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EURECA Training

Module 7: Data Centre KPIs and Standards

Target Audience: Procurement/DC ICT&FM/Operations/CSR/Environment

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

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- Starting questions
- Structure of the EURECA courses
- Learning outcomes
- Course contents
  - An examination of available KPIs
  - Introduction to key data centre standards (historically US based)
  - Emerging European Standards
  - Additional commonly used Standards
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Starting Questions

Which KPI should I use to evaluate my DC?

a) PUE
b) CUE
c) Availability / uptime
d) ETC.

Which standards can I examine to improve the performance of my DC?

a) ASHRAE
b) Uptime Institute Tiers
c) EN 50600
d) ETC.

How do the various KPIs and standards differ?

a) Specific Technology or overall Data centre
b) Focus
c) American or European

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Overview EURECA training KIT

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Learning Outcomes

- Develop a clear understanding of the relevant standards and KPIs associated with operating a data centre
- Appreciate the importance and implications of specific standards and KPIs
- Generate an understanding of how these should be applied

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Background

- The “Data Centre Industry” Is arguably only 20 years old and currently has no true data centre specific standards arrived at by international consensus.
- There are multiple competing standards bodies and government initiatives competing to occupy or even dominate the data centre space.
- This vacuum has led to confusion and over dependence on the few commonly agreed KPIs and are resulting in increasing environmental focus and a developing interest in legislation
- Finally it can be argued that Data Centres have no measurable output and do not produce anything useful – this makes an easy target for legislators who misunderstand the value that data centres bring to the economy....

European Data Centre Standards

- Genuine Standards are important to guide data centre design and legitimately compare sites – hence the success of Uptime Tiers
- Do not confuse regulations and Standards though. Standards remain voluntary, Regulations are not
- Certification against Standards is a far more confused and unregulated space than many realise
- How do we contrast and compare Data Centre sites and equipment infrastructure according to European criteria?
- What is being done to address European Data Centre Standards?

Significant Data Centre KPIs

- Availability / Uptime
- PUE/DCiE, CUE, WUE, ERE
- Certification against recognised standards such as: ISO 27001, SAS 70 / SSAE 16 / ISAE 3402, ITIL / ISO 20000, ISO 14000 Series, ISO 50000 Series, PAS 55 / ISO 55000 etc.

Data Centre KPIs

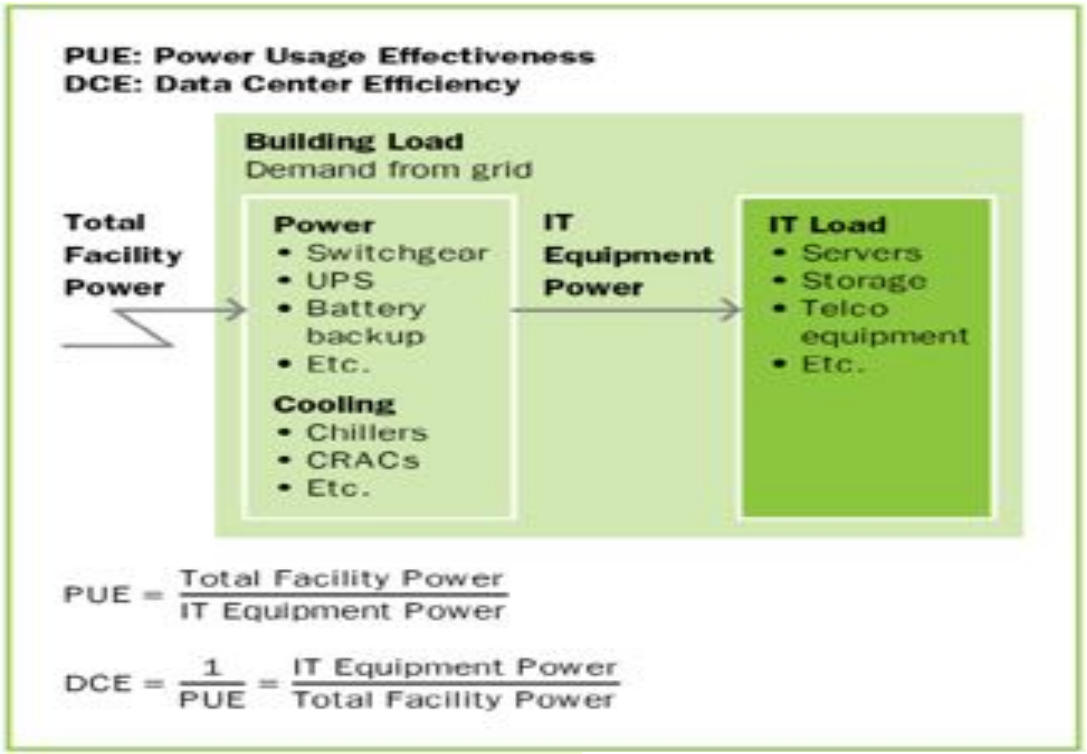
- PUE/DCiE (Power Usage Effectiveness), CUE (Carbon Usage Effectiveness) , WUE (Water Usage Effectiveness), ERE (Energy Re-Use Usage Effectiveness) are used in many data centres to indicate some areas of performance against building load.
- The only internationally agreed Data centre KPIs are: ISO/IEC 30134-2 (EN 50600-4-2) Power Usage Effectiveness (PUE) and ISO/IEC 30134-3 (EN 50600-4-3) Renewable Energy Factor (REF)
- Note that neither of these are measures of data centre energy efficiency.

Data Centre KPIs continued

- Availability / Uptime is by far the most important KPI for a data centre. Continuity of data centre services is the reason for the use of a data centre. Yet no agreed standard or KPI to measure Availability / Uptime exists. Percentage uptime is frequently used but is potentially flawed if not fully considered (Discussed further in Module 6).
- Certifications against recognised standards are routinely used in Lieu of agreed KPIs to demonstrate compliance with expected practices or levels of performance.

PUE – The Implications

Power Usage Effectiveness



Can create perverse incentives such as increasing energy usage and cost as well as introducing risk to the business

NB PUE reduction can be achieved by INCREASING power consumption.....

PUE is now defined by ISO/IEC 30134-2 (**EN 50600-4-2)**

the green grid™
get connected to efficient IT

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Significant Data Centre Infrastructure Standards

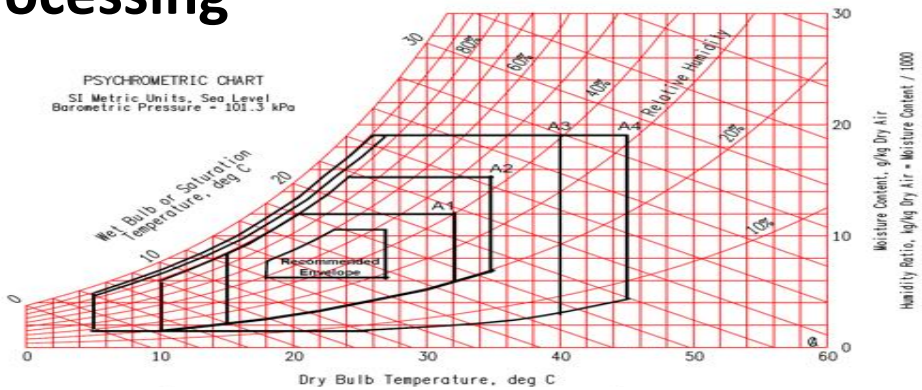
- ASHRAE TC 9.9
- Uptime Institute
- TIA 942A
- EN 50600
- ANSI/BICSI 002
- LEED and BREEAM
- NEBS and ETSI
- EU Code of Conduct for Data Centres
- Energy Star For Data Centres
- ISO 27001, SAS 70 / SSAE 16 / ISAE 3402, ITIL / ISO 20000, ISO 14000 Series, ISO 50000 Series, PAS 55 / ISO 55000

ASHRAE - TC 9.9 2015

American Society of Heating, Refrigerating and Air Conditioning Engineers

- Why is a US only standard so important?
- Provides the environmental metrics **agreed** to by the IT equipment manufacturing industry
- Defines what OEMs will **warrant** against and therefore data centre design and operation parameters
- Revised in late 2015
- Thermal Guidelines Whitepaper which defines both recommended and allowable temperature ranges for IT equipment
- Used to define data centre operating parameters and design criteria

Thermal Guidelines for Data Processing Environments



Recommended	**18-27°C at server inlet (–9°C DP to 15°C DP and 60% rh)**
Allowable (A1)	**15-32°C at server inlet (–12°C DP and 8% rh to 27°C DP and 80% rh)**
Allowable (A2)	**10-35°C at server inlet (–12°C DP and 8% rh to 27°C DP and 80% rh)**
Allowable (A3)	**5-40°C at server inlet (–12°C DP and 8% rh to 27°C DP and 85% rh)**
Allowable (A4)	**5-45°C at server inlet (–12°C DP and 8% rh to 27°C DP and 90% rh)**
Maximum Elevation	**3050 metres**
Max rate of change	**(5°C/h storage) 20 °C/h other (Max 5°C in any 15 minute period of time.)**

Uptime Institute Tiers

Uptime Institute: Tier Standard: Topology

- Last update published: 2014
- N.B. All references to % uptime (The 9s), have now been removed
- Not a true standard, rather a set of guidelines and recommendations
- Offers a Certification Programme

Uptime Institute™

Uptime Institute Tier Topology

Tier I: Basic Capacity

- Computer room, UPS, engine generator, computer cooling
- Single distribution path and ‘N’ capacity
- Susceptible to all maintenance- and fault-related shutdowns

Tier II: Redundant Capacity

- Single distribution path and N + R components
- Shutdown MAY be required for maintenance on redundant components
- Susceptible to shutdowns for maintenance on distribution paths
- Susceptible to fault / failure

Uptime Institute Tier Topology

Tier III: Concurrent Maintenance

- Maintenance or replacement of each and every distribution and capacity components
- No shut down for planned equipment work or replacement
- Susceptible to fault / failure

Tier IV: Fault Tolerance

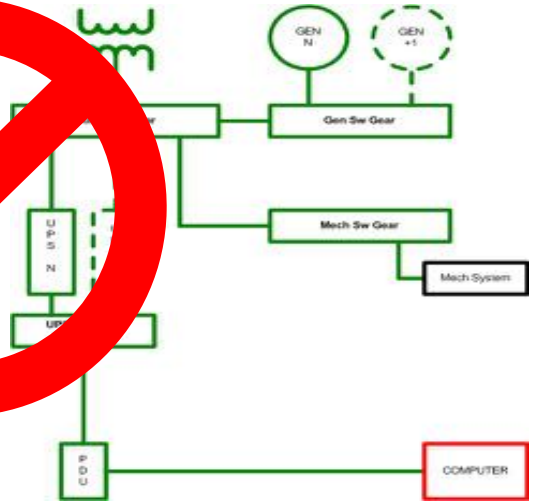
- Multiple, active, Compartmentalized capacity components and distribution paths autonomously
- 'N' after any failure
- No shut down for planned equipment work or replacement
- No shut down for single fault or failure

Uptime Institute™

Uptime Institute Tiers Updated

	TIER I	TIER II	TIER III	TIER IV
Building Type	Tenant	Tenant		Standalone
Staffing	None	1 Shi	1+ Shifts	24 by Forever
Usable for critical load	100%N	10	90%N	90%N
Initial build-out UPS output watts/ft² (typical)	20-30	4	4	-80
Ultimate UPS output watts/ft² (typical)	20-30	4	0-150	50+
Class A uninterruptible cooling	No	No	Maybe	Yes
Support space to raised floo		30%	80-90+%	100+%
Raised floor height (ty	12”	18”		30-
Floor loading lbs/ft² cal)	85	100	150	1
Utility voltage (typi	480	208,480	12-15 kV	kV
Single points-of-fai	Many + human error	Many + human error	Some + human error	EPO + h n err
Annual site caused l e (actual field data)	28.8 hour	22.0 hours	1.6 hours	0.8
Representative site availab		99.75%	99.98%	99.99%
Months to implement	3	3 to 6	15 to 20	15 to 20
Year first deployed	1965	1970	1985	1995

TIA-942 retains many of these elements despite the industry moving on



Uptime Institute Tier Topology - Myths

Myth: Uptime Institute Tiers requires an EPO.

- Uptime Institute Tiers does not mandate an EPO. Uptime Institute does not recommend EPO installation. However, if an EPO is installed, it must also incorporate the site Tier objectives.

Myth: Uptime Institute Tiers requires raised floor.

- Decisions such as raised floor or on-slab, Cold Aisle/Hot Aisle, containment of Cold/Hot Aisles, and gallery cooling can affect the efficiency of the computer room environment, but are NOT mandated by Uptime Institute Tiers.

Myth: Tiers mandate location and operations.

- Tiers focus solely on the design and its implementation. Location and operations is the focus of second Uptime Institute Standard (Operational Sustainability)

Myth: For Tier III and IV, the engine-generator plant must be operational at all times.

- Data centers will utilize the public electrical utility a majority of the time but the engine-generator plant must be properly configured and sized to carry the critical load without runtime limitations.

Myth: For Tier IV, Dual utility feeds are required.

- Utility feeds are not required at all, they are merely economic alternatives to on-site power generation.

Hidden Infrastructure Risks

- Tiers define “Opportunity for Maintenance” **NOT** redundancy (N+1 etc)
- Tier III is **NOT** Fault Tolerant (only protects against **PLANNED** events)
- **ONLY** Tier IV addresses unplanned events
- Tier III does **NOT** remove Single Points of Failure
- Tier II is likely to require service outages even for planned maintenance
- Tier I **WILL** impose some service downtime for planned maintenance (E.G. statutory 5 yearly testing)
- Frequently confused with TIA-942 requirements yet TIA do not certify data centres, nor do they certify others to do so.....
- 99.9999% availability is greater than Tier IV and yet still anticipates **32 seconds of downtime per year**

Uptime Institute™

Uptime Institute Operational Sustainability

- Uptime Institute observed the management issues that resulted in the majority of outages caused by ‘human error’
  - Inadequate staffing
  - Ineffective or non-existing maintenance and training programs
  - Lacking processes and procedures
- No standard existed to help Owners/Operators determine
  - Common language/vocabulary of data center operations
  - Resource allocation
  - Justification of additional resources
- Data centre physical design and location are important, but at best are only half of the total equation
- After build comes operation & maintenance

Uptime Institute Management & Operations

- The Uptime Institute M&O Stamp of Approval initiative is the result of a practical need for an industry driven operational and site management set of criteria, independent of Tier Certification and topology
- The defined criteria are a set of behaviors that fall into 5 categories defined in a publicly available document to allows and encourages self assessment
- Focuses on the critical facilities management and operations practices of an existing data centre
  - Staffing and Operations
  - Maintenance
  - Training
  - Planning, Coordination and Management
  - Operating Conditions

Business Objectives and Infrastructure

It is essential to ensure site capability (Tiers) and business requirements are aligned – This includes Misunderstanding between Uptime and TIA

The Tier Topology references the ability to carry out scheduled maintenance and addresses fault tolerance so the following apply:

Maintenance:

Can the organisation (or service), ***afford*** to take the computer room down to perform infrastructure maintenance (***planned downtime***)

- If Yes require Tier I or Tier II only
- If No require Tier III or above
- If No consider moving applications to higher Tier DC
- **OR** redesign applications to be more resilient

Fault Tolerance:

Can your organisation (or application), ***afford unplanned*** downtime taking your computer room down?

- If Yes require Tier III or lower
- If No require Tier IV
- (Consider moving applications to higher Tier DC)
- **OR** redesign applications to be more resilient

TIA-942A

- Telecommunications Infrastructure recommendations for Data Centers
- Had an infrastructure appendix based on original Uptime Institute Tiers which led to confusion – Now removed
- Primarily a telecoms standard not a data centre standard
- US Centric only standard and very prescriptive
- No certifications are offered by TIA nor do TIA certify others to offer certification – however certifications are offered by some
- Uptime have required that the term “Tier” be removed from the most recent version of TIA-942A
- Revision A last Updated in March 2014

Uptime Tiers / TIA 942A Comparison

- Neither TIA-942A or Uptime represent international standards.
- TIA does have the backing of ANSI, but they also support BICSI so what constitutes the true US data centre “Standard”?
- Uptime has an official certification scheme, TIA does not.
- TIA is no longer permitted to use the term “Tier” in their literature.
- TIA mandates utility power requirements, Uptime does not.
- TIA is a telecommunications standard and is influenced by telecommunications requirements.
- Very prescriptive on cabling, which may not be applicable internationally.
- Has an addendum referencing ASHRAE, Uptime does not

N.B. tia-942.org http://www.tia-942.org/ is nothing to do with TIA despite the implications!

ANSI/BICSI 002-2014

- Building Industry Consulting Service International
- Revised version available from 2014
- Based on Data Centre Design and Implementation Best Practices
- First published in 2011 but not widely adopted and remains very US focused
- As ANSI support both TIA-942A and BICSI 002, which is the true US DC Standard?

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European Data Centre Standards?

- Standards are important to guide data centre design – hence the success of Uptime Tiers despite not being a true Standard
- How do we contrast and compare Data Centre sites and equipment infrastructure according to European criteria?
- What is being done to address the lack of European Data Centre Standards? European Standards have been slow to develop but are now being brought out – Particularly EN 50600

CENELEC and European Data Centre Standards

- CENELEC is the European Committee for Electrotechnical Standardization and is responsible for European standardization in the field of electro-technical engineering.
- Designated as a European Standards Organization by the European Commission.
- CENELEC are principal members of the CEN / CENELEC / ETSI Coordination Group: Green Data Centres (GDC). http://www.cencenelec.eu/standards/Sectors/ICT/Pages/GreenDataCentres.aspx
- CENELEC TC 215 WG3 (EN 50600 series), is responsible for the development of EN50600 series of standards.

EN 50600

- EN 50600 (Information technology - Data centre facilities and infrastructures)
- Currently being drafted by local ISO country representative organisations
- CENELEC TC 215 WG3 (EN 50600 series), are responsible for the development of EN50600 series of standards (data centre facilities and infrastructures)
- Includes sections for building construction, power distribution, environmental control, telecoms cabling, security systems, management and operations
- Now incorporated into ISO/IEC JTC 1 Study Group on Energy Efficiency of Data Centers (SD-EEDC)

EN 50600 Series of Standards

EN 50600-1:	*Information technology - Data centre facilities and infrastructures – Part 1: General concepts*
EN 50600-2-1*:*	*Building construction*
EN 50600-2-2*:*	*Power distribution*
EN 50600-2-3*:*	*Environmental control*
EN 50600-2-4*:*	*Telecommunications cabling infrastructure*
EN 50600-2-5*:*	*Physical security*
EN 50600-3-1*:*	*Management and operational information*
EN 50600-4-1*:*	*KPIs - Overview and general requirements*
EN 50600-4-2*:*	*KPIs - Power Usage Effectiveness (PUE)* ISO/IEC 30134-2
EN 50600-4-3*:*	*KPIs - Renewable Energy Factor (REF)* ISO/IEC 30134-3
EN 50600-4-4*:*	*KPIs - IT Equipment Energy Efficiency for Servers*
EN 50600-4-5*:*	*KPIs - IT Equipment Energy Utilisation for Servers*
EN 50600-99-1:	*Energy management - Recommended Practices*

EN 50600 Certification

The first EN50600 Class 4e Data Centre Certification has recently been completed at EDH in Luxembourg

https://www.einnews.com/pr_news/328177348/european-data-hub-gets-europe-s-first-en50600-class-4e-data-centre-certification

Popularity will grow....

European Code of Conduct for Data Centres

- The first government led set of data centre specific best practices published worldwide
- Offers a free to download and use set of tried and tested Data Centre Best Practices available to use on a voluntary basis
- Aims to inform and support data centre operators and owners in reducing energy consumption (Endorsers and Participants)
- Parties signing up are expected to follow the intent of the Code of Conduct and abide by a set of agreed voluntary commitments
- The 2017 revision will be released shortly (V8.1.0)

European Code of Conduct for DCs

The Code is:

- **Free** to access and download
- Led by European Commission **Joint Research Centre**
- Flexible mechanism to initiate and develop policy
- Forum for industry, experts and Member States
- Open and continuous dialogue on market and product performance
- Identify and focus on key issues and agree solutions
- Set ambitious **voluntary** standards and commitments
- A set of proven **Best Practices** and a reporting **Scheme**

EN 50600 and European Code of Conduct for DCs

- The Code of Conduct best Practices have been incorporated into EN 50600 as: CLC/TR 50600-99-1
- This includes all the 2017 CoC revisions
- The TR will be translated into at least French and German in addition to English.

Warning – Legislation will increase ...

- If we do not demonstrate that we are improving and managing our energy consumption there is a significant danger that poorly understood legislation will be imposed on our sector in Europe.

- European Standards can offer proof to potential legislators that we are responding to the requirement to improve energy efficiency across the sector if administered properly.

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Additional Relevant Standards

The following are additional standards or certifications that are commonly applied or sought by the data centre sector.

ISO 14000 Series

- A series of international standards relating to environmental management.
- ISO 14001 and ISO 14004 focus on environmental management systems
- An internationally accepted standard setting out a framework of essential elements for putting an effective Environmental Management System (EMS) in place
- Works in addition to LEED / BREEAM which address building design and construction
- Audited and certified by approved national bodies

ISO 14000 Series

- ISO 14001 sets out the criteria for an environmental management system and can be used for certification. It seeks to map out a framework that a company or organization can follow to set up an effective environmental management system.
- Using ISO 14001 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.
- The benefits of using ISO 14001 can include:
  - Reduced cost of waste management
  - Savings in consumption of energy and materials
  - Lower distribution costs
  - Improved corporate image among regulators, customers and the public

ISO 50001 – Energy Management System

- ISO 50001 outlines energy management practices that are considered to globally leading. Implementing the standard can help to save energy, cut costs, and meet environmental and carbon reduction targets.
- ISO 50001 is an international standard based on the management system model of continual improvement also used for other well-known standards such as ISO 9001 or ISO 14001.
- ISO 50001 provides a framework of requirements for organizations to:
  - Develop a policy for more efficient use of energy
  - Fix targets and objectives to meet the policy
  - Use data to better understand and make decisions about energy use
  - Measure the results
  - Review how well the policy works, and
  - Continually improve energy management.

ISO 55000 Series

The International Standard for Asset Management also intended to align with ISO 14001 and ISO 9001 and is of particular note as IT are notoriously bad at asset management in the data centre!

- ISO 55000 provides an overview of the subject of asset management and the standard terms and definitions to be used
- ISO 55001 is the requirements specification for an integrated effective management system.
- IS0 55002 provides guidance for the implementation of such a system

This is considered important as data centre IT assets are notoriously poorly tracked

ITIL / ISO 20000

- IT Infrastructure Library (ITIL), relates to ISO 20000 but is not the same
- Developed by UK Office of Government Commerce (OGC) in the 1980's
- Intended to improve delivery and management of IT services to central government
- ITIL / ISO 20000 is not data centre specific but can be usefully used as a common language between IT and Facilities to bridge the communications gap.

ISO 27000 Series (IT Security)

- ISO 27001 is commonly referenced as a data centre standard however this is an IT standard more aimed at the logical layer rather than physical infrastructure security
- Originally based on BS 7799, this is a standard relating to Information Security Management Systems (ISMS)
- May be used in conjunction with ISO 27002 – A Code of Practice for Information Security Management

Energy Star for Data Centers

Joint initiative by the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DoE)

Principles established in 2010:

- PUE was established as the standard metric.
- Established where to measure IT energy consumption for PUE calculation and cited that the industry should progressively improve measurement capabilities moving forward.
- Over 50% of the building's gross area must be used for data centre purposes.
- Energy consumption data for IT loads and the total building must be gathered in kilowatt-hours for 11 consecutive months.
- Also have standards for servers (v2.0), and storage (v1.0)

ISO 14040

- ISO 14040 (second edition) details the requirements for conducting a Lifecycle Assessment (LCA) in conjunction with ISO 14044.
- LCA addresses the environmental aspects and potential environmental impacts (e.g. use of resources and the environmental consequences of releases) throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal (i.e. cradle-to-grave).
- Intended to fully align with ISO 14001 and ISO 9001
- The EU CoC includes a commitment to “Introduce a plan for Life Cycle Assessment (LCA) in accordance with emerging EU guidelines and internationally standardised methodology (ISO 14040)”.

SAS70 / SSAE16 / ISAE 3402

- SSAE 16 has replaced SAS 70.
- SSAE 16 can also be referred to as Service Organization Control (SOC) 1.
- SSAE 16 was drafted with the intention and purpose of updating the US service organization reporting standard so that it mirrors and complies with the new international service organization reporting standard ISAE 3402.
- These audits are led by accounting practices and performed by major accounting auditing firms and provide enterprise operators assurance that Sarbanes-Oxley mandates etc. are being followed.
- A SSAE 16 audit can assure enterprises that data centres have statutory procedures in place and that those procedures are followed and regularly updated.
- Essentially a confirmation of what is claimed to be in effect is genuinely in place.

ETSI and NEBS

European Telecommunications Standards Institute (ETSI)

- ETSI EN 300 019 Class 3.1. Environmental conditions and environmental tests for telecommunications equipment
- From 5 to 40°C and 5 to 85% RH (To -5 to 45°C and 5 to 90% RH by exception)
- Equates broadly to ASHRAE A4 (5 to 40°C and 8 to 80% RH)

NEBS is a US equivalent to ETSI (Network Equipment Building System)

- A set of technical requirements and objectives with the purpose of making network switches robust and reliable
- Includes cooling and humidity ranges, electrical safety, electrical emissions, shock loading, resistance to contaminants etc.

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Significant Standards Organisations

The following bodies are true international Standards bodies with an interest in the development of Data Centre Standards

European Committee for Electrotechnical Standardization

- CENELEC is the European Committee for Electrotechnical Standardization and is responsible for standardization in the field of electro-technical engineering.
- Designated as a European Standards Organization by the European Commission, CENELEC is a non-profit technical organization set up under Belgian law. It was created in 1973 as a result of the merger of two previous European organizations: CENELCOM and CENEL.
- CENELEC TC 215 WG3 (EN 50600 series), are responsible for the development of EN50600 series of standards (data centre facilities and infrastructures) via Technical Committee TCT/7 of BSI in the UK.
- CENELEC are a member of the CEN / CENELEC / ETSI Coordination Group: Green Data Centres which operates to co-ordinate standardisation activity on resource management in relation to data centres.

European Committee for Electrotechnical Standardization

- Develops European Standards and other technical specifications in the electrotechnical engineering field. CENELEC activities cover domains such as air and space, consumer products, electrotechnology, energy, health and safety, healthcare, ICT, machinery, services smart living, transport, etc. The 33 members of CENELEC are the National Electrotechnical Committees of the EU Member States, 3 EFTA countries (Iceland, Norway and Switzerland), the Former Yugoslav Republic of Macedonia and Turkey. All of them adopt and recognize the European Standards approved by CENELEC. Through its close collaboration with the International Electrotechnical Commission (IEC), under the Dresden Agreement, CENELEC adopts international standards wherever possible and creates market access at international level.
- For more information, please visit: www.cenelec.eu and www.cencenelec.eu

European Committee for Standardization

- Develops European Standards and other technical specifications in relation to a wide range of products and services in all areas of economic activity with the exception of electrotechnology and telecommunication. CEN activities cover domains such as air and space, building and civil engineering, chemical, consumer products, energy, food, healthcare, ICT, services, smart living, transport, etc. The 33 members of CEN are the National Standards Bodies of the EU Member States, 3 EFTA countries (Iceland, Norway and Switzerland), the Former Yugoslav Republic of Macedonia and Turkey. All of them adopt and recognize the European Standards approved by CEN. CEN also works to promote the international harmonization of standards through the Vienna Agreement with ISO (International Organization for Standardization).
- For more information, please visit: www.cen.eu and www.cencenelec.eu

European Telecommunications Standards Institute (ETSI)

- ETSI seeks to produce globally applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies. Recognized by the European Union as a European Standards Organization, ETSI is a not-for-profit organization with more than 700 member organizations from 62 countries across 5 continents.
- The ETSI telecoms based standards offer wider environmental parameters than normally accepted for IT equipment, yet this is a standard that is referenced in relation to non-telecoms equipment.
- ETSI are a member of the CEN / CENELEC / ETSI Coordination Group: Green Data Centres (see CENELEC).

European Telecommunications Standards Institute (ETSI)

- Produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, aeronautical, broadcast and internet technologies and is officially recognized by the European Union as a European Standards Organization. ETSI is an independent, not-for-profit association whose more than 700 member companies and organizations, drawn from 62 countries across 5 continents worldwide, determine its work programme and participate directly in its work.
- For more information please visit: www.etsi.org

International Organization for Standardization (ISO)

- ISO is an independent, non-governmental membership organization and the world's largest developer of voluntary International Standards
- Members are the national standards bodies of the 163 member countries around the world. Based in Geneva, Switzerland
- Works alongside International Electrotechnical Commission (IEC), in the development of emerging international data centre standards
- ISO/IEC JCT1 SC39 WG1 are responsible for the development of the ISO/IEC 30134 series of standards (data centre resource efficiency KPIs)
- PUE / DCiE from The Green Grid now falls under ISO/IEC JCT1 SC39 and is now defined as ISO/IEC 30134-2

International Electrotechnical Commission (IEC)

- The International Electrotechnical Commission is a global organisation that publishes consensus based International Standards and manages conformity assessment systems for electric and electronic products, systems and services, (Electrotechnology).
- The International Electrotechnical Commission (IEC) is a not-for-profit, non-governmental organization, founded in 1906.
- The IEC's members are National Committees, who appoint experts and delegates from industry, government bodies, associations and academia to participate in the technical and conformity assessment work of the IEC.
- IEC publications serve as a basis for national standardization and as references when drafting international tenders and contracts.
- JTC1 (Joint Technical Committee), is ISO and IEC combined so SC39 is equivalent to ISO/IEC JTC1 - SC39.

International Telecommunication Union (ITU)

- ITU is the United Nations specialized agency for information and communication technologies – ICTs.
- Allocate global radio spectrum and satellite orbits, develop the technical standards that ensure networks and technologies seamlessly interconnect, and strive to improve access to ICTs to underserved communities worldwide.

2013 - Rationale for minimum data set for evaluating energy efficiency and for controlling data centre equipment in view of power saving

2013 - Potential for primary energy savings in TLC/ICT centres through free cooling

2013 - Validation test of a data centre cooling method using renewable energy in a cold region

2013 - Verification experiments related to increase of efficiency of air-conditioning and control technologies at a data centre

2013 - Verification test and feasibility study of energy and space efficient cooling systems for data centres with high density ICT devices

EMAS and BEMPs

Eco-management and audit scheme (EMAS)

- A system for environmental management in the workplace
- References the international environmental management standard ISO 14001
- EMAS is open to every type of organisation eager to improve its environmental performance
- Supported by JRC documents published as ‘best environmental management practices’ (BEMPs) , referred to as Sectoral Reference Documents (SRDs)
- http://ec.europa.eu/environment/emas/register/
- http://susproc.jrc.ec.europa.eu/activities/emas/

Environmental Management - ISO 14001 and EMAS I

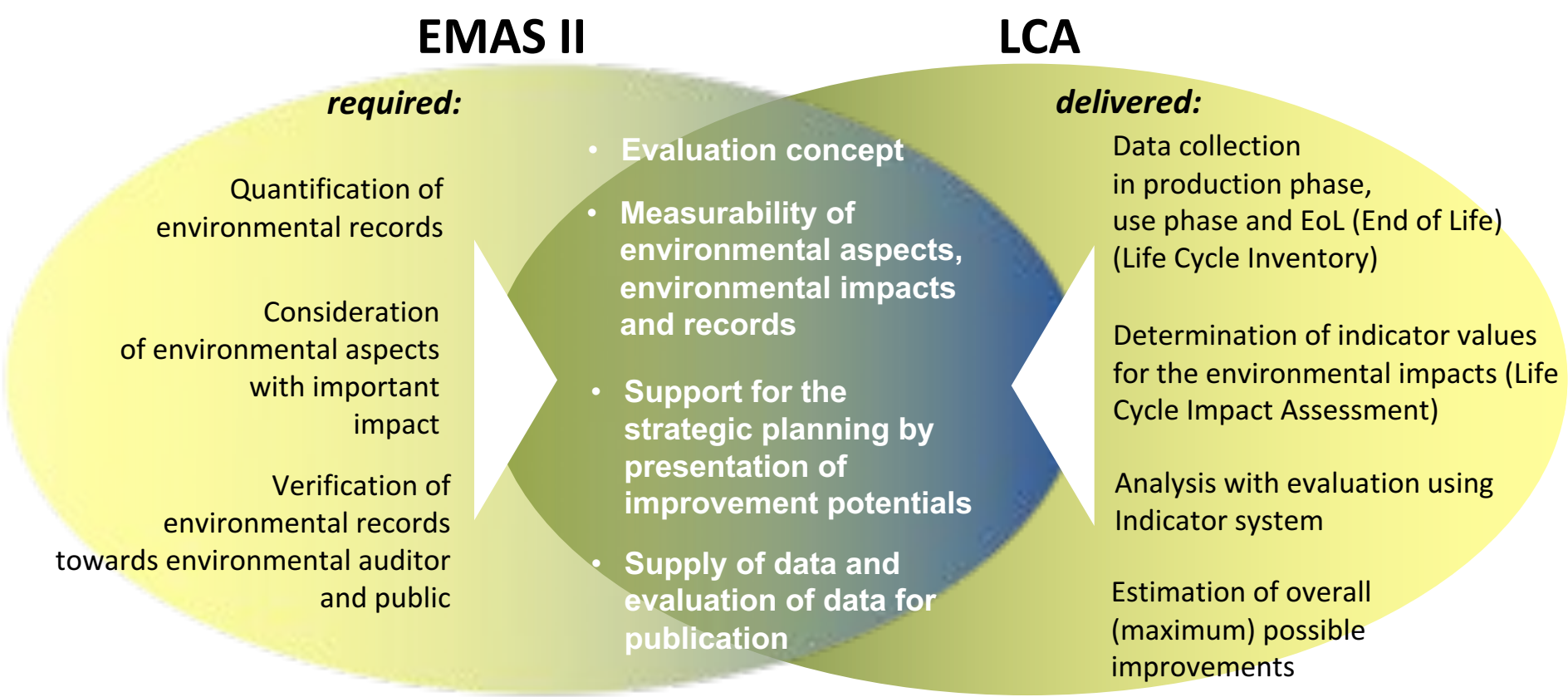
Criteria	EMAS I	ISO 14001
Goal	Continuous improvement of companies environmental protection	Continuous improvement of environmental records
Scope	EU	World
Target group	All organisations	All organisations
Reference framework	Site-specific (including other companies working on site) or organisation-related	Organisation-related
Environmental regulations	Compliance obligatory	Commitment
Public participation	Environmental statement (yearly), integration of employees	Environmental policy, no further obligation for publication
Environm. aspects	Focus on direct aspects	Focus on direct aspects
Validation	Obligatory all 1 to 3 years	Voluntarily by ISO–Auditor

EMAS II: Changes from EMAS I

Changes from EMAS I to EMAS II:

- Open for all kind of organisations
- Requirements of ISO 14001, chapter 4 have been adopted (environmental management system requirements)
- A continuous improvement of the environmental records is required
- Differentiation into ***direct*** and ***indirect environmental aspects*** (*"...(e.g. LCA,...) ..."*)
- Stronger integration of employees
- Use of a new EMAS-symbol
- Environmental statements have to be updated yearly
- Specific environmental information may be selectively published

EMAS II and Life Cycle Assessment (LCA)



Agenda

- Starting questions
- Structure of the EURECA courses
- Learning outcomes
- Course contents
  - An examination of available KPIs
  - Introduction to key data centre standards (historically US based)
  - Emerging European Standards
  - Additional commonly used Standards
  - Significant international Standards bodies
- **Starting questions to be answered**
- References and further reading

Starting Questions -answered

Which KPI should I use to evaluate my DC?

a) PUE (Recognised metric but can be counter intuitive. Not an Energy or Cost efficiency metric)
b) CUE (Recognised metric and helpful to understand environmental impact)
c) Availability / uptime (The most important metric but often misunderstood)

Which standards can I examine to improve the performance of my DC?

a) ASHRAE (Useful for warranty protection and SLA compliance)
b) Uptime Institute Tiers (Not a true Standard but a useful reference point)
c) EN 50600 (The primary European reference and a genuine Standard)

How do the various KPIs and standards differ?

a) Specific Technology or overall Data centre (ASHRAE focuses on environmental control while EN 50600 and Uptime Institute Tiers focus on overall data centre infrastructure)
b) Focus (PUE focuses on energy efficiency while CUE focuses on environmental impact)
c) American or European (European Standards have been slow to develop in the past but are currently developing rapidly. American references are still most prevalent)

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References & Further Reading

- https://tc0909.ashraetcs.org/documents.php
- https://uptimeinstitute.com/TierCertification/
- http://www.data-central.org/?page=EUCoC_EE
- http://ec.europa.eu/environment/emas/register/
- http://susproc.jrc.ec.europa.eu/activities/emas/