PAUL MOBBS

A practical guide to sustainable IT

Unit 1

This unit is one of 12 sections to a "A practical guide to sustainable IT", a hands-on guide to working with everyday technology in an environmentally conscious way. The guide has been written by environmental activist and ICT expert Paul Mobbs, and was commissioned by the Association for Progressive Comunications (APC) with the support of the International Development Research Centre (IDRC). To download the full text of the guide, or any of the other units, please visit: greeningit.apc.org

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WHAT IS SUSTAINABLE INFORMATION TECHNOLOGY?

Welcome to *A practical guide to sustainable IT*. This publication will guide you on a journey to examine how the information systems which support our lives work, and how their ecological footprint has grown to become a distinct part of the human impact upon the planet.

In developed nations, information systems are now an indispensable part of most people's lives. In developing nations, information systems are a means of enabling communication and exchange where no such infrastructure existed before, and that in turn creates many new opportunities from education to economic development.

But the development of the global communications network, and the equipment attached to it, has come at a cost. The reality is that these services are not "free"; quite apart from the financial cost, the production and use of these systems is affecting the global ecosystem which supports life on earth. For example, by some estimates the impact of information systems and telecommunications has as great an effect on climate as the air transport system.[1] How great those impacts are, or how we can reduce or manage them, is defined by the choices we make when buying, using or disposing of these machines.

If we're going to have access to these technologies in the future, without harming the planet or depleting the resources from which they are manufactured, we must learn to plan our use of information systems to maximise material efficiency while minimising their environmental impact. In short, we must make them more sustainable.[2]

1. Computing climate change – How much carbon dioxide do computers emit?, The Economist, 24th August 2009. www.economist.com/node/14297036
2. Wikipedia, "Sustainability". en.wikipedia.org/wiki/Sustainability

1.1. A PROBLEM OF WORDS AND DEFINITIONS

How do we define "sustainable"? That's a question which has been taxing the brains of policy makers, scientists and environmentalists for the last few decades.

The problem is that over the years different groups have applied slightly different meanings to the term – often based around the objectives of the study or policy they were considering at the time. A literal definition of the term means, "the ability of an activity to endure or function for a certain period of time or perhaps indefinitely". Unfortunately, for computing, telecommunications and related technologies there is no agreed standard on how we should measure these impacts. Narrow definitions of sustainability may only consider one or two features of an activity without looking at how other important factors interact with the wider world. More general definitions may look at a larger number of related factors which collectively define how "sustainable" the activity is when considered as a whole.

Many definitions take their cue from the United Nations World Commission on Environment and Development report (also known as the Brundtland report), published in 1987, which launched the modern policy debate on sustainability:[3]

> Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Going from this all-encompassing definition of sustainability to one which fits the peculiar features of information technology is a very big jump. We could take a very narrow definition, for example, looking purely at the electricity consumed by machine hardware; but if we are to give the consideration of sustainability a broader and more meaningful definition then we have to consider the operation of the whole system.

Assessing the sustainability of our use of information technology isn't just a matter of measuring environmental pollution. It's an all-encompassing view of how we design, organise and operate the information systems that allow us to carry out our work and live our lives – and doing so in a way which considers not only the impact on the planet today, but also how we develop, use and preserve information resources for ourselves and others in the future.

Tackling this is obviously a very broad agenda. While our use of computers has a direct effect on the environment, if we're looking at how "sustainable" our use of those systems is we must include the related factors which influence that process. Yes, we must look at the machine hardware – how those machines are made, but also how they are disposed of. In addition it's vital that we consider the features of the operating systems and programs that we use, and the processing and storage of information – since it is the value of information which defines the purpose for which we build these machines. If we're considering how sustainable our information keeping is, then the reliability of our record keeping/data storage systems is important – and that in turn can raises issues related to intellectual property rights and other legal considerations.

This guide is organised as a serious of themed sections or what we call "units", each looking at the sustainability issue from a slightly different angle. The objective within each unit is to get you thinking more systematically about how you can physically organise your data, programs or equipment to achieve the tasks you want to carry out.

3. World Commission on Environment and Development. Paragraph 1, chapter 2, Our Common Future, report to the UN General Assembly, 1987. www.un-documents.net/wced-ocf.htm

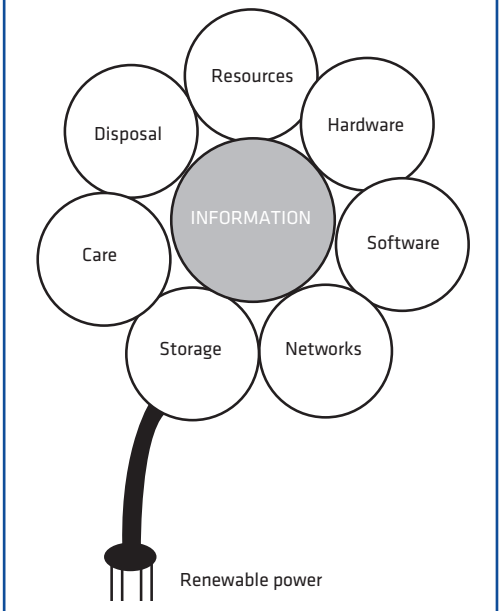
1.2. IT'S NOT EASY BEING "GREEN"

To date there has been a lot of work around the issue of *Green IT*[4] – the design and organisation of computers to achieve certain ecological objectives. Examples of recent green IT studies and useful publications are listed in the bibliography at the end of the guide. Green IT studies and programmes often take energy consumption as the lead indicator of sustainability – for example, the *Energy Star* labelling scheme developed by computer manufacturers and the US government in 1992. Others go further, considering the effects of disposing of those machines on the environment. More recent work seeks to examine the machine as part of a "holistic system"[5] – considering the whole life-cycle of the machines during production and use.

Across the array of green IT publications available there is little connection made to the other equally important issues related to our use of computers – such as systems standards, data formats or information security. That's a pity because there are many common themes between "green" issues and the everyday concerns which arise from our use of computers and information networks. It's by combining the existing "green" ideas of sustainability, with a far broader consideration of the factors which influence our everyday use of IT, that has led us to produce this guide to "sustainable information technology".

Figure 1.1.

The sustainable IT "flower"



1.2.1. The "information flower"

Rather than base our considerations around a definition which begins with hardware, in this guide we'll look at our use of IT from the point of view of the *information* which the system manipulates. Information is, after all, the vital human resource which we wish to sustain, independently of the hardware with which we choose to process it at any point in time. In order to give this definition of sustainability a practical meaning we've broken down the operations or processes which define our use of information technology, and from each we have drawn a set of ideas and activities which allow us to review, audit and improve the way we organise and work with information.

To illustrate this, we've organised the guide's themes around the holistic motif of an ***information flower*** – each petal representing one aspect of the sustainable use of IT, and the stem as the source of electrical power. Each unit in the guide corresponds to an element of the flower:

Resources, or perhaps more appropriately, The ecology of technology – a general outline of how our demand for computers affects the world, but also how those demands have changed us. Our use of energy sources and natural resources isn't random or accidental. We've progressively developed technologies that have required ever-more specialised resources and materials as time has passed. Technological progress has inherently increased the complexity of human

4. Wikipedia, "Green computing". en.wikipedia.org/wiki/Green_computing

5. Murugesan, San. Harnessing Green IT: Principles and Practices, IT Pro (Journal of the IEEE Computer Society), January/February 2008. www.comp.dit.ie/rfitzpatrick/Business Perspectives slides/Papers/Harnessing Green IT - Principles and Practice - San Murugesan.pdf

systems, and this has implications for our future as the production of certain essential resources is limited. In this unit we'll look at the resource use inherent in our consumption of information technology, but also at the wider human resource issue, and the ecological limits which are increasingly apparent as the globe's appetite for natural resources grows.

Hardware: Putting the system together – the machine and its impacts on the environment. Today computer hardware comes in many different forms, from the large mainframe and server complexes of large organisations to the mobile phones people carry down the street. In this unit we'll look at the resource implications of computer hardware, and how our choices about design specifications - but most importantly the period of time we plan to use the equipment - affect the ecological footprint of our information processing.

Software – the programs we use on the machine to perform the tasks we require. This is a large subject and so it is divided into two sections:

- **Operating systems: Making the system work** – the programs which make the computer function. Our choice of operating system has an effect on how the hardware functions, and more importantly it can have an impact on the service life of the machine.
- **Desktops: Programs, peripherals and gadgets** – in which we consider how we interact with our computer systems, and the programs we use to perform the information processing tasks that we demand from our computer systems.

Information storage – or more precisely, information storage and backing-up. Information processing is the reason we have created a diversity of machines and networks, and in turn preserving that information is a vital part of making the system secure, resilient and sustainable. In this section we look at how we store information, the options for backing up data, and how our choices create different levels of security and determine our ecological footprints.

Local and global networks – it is by linking computers together that we have created such a powerful system for human interaction and exchange, but this in turn has amplified the environmental impacts of information technology. As more information and services are digitised, so the energy and resource demands of the system grow. In this section we look at how we network computers together to meet our own information needs, and how all machines have become increasingly dependent upon the global network, both for communication and as a means of storage and distributing/updating software.

Care, or more precisely, Maintenance, security and resilience – looking after our information systems. Like any complex tool or mechanism, computer systems need care and maintenance. While solid-state technology of the silicon chip may have no moving parts, there are many aspects of everyday computer use which require physical care and maintenance. Besides hardware, the computer's software and the file system also need occasional attention to keep the logical elements of the machine working reliably. In this unit we look at how we can care for our information systems, to keep them functioning reliably, but also to get the greatest possible service life from the hardware. We'll also look at how we can plan for system failures, or more serious events, to secure our information even when the hardware fails.

Disposal – in which we examine how we can deal with equipment which has reached the end of its useful life. This is divided into two parts:

- **End of life and disposal** – how to know when equipment has reached the end of its useful life, and how to dispose of it safely. The components inside computer systems can fail, but sometimes they are discarded because of other factors, such as changes in software or operating systems, which necessitate using more powerful hardware. In this unit we'll look at the environmental risks of computer hardware, how to determine if any item of hardware can be used for other tasks, how to dispose of it if necessary, and the problematic issue of erasing data to prevent the disclosure of sensitive information.

- **Reuse and reclamation** – how machines can be upgraded or recycled and given a new lease of life. This is a more ambitious unit, which seeks to takes people beyond simply "using" a computer, to thinking more technically about how they can reconfigure their hardware to serve other needs. We'll look at the options for donating old equipment, but also how components can be upgraded to extend the lifetime of the equipment, or installed with different software to give the machine a new function to support your information infrastructure.

Renewable power – the options for sourcing electricity from lower carbon and renewable resources. Computers require electrical power to operate, and the generation of electricity is one of the major carbon-intensive industries on the planet, which gives rise to a number of pollutants, besides carbon dioxide. In this unit we'll look at alternative options to sourcing electricity from the power grid, and we'll also look at going off grid – both to exploit renewable energy resources and as a means of taking computers outdoors, beyond the reach of the mains grid.

The final unit contains a subject index for all the sections, a glossary of the technical terms used in the guide, as well as a bibliography and directory of online information sources. Green advice for policy makers, and a check-list for internet service providers are then included in the appendices.

A practical guide to sustainable IT

This practical guide to sustainable IT offers a detailed, hands-on introduction to thinking about sustainable computing holistically; starting with the choices you make when buying technology, the software and peripherals you use, through to how you store and work with information, manage your security, save power, and maintain and dispose of your old hardware. Suggestions and advice for policy makers are also included, along with some practical tips for internet service providers.

Written by IT expert and environmentalist Paul Mobbs, the purpose of the guide is to encourage ICT-for-development (ICTD) practitioners to begin using technology in an environmentally sound way. But its usefulness extends beyond this to everyday consumers of technology, whether in the home or office environment. We can all play our part, and the practice of sustainable computing will go a long way in helping to tackle the environmental crisis facing our planet.

This is also more than just a "how to" guide. Mobbs brings his specific perspective to the topic of sustainable IT, and the practical lessons learned here suggest a bigger picture of how we, as humans, need to live and interact in order to secure our future.

The guide is divided into 12 sections (or "units"), with each unit building thematically on the ones that have come before. They can be read consecutively, or separately. The "unit" approach allows the sections to be updated over time, extracted for use as resource guides in workshops, or shared easily with colleagues and friends.

The guide has been developed on behalf of the Association for Progressive Communications (APC), with funding support from the International Development Research Centre (www.idrc.ca). It is part of a APC's GreeningIT initiative, which looks to promote an environmental consciousness amongst civil society groups using ICTs, and amongst the public generally. Other publications and research reports completed as part of the GreeningIT initiative can be downloaded at: greeningit.apc.org

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