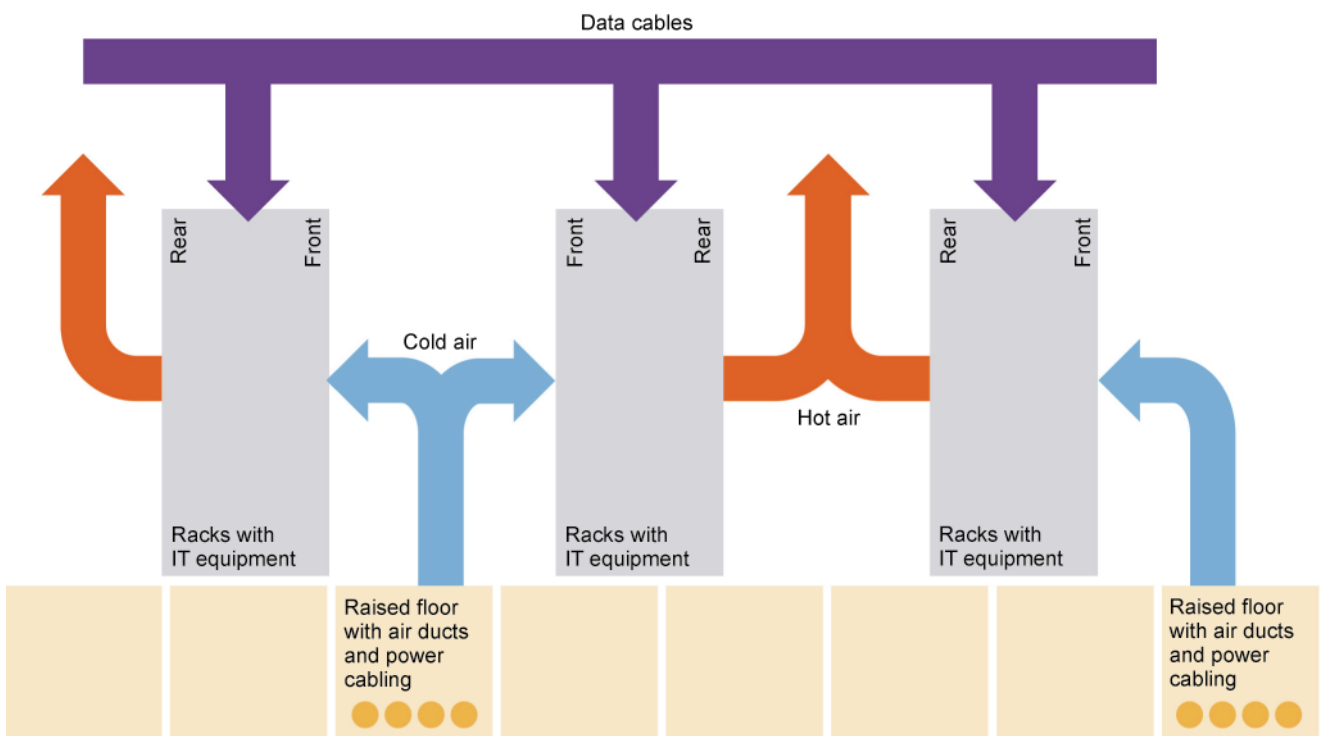


## Green Sustainable Data Centres

### Course and Project Summary





This course is produced under the authority of e-Infranet: <http://e-infranet.eu/>

#### *Course team*

prof. dr. Colin Pattinson, Leeds Beckett University (United Kingdom),  
*course chairman and author of Chapter 1 and 7*

prof. dr. Ilmars Slaidins, Riga Technical University (Latvia),  
*assessment material development: Study Guide*

dr. Anda Counotte, Open Universiteit (The Netherlands),  
*distance learning material development, editor-in-chief*

dr. Paulo Carreira, IST, Universidade de Lisboa (Portugal),  
*author of Chapter 8*

Damian Dalton, MSc, University College Dublin (Ireland),  
*author of Chapter 5 and 6*

Johan De Gelas, MSc, University College of West Flanders (Belgium),  
*author of Chapter 3 and 4*

dr. César Gómez-Martin, CénitS - Supercomputing Center and  
University of Extremadura (Spain),  
*author of Checklist Data Centre Audit*

Joona Tolonen, MSc, Kajaani University of Applied Sciences (Finland),  
*author of Chapter 2*

#### *Program direction*

prof. dr. Colin Pattinson, Leeds Beckett University (United Kingdom),

prof. dr. Ilmars Slaidins, Riga Technical University (Latvia)

dr. Anda Counotte, Open Universiteit (The Netherlands)

#### *Hosting and Lay-out*

[http://portal.ou.nl/web/green-sustainable-  
data-centres](http://portal.ou.nl/web/green-sustainable-data-centres)

Arnold van der Leer, MSc

Maria Wienbröker-Kampermann

Open Universiteit in the Netherlands

This course is published under  
Creative Commons Licence, see  
<http://creativecommons.org/>



First edition 2014



# Green Sustainable Data Centres

## Course and Project Summary

dr. Anda Counotte,  
Open Universiteit (The Netherlands)  
Professor Colin Pattinson  
Leeds Beckett University (UK)



# e-InfraNet

- FP7 project, 2010-2013, <http://e-infranet.eu>
- **Vision** – be the high-level body developing policies for e-Infrastructures
- **Goals** - strengthen cooperation and coordination between national e-infrastructures for efficient integration in the European Research Area.
- **Focus Areas:**
  - Cloud Computing
  - Environmental and Green Computing
  - Openness



 Search

- [e-InfraNet](#)
- [About us](#)
- [What we're doing](#)
- [Key results/outputs](#)
- [Communicate](#)
- [Special interest groups](#)
- [Wiki](#)

**Vision** – be the high-level body developing policies to reinforce and promote efforts to foster world-class ICT infrastructures

**Goals** - to build a network that will develop and strengthen cooperation and coordination between national e-infrastructures and smooth their efficient integration in the European Research Area. The project will establish an effective dialogue between national e-infrastructure programme owners and managers in Europe, at the European Commission level and globally.

#### Focus Areas

- **Cloud Computing** – Dynamically scaleable and often virtualised resources.
- **Environmental and Green Computing** – Environmentally sustainable computing or ICT
- **Openness** -Open Access, Open Source, Open Borders and Open Opportunity

#### Latest News

JUN  
26

**e-InfraNet at Terena Networking Conference 4th of June 2013-Innovating Together (Maastricht, the Netherlands)**



# EISTER

- **e-Infranet Sustainability Training and Educational Resource**
- E-InfraNet Open Call, project 15.08.2013 – 15.01.2014
- Educational programme on green sustainability of ICT
- Specifically aimed at meeting the education and development needs of the community of data centre and IT professionals who will develop, support and maintain the physical resources which comprise the e-Infranet





# Partners

- Leeds Beckett University, UK
- Riga Technical University, Latvia
- University College Dublin, Ireland
- Open Universiteit, the Netherlands
- Kajaani University of Applied Sciences, Finland
- University College of West Flanders, Belgium
- IST – Universidade de Lisboa, Portugal
- CénitS Trujillo and University of Extremadura, Spain



# The course

- Aim: To provide e-Infrastructure professionals with the knowledge and skills needed to perform a sustainability audit and prepare a strategy to update the Data Centre.
- Based on the EU Code of Conduct on Data Centres
- Allows you to conduct an audit of your Data Centre according to the CoC
- Explores
  - the background to the field
  - Measurements
  - Standards / best practice



# The course as OER



The screenshot shows the website for 'Green Sustainable Data Centres' on the Open Universiteit portal. The header includes the course title and the Open Universiteit logo. A navigation menu on the left has 'Home' and 'Search' options. The main content area features the 'e-InfraNet' logo, a registration prompt, and a list of environmental concerns: climate change, electronic waste, scarce materials, and water supplies. It also mentions energy consumption statistics for the IT industry and data centres.

Green Sustainable Data Centres

Open Universiteit

Dashboard > Green Sustainable Data Centres > Home

Home Search

Home  
Search

If you like to see all the content, we ask you to register to our website:

- Change the language to English.
- If you already have an account: [sign in](#), else: make a new account and follow the instructions under: 'I am new at the Open Universiteit'.
- Go to the page [Electronic Workbook](#).
- Click on Register (left).

**e-InfraNet**

**Green Sustainable Data Centres**

Since 2006 the IT Industry became aware of the environmental impact of their operations. In order of importance these are:

- Climate change due to CO<sub>2</sub> that is emitted on energy production
- Waste of electronic equipment
- Exhaustion of supplies of scarce materials
- Disturbance of water supplies.

In 2012 the energy consumption by IT was of the same magnitude as the energy consumption of the aircraft industry and it is expanding every year.

In IT Industry the data centres are the largest consumers of energy. Data centre energy consumption worldwide has doubled since 2000 and by 2020, it is predicted that the Carbon footprint of the EU data centre community will constitute 15-20% of Europe's total CO<sub>2</sub> emissions.

The European Code of Conduct on Data Centres gives best practices how the energy efficiency of data centres can be measured and improved.

<http://portal.ou.nl/web/green-sustainable-data-centres>



## Learning Outcomes

- On completion of this course, students should be able to:
  - Understand the place of the data centre in the overall carbon footprint of IT provision
  - Select, plan and conduct suitable measurement methods to assess the environmental performance of a data centre
  - Make decisions informed by those measurements to modify the behaviour of the data centre to reduce its environmental impact
  - Apply relevant national and international standards, policies and recommendations to their place of work.



# Highlights of the Course Project

- On completion of this project you will be able to:
  - Understand the role and purpose of the EU CoC
  - Describe the composition of a typical data centre
  - Show how that composition offers both opportunities and challenges to sustainable operation
  - Understand the measurements required for an audit
  - Carry out an audit according to the CoC
  - Suggest measures to improve sustainability



## Course structure

- 13 weeks in total
- 125 hours of study (nominal) 5 ECTS
- Distance learning, supported by workbooks
- Workshop visits to example data centres
- Final assessment a course project:
  - Present a data centre audit according to the CoC
  - Suggest measures to improve sustainability



# Course schedule

Week	Topic	Other activity	Workload (hours)
1	Introduction to Programme - Workshop	Study Guide	6
2	Introduction to Green IT		12
3	Data Centre Facilities		8
4	IT Equipment		6
5	Operating Systems & Virtualisation	Homework 1 and test	6 + 3
6	Measurement and Control		12
7	Data Centre Infrastructure Management	Homework 2 and test	12 + 5
8	Roadshow Workshop		10
9	Legal and Regulatory Framework		10
10	Greening by ICT	Homework 3 and test	10 + 5
11 & 12	Course Project/Case Studies	Building up from homework 1-3	12
13	Final Workshop	Presentation and defence	8
	<b>Total</b>		<b>125</b>

# How to study...

- Introductory Workshop
- The Study Guide
- 3 Homeworks
- Roadshow Workshop
- Course project and Final Workshop





## Conclusion

- This is an Introductory course for Master of Science
- MSc. Courses in Dublin and Leeds
- Projects Pedca etc.
- We aim to develop a full Master of Science course
  - 60 ECTS
  - Blended learning
  - Specialisation in
    - Strategic
    - Technical
    - Greening by IT



We wish you a pleasant learning!

