Module Descriptor 2012/13
School of Computer Science and Statistics.

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<th>Module Code</th>
<th>CS7052</th>
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<tr>
<td>Module Name</td>
<td>Sustainable ICT</td>
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<tr>
<td>Module Short Title</td>
<td>N/a</td>
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<td>ECTS weighting</td>
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<td>Semester/term taught</td>
<td>2nd Semester</td>
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<tr>
<td>Contact Hours</td>
<td>Lecture hours: 22 Lab hours: 3 Tutorial hours: 8 Total hours: 33</td>
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<td>Module Personnel</td>
<td>Prof. Donal O'Mahony</td>
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**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.

Student 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**

This course introduces the foundations of sustainability and gives an appreciation for how energy is currently used in ICT and the problems created by the continuous growth of the ICT industry. The course will then delve into some detail on where power is consumed in current networks and how new techniques and trends will affect this. It will examine initiatives that have been taken to date, the impact that they have had and the prospects for future initiatives that will shape the industry.
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
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<tr>
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