Module Descriptor 2016/17  
School of Computer Science and Statistics.

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<tr>
<th>Module Code</th>
<th>CS7052</th>
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<tbody>
<tr>
<td>Module Name</td>
<td>Sustainable Computing</td>
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<tr>
<td>Module Short Title</td>
<td>N/a</td>
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<tr>
<td>ECTS weighting</td>
<td>5</td>
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<tr>
<td>Semester/term taught</td>
<td>2nd Semester</td>
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**Contact Hours**
- Lecture hours: 22
- Lab hours: 3
- Tutorial hours: 8
- Total hours: 33

**Module Personnel**
Professor Donal O'Mahony

**Learning Outcomes**
Students will develop a broad understanding of the issues surrounding energy supply and demand as well as the adverse effects of consumption on the environment.

Students should understand how energy is currently expended and in particular understand what proportion of this is accounted for by ICT. They should be able to critically assess the options for deriving this energy from hydrocarbon, nuclear or renewable sources.

Students should develop an appreciation for the role Computing and ICT plays in resource consumption now, how that is changing and how it will evolve in the future. Students should be able to articulate the arguments for and against the major migration of computer applications towards the cloud computing model. They should understand the energy implications of this and its role in sustainable ICT.

Students should have knowledge of the level of waste that is generated by the ICT industry. They should know how this is currently being handled, be aware of good and bad practice and be able to engage in intelligent debate of this topic with their peers.

**Module Learning Aims**
Following completion of this module, students will be able to:

1. Describe the main forces governing the supply and consumption of energy now and in future years
2. Appreciate the impact of the personal lifestyle choices made by people in different countries on their energy consumption
3. Compare the energy consumption of the ICT industry as a whole and in its component parts against other industries
4. Demonstrate a knowledge of the significance of cloud computing to the computer industry and a knowledge of how it is realized
Demonstrate a knowledge of the main trends in wireless and fixed networking and the impact this has on energy consumption.

Demonstrate a knowledge of the impact of waste generation in the IT industry including its environmental and ethical implications and the impact of regulation and standardization.

1. Long Term Energy usage Trends
   - The Tragedy of the Commons & Peak Oil
   - Future Prospects for Hydrocarbons - Oil Sands, Gas Shales
   - The Environmental Argument
   - Emissions Reduction – The Kyoto Protocol
   - Economic Mechanisms - Cap & Trade

2. Personal Energy Consumption
   - The 125 lightbulbs model
   - Renewable Energy – expected contribution
     - Nuclear – potential and obstacles

3. ICT’s Role in Power Consumption
   - Individual PC & Servers – consumption and trends
   - Endpoint Consumption beyond PCs
   - The Cloud Computing Concept
   - Cloud Hardware & Software Platforms
   - Cloud Economics
     - Energy usage, Cooling, Packaging
     - Examples of Cloud Computing & Warehouse Scale Computing
     - The Cloud Computing Workload – programming models, Map/Reduce
     - Power Usage in the Fixed Network
     - Power Usage in the Wireless Network

4. ICT End-of-Life Processing – Sustainable approaches
   - Reduction
     - Reuse Potential
     - Recovery
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| Recommended Reading List | Sustainable Energy – Without the Hot Air, David MacKay, UIT Cambridge, 2009  
|                         | The Greening of IT, John Lamb, IBM Press, 2009  
|                         | Foundations of Green IT, M. Poniatowski, Prentice hall, 2009  
|                         | The Sustainable Network, S. Sorensen, O'Reilly Media, 2009 |

<table>
<thead>
<tr>
<th>Module Pre Requisite</th>
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<th>Module Co Requisite</th>
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| Assessment Details | %100 Coursework:  
|                    | Supplemental 100% coursework |

| Module approval date | N/a |

| Approved By | N/a |

| Academic Start Year | N/a |

| Academic Year of Data | N/a |