

PAUL MOBBS

A practical guide to sustainable IT

Unit 12



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 Communications (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

A practical guide to sustainable IT

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FURTHER INFORMATION

This publication cannot be a solution in itself; it is a starting point from which you can hopefully gain the inspiration to change and adapt your use of ICTs to minimise your impacts on the environment. Below, sorted by theme, is a list of reports, books, videos and websites which can help to fill in the detail that is beyond the scope of this guide:

Green & sustainable IT

- Global Action Plan (2007). *An Inefficient Truth*. www.it-energy.co.uk/pdf/GAP_An_Inefficient_Truth_Dec_2007.pdf
- Unhelkar, Bhuvan (2011). *Green IT Strategies and Applications: Using Environmental Intelligence*. CRC Press, ISBN 9781-4398-3780-1.
- Willcocks and Lester (1996). *Beyond the IT Productivity Paradox*, European Management Journal, vol.14 no.3 pp.279-290, June 1996. [dx.doi.org/10.1016/0263-2373\(96\)00007-2](https://doi.org/10.1016/0263-2373(96)00007-2)
- Murugesan, San. *Harnessing Green IT: Principles and Practices*, IT Pro (Journal of the IEEE Computer Society), January/February 2008. www.sis.pitt.edu/~dtipper/2011/GreenPaper.pdf
- International Energy Agency. (2009) *Gadgets and Gigawatts – Summary*, OECD/IEA, Paris. www.iea.org/Textbase/npsum/Gigawatts2009SUM.pdf
- Velte and Elsenpeter (2008). *Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line*. McGraw-Hill Osborne, ISBN 9780-0715-9923-8.
- *Whole Building Design Guide: Sustainability* – www.wbdg.org/design/sustainable.php

Ecological limits, sustainability and resource depletion

- Leonard, Annie (2007). *The Story of Stuff*. www.storyofstuff.org/movies-all/story-of-stuff/
- Smithsonian Institute/MIT (March 2012). *Perspectives on Limits to Growth: Challenges to Building a Sustainable Planet*. si.edu/consortia/limitstogrowth2012

- Randers, Jorgen (2012). *2052: A Global Forecast for the Next Forty Years*. Chelsea Green Publishing, ISBN 9781-6035-8467-8.
- APC (2010). *Global Information Society Watch 2010: ICTs and Environmental Sustainability*. www.giswatch.org/en/2010
- Bardi, Ugo (2011). *The Limits to Growth Revisited*. Springer Publishing, ISBN 9781-4419-9415-8.
- Turner, Graham (June 2008). *A Comparison of the Limits to Growth with Thirty Years of Reality*, Commonwealth Scientific and Industrial Research Organisation (CSIRO). www.csiro.au/files/files/plje.pdf
- Raghavan and Ma (2011). *The Energy and Emery of the Internet*. www.cs.berkeley.edu/~jtma/papers/emery-hotnets2011.pdf
- European Commission (2010). *Critical raw materials for the EU*, CEC. ec.europa.eu/enterprise/policies/raw-materials/files/docs/report_en.pdf
- WWF-UK (2010). *Common Cause: The Case for Working with our Cultural Values*. assets.wwf.org.uk/downloads/common_cause_report.pdf

Computer reclamation

- *Computeraid International* – www.computeraid.org
- *ifixit. Self-Repair Manifesto*. www.ifixit.com/Manifesto
- *Sheffield Access Space* – access-space.org
- Mueller, Scott (2011). *Upgrading and Repairing PCs* (20th Edition). QUE Publishing, ISBN 9780-7897-4710-5.

Free and open source software (FOSS)

- *Free Software Foundation* – www.fsf.org
- Free Range Network (2009). *Thinking Outside the Cage: An introduction to Free/Open Source Philosophy*. www.fraw.org.uk/fwd?j1
- *Lesswatts: Saving Power with Linux* – lesswatts.org
- *Open Source Ecology* – opensourceecology.org
- *Open Hardware* – www.openhardware.org
- *Open Source Windows* – opensourcewindows.org

Electronic waste management and cleaner production

- *Waste Electrical and Electronic Equipment Directive* – ec.europa.eu/environment/waste/weee/index_en.htm
- Leonard, Annie (2010). *The Story of Electronics*. www.storyofelectronics.org
- U.S. Geological Survey (July 2006). *Recycled Cell Phones – A Treasure Trove of Valuable Metals*, USGS Fact Sheet 2006–3097. pubs.usgs.gov/fs/2006/3097/fs2006-3097.pdf
- Greenpeace International (2010). *Why BFRs and PVC should be phased out of electronic devices*. www.greenpeace.org/international/en/campaigns/toxics/electronics/the-e-waste-problem/what-s-in-electronicdevices/bfr-pvc-toxic/
- Greenpeace International (2010). *Toxic Transformers Briefing*. www.greenpeace.org/international/en/publications/reports/toxic-transformers-briefing
- Basel Action Network (October 2005). *The Digital Dump – Exporting Reuse and Abuse to Africa* www.ban.org/films/TheDigitalDump.html
- Basel Action Network/Silicon Valley Toxics Coalition (2002). *Exporting Harm: The High-Tech Trashing of Asia*. www.ban.org/E-waste/technotrashfinalcomp.pdf
- Greenpeace International (August 2005). *Recycling of Electronic Wastes in China and India*. www.greenpeace.org/international/PageFiles/25502/recyclingelectronicwasteindiachinafull.pdf
- Global Witness (2009) *Faced with a Gun, What Can You Do?* www.globalwitness.org/media_library_get.php/980/1277197135/report_en_final.pdf

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ANNEX 1

Guidance for internet service providers

During the late 1980s, when the public first began accessing dial-up bulletin boards and internet systems, the role of internet service providers (ISPs) was highly specialised and served a limited audience. With the coming of the world-wide web in the mid-90s, the opportunities for public participation in computer-mediated communication and expression grew, and the role of service providers grew with this trend. In turn, as the social and political importance of electronic media grew, civil rights campaigners and ISPs sought to tackle the legal, economic and technological restrictions hampering wider public access to the internet – ensuring that the online community was open to as wide a range of social and ethnic groups as possible.

That objective became easier to secure in the first decade of the new millennium with the emergence of new ways to access electronics networks, such as mobile/smart phones, as well as the development of many different interactive and social media services which allowed easier communication. Almost 30 years after it left the closed world of academia and industrial research, the internet and electronic services are a vital part of many people's everyday lives – and even those who do not directly use them benefit from their use in logistics, manufacturing and government administration.

Now we have to deal with the impacts of that success; not only in terms of direct energy consumption, but also the indirect use of energy and resources in the manufacture of digital electronics and the waste and pollution this generates. This creates a number of problems with many people's expectations of information systems because, just like the problems of the human system within the physical world, balancing the demand of information systems for materials and resources, with the ability of the environment to sustain those activities indefinitely, will require redesigning our use of certain technologies.

At the same time the present economic crisis, which arguably has a relationship to energy and

resource use,¹ is generating calls for much wider social and economic change – from the online organisation of the Occupy movement, to the use of electronic media in the organising of the Arab Spring. Electronic communications and internet services have a role to play in enabling these changes, giving society a means to understand, debate and act to solve its problems more directly.

In the short-term, addressing the historic legacy of our development of IT systems is likely to involve slowing the pace of development. That's not just an implication of the current economic downturn and the financial pressure it is creating; in order to improve the quality of the systems we use, and reduce their ecological impacts, we have to extend service life and that inevitably means slowing the pace of upgrading. If we look at the roots of human sustainability, it is the scale of growth in the use of information systems which has driven the ecological issues surrounding their use today. Slowing that physical scale of growth by optimising the productivity of existing infrastructure can reduce the capital costs related to the turnover of equipment.

The primary role of ISPs is to provide network connectivity, technical services and training to those who use its electronic networks. In carrying out these functions ISPs have to opportunity to take a lead in reforming the way we acquire, use and dispose of technology. That begins by changing the way the service provider meets its own needs. As their own efforts to address these problems develop, it is likely they will need to engage their users/customers in that process to make the changes viable and more effective – for example optimising software to reduce system load or bandwidth use, or scheduling tasks to spread the load across a longer time period, utilising the space capacity available at off-peak hours. This requires change in the ways ISPs function, although it might also create new areas to provide support

1. Hall and Klitgaard (2011). *Energy and the Wealth of Nations: Understanding the Biophysical Economy*. Springer Publishing, ISBN 9781-4419-9397-7.

and services as part of their business model. In a world where economic pressures are causing more businesses and individuals to “make do” with the resources they already have, the skills ISPs develop to manage their own systems offer the potential to offer new support services to solve their customers problems.

Changing the way society uses online services is a complex problem – like many other ecological issues.² Encouraging people to change their lifestyles requires that they understand the links between their own small actions, the global impacts of all those similar actions by society, and understand why changes to our established ways of working can have both personal and global benefits. Education and raising awareness is the most direct method to allow people to understand their everyday impact, and make the types of changes which benefit them the most. This is a role which the internet, and ISPs as the creators or hosts of content, are well suited to.

Alongside their traditional role in providing internet services, ISPs are in an ideal position to provide advice and training on minimising the impacts of ICTs. Whether they draw on their own knowledge and abilities to produce their own resources tailored to their users needs; or work within the projects and programmes developed

by the industry; or collaborate more proactively with researchers, educators and campaigners, ISPs are in a position to help promote change in the way society uses ICTs through the contact they have with their users/customer base.

Box A1 lists 10 priority areas for change: some are found in all green IT guides, such as improving energy efficiency; others are rarely included in guides, such as highlighting the role of ISPs in defending the public's right to expression and communication. If you review the content of the whole guide, the points in Box A1 are not exhaustive. What they are meant to do is act as general headings or signposts; they are there to point a direction from which you can carry out your own research, measurement and analysis.

Unit 12.1.1 ('Green & sustainable IT') lists a number of publications and reports which examine the issues. These are usually intended for use by medium and large system operators – smaller systems have not been well served by green ICT research as the costs and savings are often only significant when applied across a large IT systems. To redress this balance, much of this guide is tailored to the needs of those using small networks and stand-alone computer systems. The publications listed in unit 12.1.1 are more appropriate to the highly specific needs of large IT system users.

2. WWF-UK (2010). Common Cause: The Case for Working with our Cultural Values. assets.wwf.org.uk/downloads/common_cause_report.pdf

ANNEX 2

Guidance for policy makers & campaigners

Modern democratic principles are founded upon the work of 16th and 18th Century Enlightenment philosophers.¹ Exploiting the revolutionary information technology of the 16th Century – the metal movable type printing press – they were able to share and then collaboratively develop ideas which formed the basis of the political, economic and technological sciences which make society function today. Today the technological diversity and ease of use of information systems is driving a similar revolutionary process. However, this time the process is broadening the ability for groups across the social spectrum to access and share information. The result – from the crowd funding² of social projects, to the production of computer software which uses first/native languages, to the recent upheavals in the Middle East – is a trend towards greater social debate and diversity within societies where ICTs are widely available.

The downside of this is that as more people access and use the network, so the ecological impacts of this the system multiply. At the same time, while computing and network speeds increase, the movement of more data at higher speeds creates a rebound effect,³ erasing many of the technological efficiencies and energy savings that these new system create. Finding solutions to these ecological impacts does not require prohibiting or restricting the use of ICTs in the future. By redesigning the technologies involved to reduce the impacts of their use – both the physical hardware, software, and technological standards the system is built upon, and the manufacturing and waste disposal processes related to the device – we can create a significant reduction in the global impact of these systems.

To illustrate the subtle implications of this approach, let's look at a highly significant develop-

ment in the field of ICT policy. On 5 July 2012, the UN Human Rights Council approved a resolution stating that the right to freedom of expression on the internet should be protected by state parties. To quote the most significant part of the text,⁴

...the General Assembly at its sixty-sixth session on freedom of expression on the Internet, affirms that the same rights that people have offline must also be protected online, in particular freedom of expression, which is applicable regardless of frontiers and through any media of one's choice, in accordance with articles 19 of the Universal Declaration of Human Rights and the International Covenant on Civil and Political Rights.

This is a significant breakthrough in the long campaign for digital rights, and should be celebrated. Unfortunately, while this applies to the policies created by national and international governmental agencies, it does not have direct effect upon the handful of hardware and software companies who produce the bulk of the world's information systems. As a result new programs or operating systems could introduce restrictions on communication and there would be nothing the public could do to remedy that situation. Consumers could change their operating system or hardware, but as the production of equipment is concentrated amongst so few companies there is not a lot of choice to be had – and often these choices lead to other problems or arbitrary incompatibilities between different hardware and software technologies.

There are a number of solutions to this, and many of them have a positive effect on the sustainability of ICT equipment. In unit 4 we examined the idea of “unbundling”⁵ – removing the restrictions which close the design of products to a limited set of technologies, preventing the use of components from other manufacturers. On this

1. Wikipedia, 'Age of Enlightenment'. en.wikipedia.org/wiki/Age_of_Enlightenment

2. Wikipedia, 'Crowd funding'. en.wikipedia.org/wiki/Crowd_funding

3. Wikipedia, 'Rebound effect (conservation)'. [en.wikipedia.org/wiki/Rebound_effect_\(conservation\)](http://en.wikipedia.org/wiki/Rebound_effect_(conservation))

4. APC (July 2012). The UN recognises freedom of expression on the internet as a human right. www.apc.org/en/node/14772/

5. Wikipedia, 'Product bundling'. en.wikipedia.org/wiki/Product_bundling

issue we're approaching an interesting moment in time. One of the successes of the IBM-compatible PC was that, while the design was copyrighted, the functional components of which it was made were the property of a range of hardware manufacturers. That meant once PCs became widely used, consumers, and the PC marketing companies they bought their systems from, has a wide choice of parts with different qualities in order to construct the type of system that suited them – but, due to the “IBM-compatible PC” standard, the components could work together.

Now that era is slowly coming to an end as the world moves away from desktop PCs to other kinds of information appliances. As we move from the open design of the IBM PC to mobile phones, tablets, notepads and palm-top devices, we are losing the freedom to maintain, repair, reconfigure and reuse computing technologies. Unlike the advantages of the IBM PC's open design, these new appliances are mostly closed technology, unable to be modified by the user or retailer, and which vest control over the technology they contain to a handful of companies involved in their production.

In sustainability terms, this is taking us in the wrong direction; it encourages obsolescence and short-service lives because of the lack of competition in the market for parts, and because there is very little chance that we could repair the technology if it went wrong (proprietary components are often linked to one manufacturer, so buying one small part can often cost a large proportion of the cost of buying a new device). To make this clearer let's look at this another way. Even without a coherent policy on sustainable design, consumer pressure for greater service and reliability of household white goods – such as washing machines, fridges or cookers – mean that they can last five to fifteen years before they are physically worn out. Why then should a laptop or mobile phone only be used for two or three years, and a mobile phone even less? We

need the same consumer pressure to push the design standards and service life of consumer electronics in a more sustainable direction.

Box A2 contains a list of points we should be working towards in order to make ICTs more sustainable. Note that the list does not include many of the practical ideas outlined in the text of the guide. That is because, from the design of our hardware to the use of power management or security features, many of those things are already achievable – the fact they are not implemented is because people do not understand how to implement them, or the benefits of doing so.

Box A2 focuses on those essential elements of sustainable ICTs which we currently *do not* have the ability to enact – and for which change in national and international environmental and industrial policy is required to encourage change in the world's manufacturing systems. The list represents a kind of sustainability manifesto for the types of political, economic and technical changes that we need to enact to improve the ecological performance of information systems.

Finally, no matter how clean and green our information technologies become, it makes little difference if the rest of our everyday lifestyle is not sustainable. ICTs are only one small aspect of our personal ecological footprint; food, transport, buildings and the use of other consumer goods far outweigh the effect of using computers and electronic networks. Adapting our use of computers to significantly reduce energy and resource use is very important; ICTs are reliant of certain types of minerals, as well as fossil fuels and chemicals, the production of which will become more constrained as we move through the 21st Century. However, in terms of the relative scale, we cannot solve the ecological problems of the human system with ICTs alone – we must also adapt those other aspects of our lives to take control of the unique set of impacts that our demand for those goods has.

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

