

BCS Intermediate Certificate in Energy and Cost Management in the Data Centre Syllabus

Version 2.3

December 2016

This professional certification is not regulated by the following United Kingdom Regulators - Ofqual, Qualification in Wales, CCEA or SQA

Change History

Any changes made to the syllabus shall be clearly documented with a change history log. This shall include the latest version number, date of the amendment and changes made. The purpose is to identify quickly what changes have been made.

Version History	
Version Number and Date	Changes Made
V2.3 December 2016	Strapline regarding regulated statement has been added
V2.2 March 2015	Updated language requirements for extra time and use of dictionaries. Standardised the trainer requirements
V2.1 September 2012	Added information to assist candidates whose business language is not English
V2.0 May 2012	Learning hours added to syllabus. Reference to ISEB replaced throughout with BCS. No change to content of syllabus
V1.0 June 2011	Syllabus created

Contents

Change History	1
Aims and Objectives	5
Target Group	5
Eligibility for the Examination	6
Format of the Examination	6
Accreditation Guidelines for Training Providers.....	6
Additional Time for Candidates requiring Reasonable Adjustments due to a temporary or permanent disability	6
Additional Time for Candidates whose language is different to the language of the exam..	6
Syllabus	7
1. Introduction – Cost & Energy Monitoring and reporting in the data centre (2 hours) ...	7
1.1 Identify and explain the legislative drivers for energy management and reporting (specifically EU ETS and CRC in the UK) this includes the conversion of carbon to cost or cost equivalents	7
1.2 Identify the corporate drivers for energy management, corporate social responsibility, brand value etc - discuss own organisations	7
1.3 Describe and explain the concept of supply and demand side measures and where the data centre and ICT organisations sit on that scale	7
1.4 Understand why the data centre industry with its scale of energy consumption is not identified as a sector as for steel and others – ICT energy in the context of overall business energy	7
1.5 Understand the principle of reflecting energy and cost to the demand side and how this changes demand behaviour	7
2. Introduction – How to manage energy and cost (2 hours)	7
2.1 Describe the basic measurement points for data centre and IT systems energy	7
2.2 Define and explain the basic metrics for data centre efficiency (include DCIE / PUE but also introduce the entire stack and where metrics are still required or under development)	7
2.3 Explain how to benchmark the performance of a facility	7
2.4 Describe the concept of a proxy measure where no common measure is available as well as the weaknesses and lack of portability inherent in such measure	7
2.5 Assess the metrics dashboard to assist candidates in considering metrics in the context of their own environment	7
2.6 Understand the data centre energy usage and cost implications – example of single 1U server over 4 year lifetime ~ £8K	7
3. Introduction – Roles (1 hour).....	7
3.1 Estate management – physical buildings, location and planning	7
3.2 Facilities management – plant management, safety	7
3.3 Data centre manager – operational management, capacity management	7

3.4	IT management - <i>delivery of IT service platforms from hardware through to shared services and virtual infrastructure</i>	7
3.5	Analysts – mapping of business requirements to IT solutions, application selection and delivery	7
3.6	Business management – consumption of ICT resource, from grids of processors to outlook mailboxes	7
4.	Interdisciplinary teams – interactions and communications (1 hour).....	8
4.1	Describe the importance of establishing a cross-functional team	8
4.2	Define and explain the potential from interaction	8
4.3	Define and explain the role of such a team	8
5.	Energy Management (2 hours).....	8
5.1	Identify space, power and cooling capacity as constraints on the data centre including the various units of each (kW, BTU kVA etc)	8
5.2	Identify resilience grades in the data centre, dual corded loads and the impact on device load points and achieved efficiency	8
5.3	Identify design constraints in the data centre, power and thermal density etc.	8
5.4	Understand different types of IT equipment, storage, network, compute	8
5.5	Understand the different criticality of different IT services and thus equipment	8
5.6	Understand that reliability may be achieved at several levels	8
5.7	Understand the impact of IT device power management on the infrastructure – transitioning from a constant load	8
6.	Energy Performance Efficiency (3 hours).....	8
6.1	Explain – goals and objectives of energy efficiency management in this context	8
6.2	Apply – basic energy efficiency management techniques in the following areas:	8
7.	Efficiency Metrics (2 hours).....	8
7.1	Refresh - what metrics represent – metrics dashboard for candidate evaluation	8
7.2	Identify – list the major metrics that are in use	8
7.3	Identify how these metrics are affected by load and external factors such as temperature – why they vary (use DCIE against load example charts)	8
7.4	Describe the concept of a perverse incentive and why it is inappropriate to target on – the PUE	8
7.5	Analyse – the capabilities and limitations of metrics, how to use these metrics as:	8
8.	Metering (2 hours).....	9
8.1	Explain - what can and what can't be metered (electricity, water temperature, water flow, air temp, processor load etc)	9
8.2	Explain - types of metering from heavy plant to power sockets in a rack	9
8.3	Describe power factor and how kW relates to kVA	9
8.4	Identify - what metering can reveal (look for the daily ripple)	9
8.5	Understand - the capabilities and limitations of metering	9
8.6	Shared use buildings – how to meter the part that is data centre	9
8.7	Define and explain the concept of energy versus power measurement	9
8.8	Progression in metering from utility meter to fully instrumented	9
8.9	Progression in energy reporting from monthly written to live dashboard	9
8.10	Integration of IT and M&E reporting	9
9.	Reporting Energy and Carbon e.g. for CRC (1 hour).....	9
9.1	Explain benchmarking & the reporting options for a data centre	9
9.2	Define the energy reporting requirements and schemes	9

9.3	Explain the concept of carbon intensity – convert energy consumption to carbon	9
9.4	Explain how to include non electrical energy sources	9
10.	Reporting Cost – the challenge of per cost accounting (1 hour)	9
10.1	Describe how to report data centre costs	9
10.2	Explain the limitations in achieving per service level detail	9
10.3	Examine the per service requirement	9
	Levels of Knowledge	9
	Levels of Skill and Responsibility (SFIA Levels)	Error! Bookmark not defined.
	Format of the Examination	10
	Trainer Qualification Criteria	10
	Class Room Size	10
	Recommended Reading List	10

Aims and Objectives

This course explicitly deals with an organisation's strategy as it relates to the effective use of energy by software, ICT systems and support infrastructure (mechanical and electrical systems) within the data centre. It will impart an understanding of the use and cost of energy in data centres with an appreciation of the contributing factors, awareness of best practices at a high-level and strategies to control and manage energy efficiency in data centres.

Those completing the course will also gain an understanding of what metering is required to comply with the CRC.

Candidates can expect to gain knowledge and understanding in the following areas upon successful completion of the education and examination components related to this certification.

- Why managing data centre energy and cost is important (*Blooms Level 1 – Remembering*)
- Explain what energy and cost management in the data centre involves (*Blooms Level 2 – Understanding*)
- Predicting and demonstrating appropriate management steps (*Blooms Level 3 – Applying*)
- Compare and distinguish between energy and cost management options (*Blooms Level 4 – Analysing*)

Target Group

The purpose of the Intermediate Certificate in Energy and Cost Management in the Data Centre is to certify that the candidate has gained the knowledge of the need for, understands the engineering principles of, the terminology and the structure of strategies for managing both energy consumption and cost.

Data centre energy consumption and cost is a systems level issue requiring a multi-disciplinary solution, therefore the Certificate is not intended to enable the holder of the Certificate to individually be able to manage, control or optimise all aspects of the energy use in a data centre but to provide them with the skills to work with assistance from experts in other disciplines to deliver an overall efficiency and cost control strategy.

Those likely to be interested in obtaining a qualification of this nature include:

- Data Centre Managers
- Data Centre Operators
- Data Centre Design Consultants
- Data Centre Technicians
- Business Unit Directors/Managers
- IT Purchasers (Hardware & Software)
- IT Architects / Solution Consultants
- Independent IT Consultants
- CSR / Environmental Champions within the technology departments
- Pre-Sales Engineers from OEM Vendors

Course Duration and Format

Candidates can study for this certificate in two ways: by attending training courses provided by Accredited Training Organisations or by self-study.

It is the view of BCS that, for full coverage to be achieved, training courses leading to the certificate should normally run for 17 hours.

The course can be delivered a number of different ways from traditional class-room based training to online e-learning.

Eligibility for the Examination

There are no specific pre-requisites for entry to the examination; however candidates should possess the appropriate level of knowledge to fulfil the objective shown above.

Format of the Examination

The format for the examination is a one hour complex multiple-choice examination consisting of 25 questions based on 5 scenarios. The examination is closed book (no materials can be taken into the examination room). The pass mark is 15/25.

Additional time for candidates requiring Reasonable Adjustments due to a disability

Candidates may request additional time if they require reasonable adjustments. Please refer to the [reasonable adjustments policy](#) for detailed information on how and when to apply.

Additional time for candidates whose language is different to the language of the exam

If the examination is taken in a language that is not the candidate's native / official language then they are entitled to 25% extra time.

If the examination is taken in a language that is not the candidate's native / official language then they are entitled to use their own **paper** language dictionary (whose purpose is translation between the examination language and another national language) during the examination. Electronic versions of dictionaries will **not** be allowed into the examination room.

Syllabus

1. Introduction – Cost & Energy Monitoring and reporting in the data centre (2 hours)

The purpose of this unit is to explain the basics of cost & energy usage monitoring and reporting

- 1.1 Identify and explain the legislative drivers for energy management and reporting (specifically EU ETS and CRC in the UK) this includes the conversion of carbon to cost or cost equivalents
- 1.2 Identify the corporate drivers for energy management, corporate social responsibility, brand value etc - discuss own organisations
- 1.3 Describe and explain the concept of supply and demand side measures and where the data centre and ICT organisations sit on that scale
- 1.4 Understand why the data centre industry with its scale of energy consumption is not identified as a sector as for steel and others – ICT energy in the context of overall business energy
- 1.5 Understand the principle of reflecting energy and cost to the demand side and how this changes demand behaviour

2. Introduction – How to manage energy and cost (2 hours)

The purpose of this unit is to help the candidate to comprehend how to manage cost & energy

- 2.1 Describe the basic measurement points for data centre and IT systems energy
- 2.2 Define and explain the basic metrics for data centre efficiency (include DCIE / PUE but also introduce the entire stack and where metrics are still required or under development)
- 2.3 Explain how to benchmark the performance of a facility
- 2.4 Describe the concept of a proxy measure where no common measure is available as well as the weaknesses and lack of portability inherent in such measure
- 2.5 Assess the metrics dashboard to assist candidates in considering metrics in the context of their own environment
- 2.6 Understand the data centre energy usage and cost implications – example of single 1U server over 4 year lifetime ~ £8K

3. Introduction – Roles (1 hour)

Specifically, candidates must understand key roles and responsibilities:

- 3.1 Estate management – physical buildings, location and planning
- 3.2 Facilities management – plant management, safety
- 3.3 Data centre manager – operational management, capacity management
- 3.4 IT management - *delivery of IT service platforms from hardware through to shared services and virtual infrastructure*
- 3.5 Analysts – mapping of business requirements to IT solutions, application selection and delivery
- 3.6 Business management – consumption of ICT resource, from grids of processors to outlook mailboxes

4. Interdisciplinary teams – interactions and communications (1 hour)

- 4.1 Describe the importance of establishing a cross-functional team
- 4.2 Define and explain the potential from interaction
- 4.3 Define and explain the role of such a team

5. Energy Management (2 hours)

The purpose of this unit is to help candidates understand the roles, terminology and technology of other groups.

- 5.1 Identify space, power and cooling capacity as constraints on the data centre including the various units of each (kW, BTU kVA etc)
- 5.2 Identify resilience grades in the data centre, dual corded loads and the impact on device load points and achieved efficiency
- 5.3 Identify design constraints in the data centre, power and thermal density etc.
- 5.4 Understand different types of IT equipment, storage, network, compute
- 5.5 Understand the different criticality of different IT services and thus equipment
- 5.6 Understand that reliability may be achieved at several levels
- 5.7 Understand the impact of IT device power management on the infrastructure – transitioning from a constant load

6. Energy Performance Efficiency (3 hours)

The purpose of this unit is to help the candidate to comprehend and apply energy performance efficiency concepts in the context of the data centre

- 6.1 Explain – goals and objectives of energy efficiency management in this context
- 6.2 Apply – basic energy efficiency management techniques in the following areas:
 - IT device energy use and efficiency – power provisioning, moving from nameplate to peak or mean – the future DCM etc
 - IT *device environmental constraints – impacts on IT device efficiency*
 - Cooling systems efficiency – humidity controls, supply temperatures, economiser systems, part load, staging etc
 - Electrical systems efficiency – operating modes, part load, modular provisioning
 - Systems level efficiency

7. Efficiency Metrics (2 hours)

The purpose of this unit is to explain the various efficiency metrics in the context of the data centre

- 7.1 Refresh - what metrics represent – metrics dashboard for candidate evaluation
- 7.2 Identify – list the major metrics that are in use
- 7.3 Identify how these metrics are affected by load and external factors such as temperature – why they vary (use DCIE against load example charts)
- 7.4 Describe the concept of a perverse incentive and why it is inappropriate to target on – the PUE
- 7.5 Analyse – the capabilities and limitations of metrics, how to use these metrics as:
 - Reporting metrics
 - Analysis and diagnostic metrics
 - Predictive metrics

8. Metering (2 hours)

The purpose of this unit is to explain the various methods of metering used in the data centre

- 8.1 Explain - what can and what can't be metered (electricity, water temperature, water flow, air temp, processor load etc)
- 8.2 Explain - types of metering from heavy plant to power sockets in a rack
- 8.3 Describe power factor and how kW relates to kVA
- 8.4 Identify - what metering can reveal (look for the daily ripple)
- 8.5 Understand - the capabilities and limitations of metering
- 8.6 Shared use buildings – how to meter the part that is data centre
- 8.7 Define and explain the concept of energy versus power measurement
- 8.8 Progression in metering from utility meter to fully instrumented
- 8.9 Progression in energy reporting from monthly written to live dashboard
- 8.10 Integration of IT and M&E reporting

9. Reporting Energy and Carbon e.g. for CRC (1 hour)

- 9.1 Explain benchmarking & the reporting options for a data centre
- 9.2 Define the energy reporting requirements and schemes
- 9.3 Explain the concept of carbon intensity – convert energy consumption to carbon
- 9.4 Explain how to include non-electrical energy sources

10. Reporting Cost – the challenge of per cost accounting (1 hour)

- 10.1 Describe how to report data centre costs
- 10.2 Explain the limitations in achieving per service level detail
- 10.3 Examine the per service requirement

Levels of Knowledge / SFIA Levels

This course will provide candidates with the levels of difficulty / knowledge skill highlighted within the following table, enabling them to develop the skills to operate at the levels of responsibility indicated.

The levels of knowledge and SFIA levels are explained at www.bcs.org/levels

Level	Levels of Knowledge	Levels of Skill and Responsibility (SFIA)
K7		Set strategy, inspire and mobilise
K6	Evaluate	Initiate and influence
K5	Synthesise	Ensure and advise
K4	Analyse	Enable
K3	Apply	Apply
K2	Understand	Assist
K1	Remember	Follow

Format of the Examination

Type	Complex Multiple choice, 25 questions based on 5 scenarios
Duration	1 Hour. Candidates are entitled to an additional 15 minutes if they are sitting the examination in a language that is not their native/official language.
Pre-requisites	None, although accredited training is strongly recommended.
Supervised / Invigilated	Yes
Open Book	No
Pass Mark	15/25 (60%)
Distinction Mark	None
Calculators	Calculators cannot be used during this examination
Learning Hours	17 Hours
Delivery	Paper based examination only

Trainer Criteria

Criteria	<ul style="list-style-type: none">• Hold the BCS Intermediate Certificate in Energy and Cost Management in the Data Centre• Have 10 days training experience or hold a train the trainer qualification• Have a minimum of 3 years' experience in the area of Energy and Cost Management
----------	---

Class Room Size

Trainer to candidate ratio	1:16
----------------------------	------

Recommended Reading List

White Paper "Data centre energy efficiency metrics" April 2008 Author: Liam Newcombe, Romonet Limited

Presentation at Data Centre Dynamics (London): "Data Centre Metrics, From PUE to Data Centre Performance" November 2009 Author: Liam Newcombe BCS DCSG Secretary

Publication: "Data Centre Carbon Reporting, BCS DCSG review of the proposed CRC mechanism" June 2009 Author: Liam Newcombe, Secretary of BCS DCSG