPS protected power is delivered to the racks. Note that this is required for CoC reporting. | Entire Data Centre | 3 |

- Mandatory
- IT Load Measured
- Facility Load Measured
- Code does not require: DCiE/PUE
- Basic Energy measurement is a starting point
- Rare

# EUCOC – EUCOC Best Practices Document (1)



# EUCOC – EUCOC Best Practices Document (2)



**Code of Conduct for Data Centres Energy Efficiency**
**Reporting Form**

***Data Collection Guidelines***

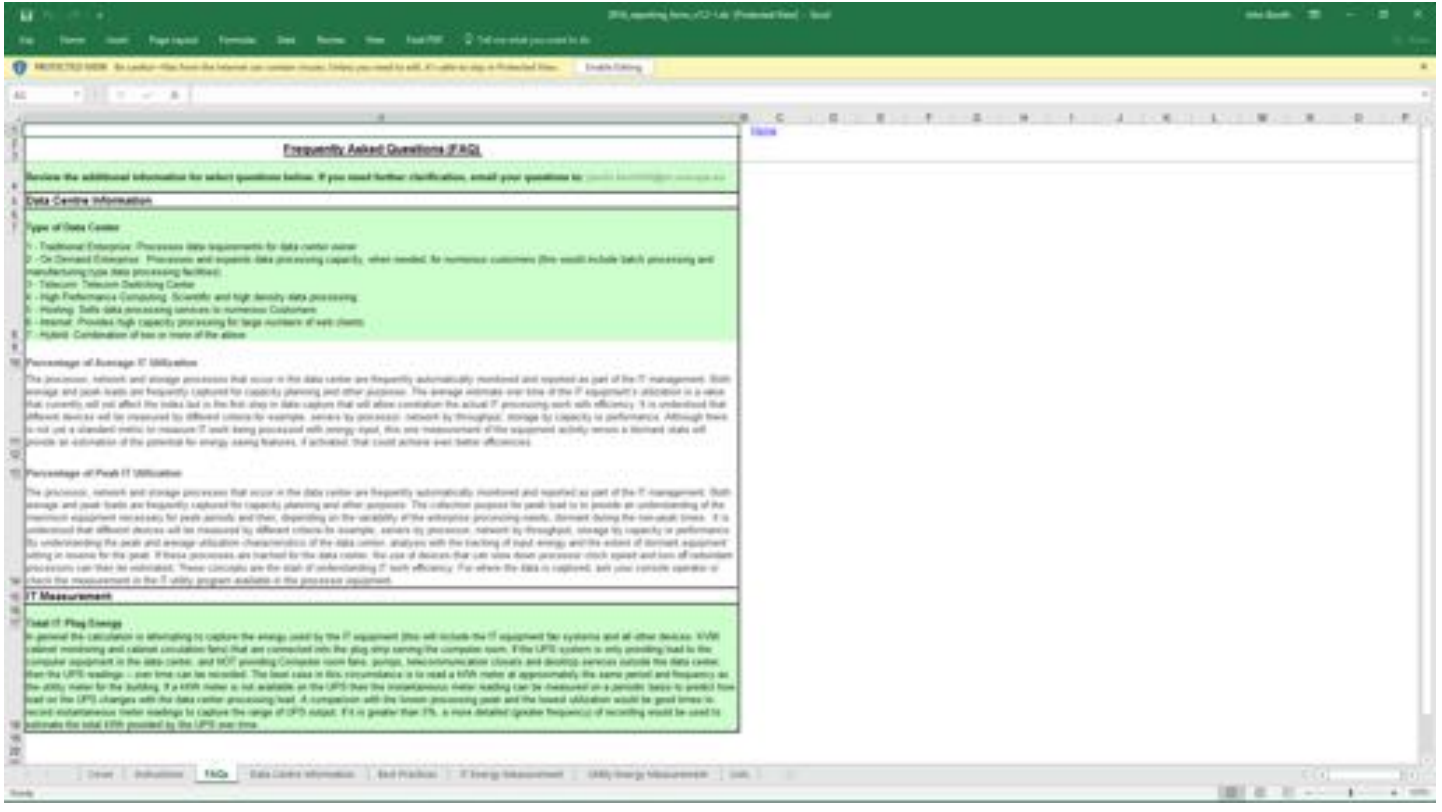
- If data elements change over time (e.g. the number of racks, UPS utilization), provide the average of that element over the 12 month data collection period.
- If you have any specific questions about the items listed below, or difficulty assessing data during this data collection period, please send an email to paolo.bertoldi@ec.europa.eu

***Data Elements List***

The following table outlines the data elements of interest, each section of the table corresponds to a tab in this MS Excel Data Template.

| Data Element Name | Description/Question |
|---|---|
| **Best Practices** | |
| Practice | For each practice, please enter whether it has been implemented or if not the planned implementation this data. Additional comments can also be added. Those could be reasons the practice cannot be implemented or is inappropriate in this data centre. **Forms that fail to have an entry in at least one of either "comments", "reasons why the practice cannot be implemented", "action plans" or "endorsing actions" WILL be rejected.** These will be used to assess the application for participant status as well as for correlation of the best practices with actual measured efficiency. |
| **Data Centre Information** | |
| Data Center Name or ID | Please provide a unique name (or number) for each data center in your sample |
| Location | Please provide nearest city (to help us determine the DC climate zone) |
| Type of Data Center | Please select among the following: 1 = Traditional Enterprise; 2 = On-Demand Enterprise; 3 = Telecomm; 4 = High Performance Computing Center (Scientific); 5 = Hosting; 6 = Internet; 7 = Hybrid |
| Type of Building | Please select between the following: 1 = Stand-alone; 2 = Enclosed in a larger building (i.e. office building or other space type). **NOTE: If the data center is enclosed within another building space, it must be completely substantiated in order to proceed with this data collection.** |
| Building Floor Area | Provide the gross or total floor area of the building. Gross floor area is useful to give an idea of the proportion of floor space a data centre might occupy, particularly if enclosed in a larger building. |
| Data Center Floor Area | Provide the floor area of the data center space that includes the rack equipment, service clearance and circulation, control console area, power distribution, and local air conditioning that is encapsulated by the proper protective walls. Exclude administrative offices, storage, loading docks, and other non-essential space that does not directly support the operation of this data center. |

# EUCOC – EUCOC Best Practices Document (1)



Frequently Asked Questions (FAQ)

Review the additional information for select questions below. If you need further clarification, email your questions to:

Data Centre Information

Type of Data Centre

1 - Traditional Enterprise: Processes data requirements for data center owner
2 - On Demand Enterprise: Processes and expands data processing capacity, when needed, for numerous customers (this would include batch processing and manufacturing type data processing facilities)
3 - Telecom: Telecom Switching Center
4 - High Performance Computing: Scientific and high density data processing
5 - Hosting: Sells data processing services to numerous Customers
6 - Internet: Provides high capacity processing for large numbers of web clients
7 - Hybrid: Combination of two or more of the above

Percentage of Average IT Utilization

The processor, network and storage processes that occur in the data center are frequently automatically monitored and reported as part of the IT management. Both average and peak loads are frequently captured for capacity planning and other purposes. The average estimate over time of the IT equipment's utilization is a value that currently will not affect this index but in the first step in data capture that will allow correlation the actual IT processing work with efficiency. It is understood that different devices will be measured by different criteria for example, servers by processor, network by throughput, storage by capacity or performance. Although there is not yet a standard metric to measure IT work being processed with energy input, this one measurement of the equipment activity versus a dormant state will provide an estimation of the potential for energy saving features, if activated, that could achieve even better efficiencies.

Percentage of Peak IT Utilization

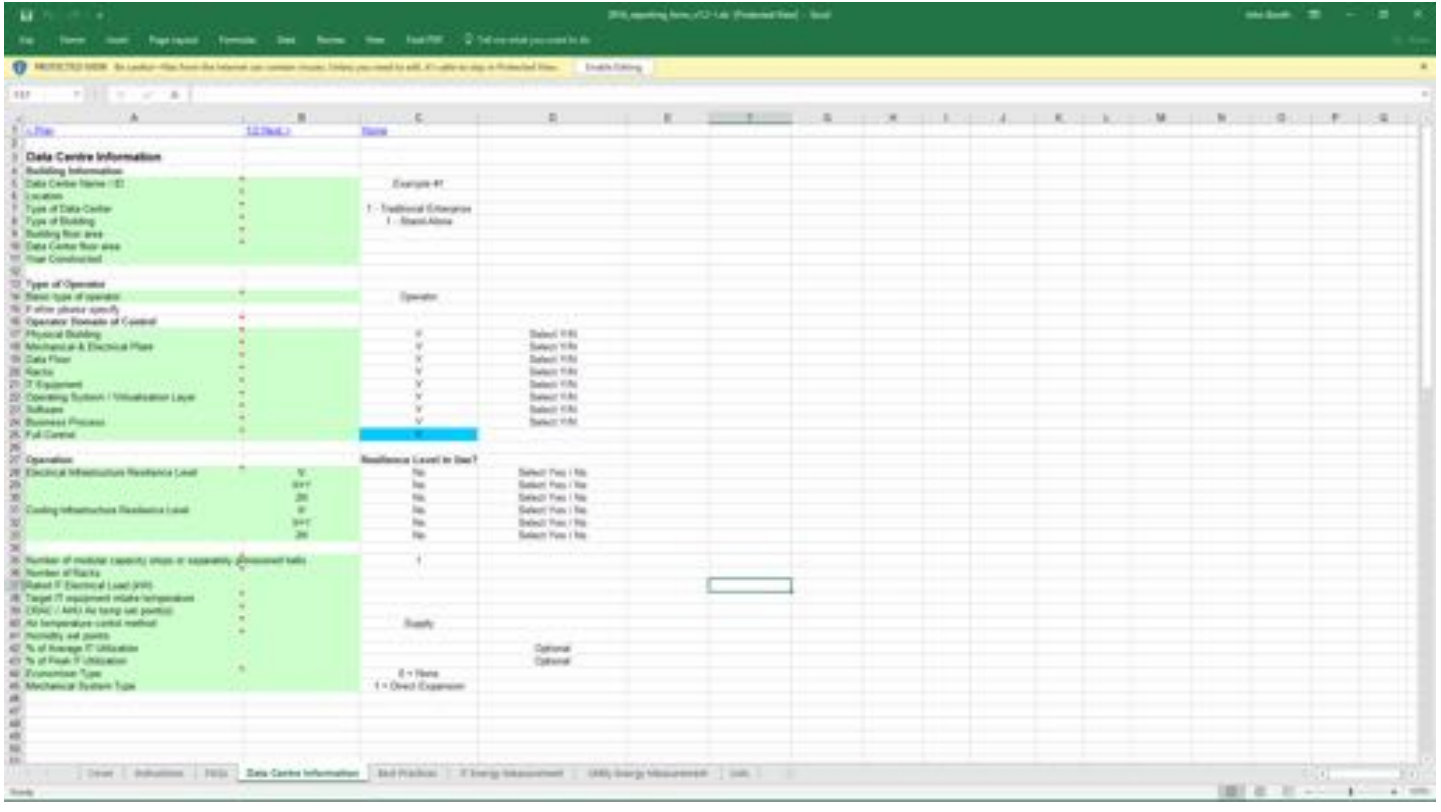
The processor, network and storage processes that occur in the data center are frequently automatically monitored and reported as part of the IT management. Both average and peak loads are frequently captured for capacity planning and other purposes. This collection purpose for peak load is to provide an understanding of the maximum equipment necessary for peak periods and then, depending on the variability of the enterprise processing needs, dormant during the non-peak times. It is understood that different devices will be measured by different criteria for example, servers by processor, network by throughput, storage by capacity or performance. By understanding the peak and average utilization characteristics of the data center, analysis with the tracking of input energy and the extent of dormant equipment putting in reserve for the peak. If these processes are tracked for the data center, the use of devices that can slow down processor clock speed and turn off redundant processors can then be estimated. These concepts are the start of understanding IT tech efficiency. For where the data is captured, ask your console operator or check the measurement in the IT utility program available in the processor equipment.

IT Measurement

Total IT Plug Energy

In general the calculation is attempting to capture the energy used by the IT equipment (this will include the IT equipment fan systems and all other devices. KVM cabinet monitoring and cabinet circulation fans) that are connected into the plug strip serving the computer room. If the UPS system is only providing load to the computer equipment in the data center, and NOT providing Computer room fans, pumps, telecommunication closets and desktop services outside this data center, then the UPS readings – over time can be recorded. The best case in this circumstance is to read a kWh meter at approximately the same period and frequency as the utility meter for the building. If a kWh meter is not available on the UPS then the instantaneous meter reading can be measured on a periodic basis to predict how load on the UPS changes with the data center processing load. A comparison with the known processing peak and the lowest utilization would be good times to record instantaneous meter readings to capture the range of UPS output. If it is greater than 3%, a more detailed (greater frequency) of recording would be used to estimate the total kWh provided by the UPS over time.

# EUCOC – EUCOC Best Practices Document (1)



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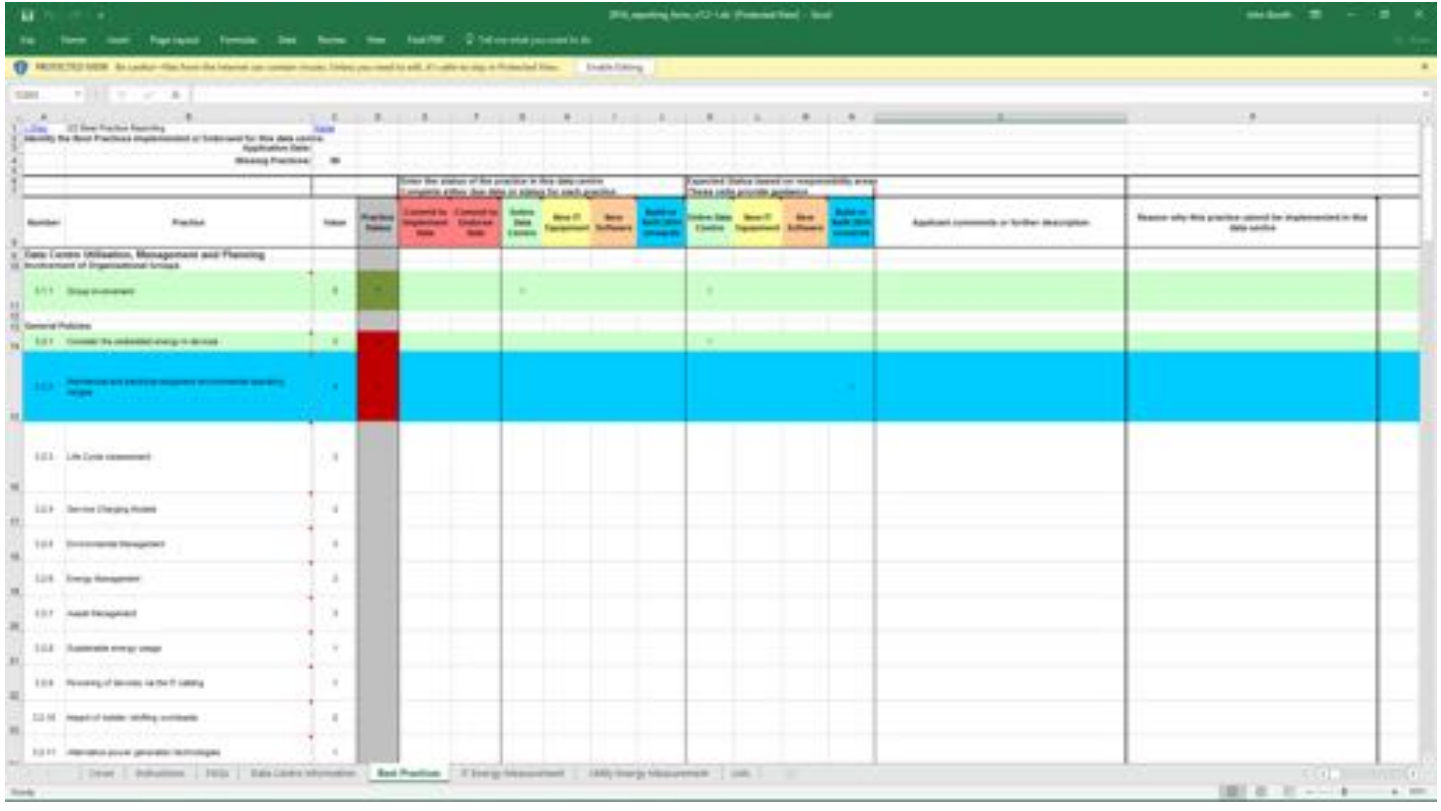

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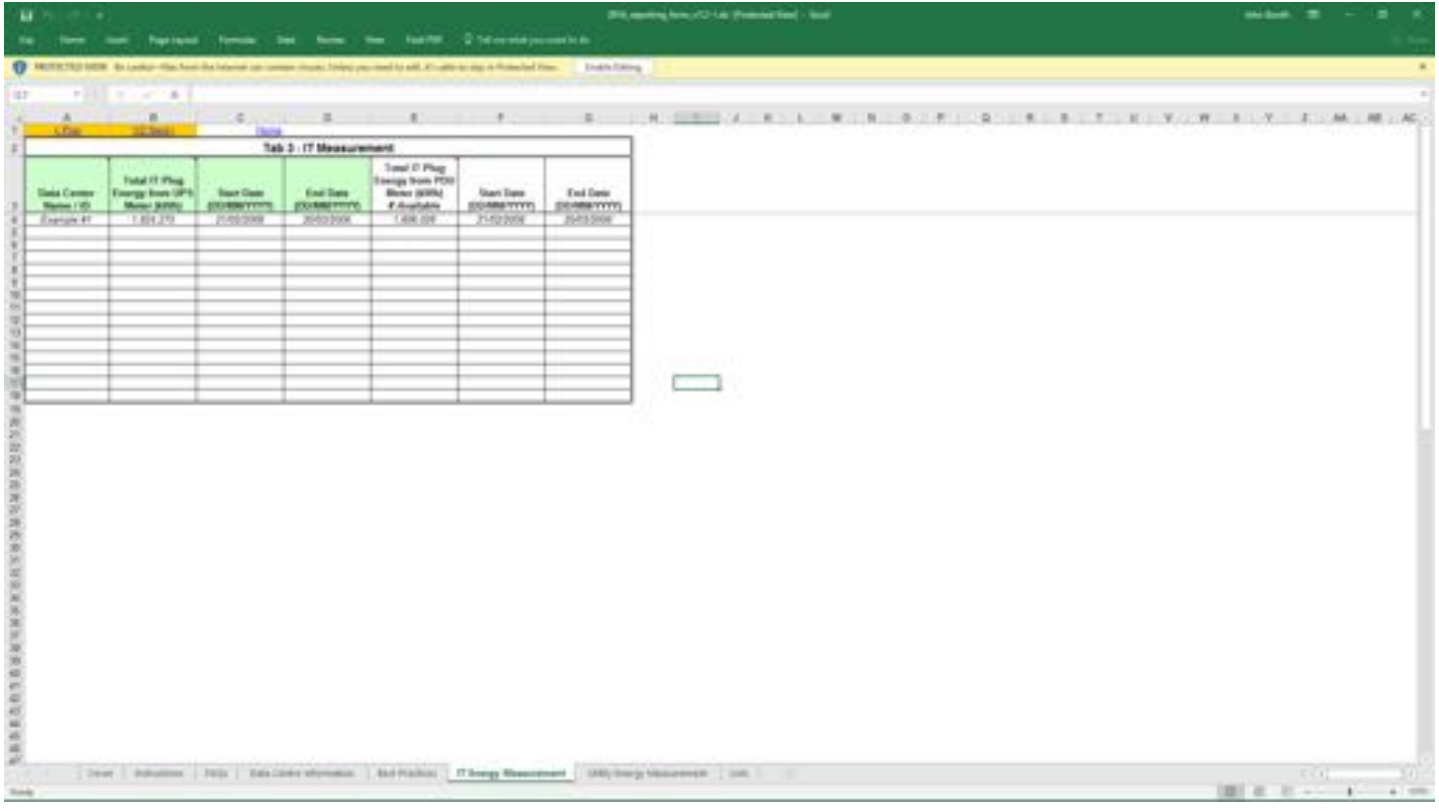

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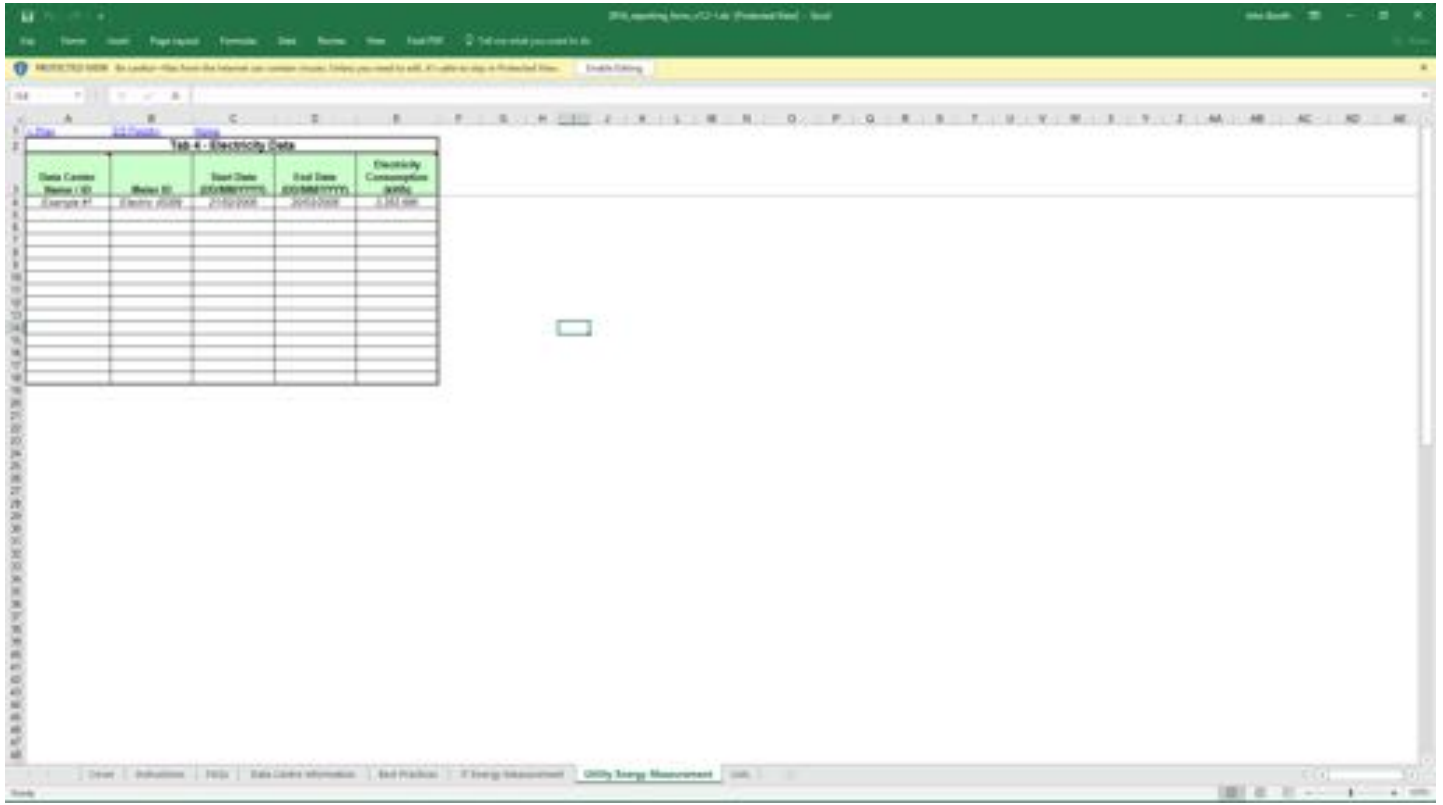

# Case Studies

# Case Studies

- Complete an application for:
  - An Owner Operator
  - A Colocation Provider.
  - A MSP in a Colocation facility
  - An Endorser


# Agenda

- Starting questions
- Structure of the EURECA courses
- Learning outcomes
- **Course contents**
  - Introduction
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  - **Energy Saving Opportunities with PPI**
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- References and further reading

# Overview – EUCoC - PPI Opportunities

- Public Procurement of Innovative solutions (PPI) is used when challenges can be addressed by innovative solutions that are nearly or already in small quantity in the market and don't need new Research & Development (R&D).

# Overview – EUCoC - PPI Opportunities

- General Policies - Standards
- IT Equipment
- Cooling
- Power
- Building Design
- Monitoring & Measurement

# Standards – EUCOC General Policies 3.2.x

- Standard Tender Documents include:
  - Quality Management Systems to ISO 9001
  - Environmental Management Systems to ISO14001
  - Requirements, normally contained in PQQ or
- EUCOC has:
  - ISO 14040 For Lifecycle Assessment (Optional)
  - ISO140001 Environmental Management (2016 Optional, 2017 Mandatory)
  - ISO50001 Energy Management (2016 Optional, 2017 Mandatory)
  - ISO 55000 Asset Management Systems (Optional)

# Standards – EUCOC General Policies 3.2.x

- Sustainable Energy Procurement
- EUCOC has:
  - Sustainable Energy Usage
  - EN50600 4.X Series
  - ISO 30134 Series
  - Alternative Power Generation Technologies
    - Fuel Cells
    - Wind
    - Solar
    - Biomass

# Innovative ICT – EUCOC IT 4.1.x

- Wider Operational Temperature/Humidity Ranges for ICT Equipment
- Means Data Centres/Server Rooms can operate at  Upper End of ASHRAE 25-32°

- EUCOC
- 18 – 32/35° ASHRAE Class A2/A4

- Temperature/Humidity Reporting by ICT (4.1.11)
- Closer control between ICT and M&E (4.1.12)
- Liquid Cooled Servers (4.1.14)

# Innovative ICT – EUCOC IT 4.2.x

- Grid/Virtualisation Technologies = G Cloud/Internal Cloud
- Better analysis of Service Level Agreements
  - Reduce IT Hardware resilience
  - Reduce Hot/Cold standby equipment (IT Architecture)
- Software
  - Monitor software energy performance
  - Develop energy efficient aware software
  - Incentivise software development

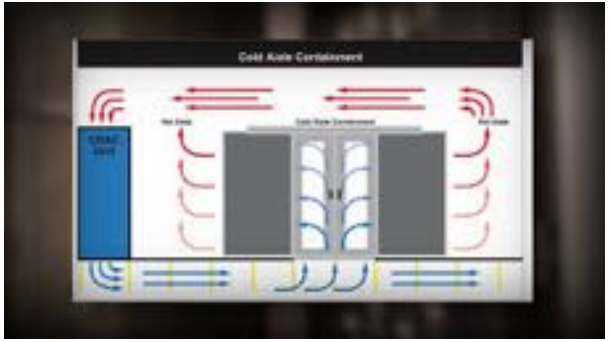
# Innovative ICT – EUCOC IT 4.3.x

- Audit/Audit/Audit
- Do you know…
- What assets you have
- What they are used for
- How much they cost in terms of Energy, Network and Service Costs
- Check!

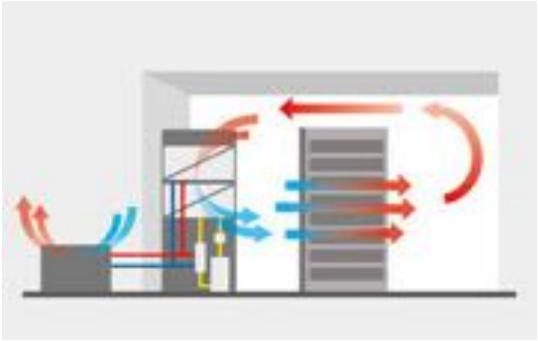
# Innovative ICT – EUCOC IT 4.4.x

- Data Management
- What is it?
- Where is it?
- How valuable is it?
- Access - Hot/Warm/Cold/Frozen
- Storage costs

# Innovative Cooling – EUCOC 5.x




- Hot/Cold Aisle
- Contained Hot/Cold Aisle
- CFD Air Flow Analysis
- Equipment Segregation/Environmental Zones
  - Put equipment that had legacy environmentals in their own separately cooled area
- Install Free Cooling



# Innovative Cooling – EUCOC 5.x

- Scalable/Modular Approach
- Review Cooling Strategy
- Dynamic Control of Cooling
- Maintenance of Equipment
- Alternative Cooling Sources


# Innovative Cooling – EUCOC 5.x

- Part Load Operation
- Variable Speed Drives
- Liquid Cooling
- Reuse of Heat
- DCiM

# Power– EUCOC 6.x

- Modular UPS
- Efficient Operating Modes
- Part load
- Power Factor Correction

# Power– EUCOC 7.x

- Automatic Lighting
- Low Energy
- DCiM

# Building– EUCOC 8.x

- 8.1.x Move M&E Plant outside of cooled areas, Free Cooling, Location/Orientation of Plant, Minimise Direct solar heating.
- 8.2.x Use waste heat! ,Check LOCAL external Temperatures/Humidity, Locate near source of Free Cooling/Power
- 8.3.x Capture Rain water, Consider other water sources & Monitor and Measure

# Metrics– EUCOC 9.x

- DCiM
- Dashboards

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# Starting Questions -answered

1. What timescales do the EU-JRC specify for confirmation of both “Endorser/Participation Applications?

   A. 10 Days/10 Days
   B. 10/15 Days
   C. 20/25 Days
   D. 40/45 Days

2. How many best practices are there?

   A. 54
   B. 98
   C. 153
   D. 400

# Starting Questions -answered

3. How different roles are there?

   A. 10

   B. 7

   C. 5 -Owner Operator/Colo Provider/Colo Customer/MSP in Colo/MSP

   D. 3

4. How many types of “data centre” are available on the EUCOC Participation Application Reporting Form?

   A. 10

   B. 7 -Traditional Enterprise/On-Demand Enterprise/Telecom/HPCC -Scientific/Internet/Hosting/Other

   C. 5

   D. 15

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# References & Further Reading

- EURECA project: www.dceureca.eu
- The EURECA tool (after registration): https://tool.dceureca.eu
- **EUCoC:**
  - Introductory Guide v3.1.2
  - Reporting Form v7.2 OR v8.1 (Once Published)
  - Endorser Guidelines v3.0.0
  - Participant Guidelines v2.0
  - 2016/2017 Best Practices Guidelines v7.1.2 or v8.1.0 (Once Published)

These documents are free on the EUCOC website:

http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/data-centres-energy-efficiency