What are the environmental and economic issues surrounding ICT ?

I saw an email not so very long ago that highlighted just how much even the words we use have been totally transformed because of computers. So, 'IT' is no longer just a gender neutral pronoun and a mouse is no longer simply something that gets chased by a cat. Similarly, the word 'web' refers to rather more than a spider's unique approach to catching flies, a hard drive does not refer to getting stuck on the M25 in a blizzard, and a zip is no longer just a way to keep your trousers up. Of course, it is not just language that has been altered because of the way that computers are now at the heart of so much day to day life. The IT revolution has consequences far beyond our desks and work places and today I want to explore just some of those.

I am far from being an IT expert. Rather, as a Member of the European Parliament my work focuses on how legislation can create the circumstances in which individually and collectively we choose to live more sustainably. The concept of sustainability is bandied around a great deal, so let me just be clear what it means to me. Traditionally, the idea is a little like a three legged stool, with each leg standing for something different. One is the environment, one is society and one is the economy. All three legs play an equal role in keeping the stool upright so it can be used. Take one away and the stall falls over - it doesn't work properly. Sustainable development is like that too, with environmental, social and economic

considerations all taking centre stage. In the 17 growth fuelled years that predate our current recession, what is good for the economy has been allowed to take precedence over what is good for society and the environment. This approach has failed in numerous ways, including failing to take account of the restraints inevitably imposed upon the economy by the environment. Growth has been based almost exclusively on the exploitation of natural – and of course finite – resources. As these start to run out, the economy can only survive if it evolves in such a way as to recognise that it is dependent on the environment and not master of it.

So how does all this relate to the IT sector?

From the energy and raw materials used in the manufacture of mother boards, computer monitors and millions of miles of cabling, to the waste generated when we upgrade to a faster and sexier bit of kit, ICT has a massive environmental impact. The industry is currently responsible for around 2% of greenhouse gas emissions and this share is growing even faster than those of the rightly much maligned aviation industry. BT alone uses 0.7 per cent of the UK's electricity supply.[1]

Yet IT also has the potential to help us lead greener lives, by helping us to cut down on journeys, for example, or to monitor how much electricity we are using. The Wuppertal Institute in Germany

[1] according to research firm Gartner. The ICT figure includes the energy used from hardware such as PCs, servers, cooling, fixed and mobile telephony, local area networks, office telecommunications and printers, as well as government and commercial infrastructure.

has calculated that downloading 56 minutes of music is twice as resource-efficient as buying a CD online and more than 2.5 times as resource-efficient than going to a shop to make the purchase. Paying any bill online is 2.25 times more resource-efficient than paying at point of sale.

This potential means that the IT sector is well placed to be taking a lead when it comes to sustainable development. It needs to be thinking not just about what makes sense economically, but also environmentally and socially. In particular, the current financial crisis is an opportunity for ICT providers to deliver services that both save money and carbon emissions, especially compared with many other solutions where there is a choice between money or the environment

Let's begin by looking in more detail at the manufacture of IT equipment and how this might be done sustainably. In the excellent Soctim report *'Green ICT?'*, the authors highlight a study that estimates around 240 kg of fossil fuels, 22kg of chemicals and 1,500 litres of water are used in the production of just one average PC. Taken together these resources weigh more than 10 times that of the finished product. Compare this with a car or fridge, both of which can be manufactured using only twice their weight in fossil fuels, raw materials and process chemicals. The vast difference is due almost exclusively to the number of intricately made components that make up a computer. So, the circuit board, for

example, accounts for almost half the 1,500 litres of water used and for the highest chemical use.

The water, by the way, is used to rinse away acids and alkalis that are used for etching network connections onto the copper layer of the circuit board. This water then becomes contaminated with chemicals because waste water treatment processes cannot deal with the worst pollutants, all of which, whilst varying in toxicity, have a potentially negative impact on both the environment and human health. The EU's Directive on the Restriction of Hazardous Substances goes some way towards preventing the worst effects through careful regulation of both what is permitted and the processes involved. It also bans for sale in the EU any IT equipment that has above permitted levels of lead, cadmium, mercury, hexavalent chromium, and the brominated flameretardants — polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE). But the legislation does not go far enough. There are some exemptions for example, including lead in cathode ray tubes. Phthalates, banned in Europe from children's toys because of health and environmental concerns, are still permitted for use in the manufacture of plastics – and thus in computers. And flame retardants are still used in liquid crystal display screens and in plastics, despite being linked to birth defects, liver, kidney and neurological damage, thyroid imbalances and hormone mimicking.

Outside of the EU, residents living close to computer manufacturing plants are waking up to the consequences of years of air, water and soil contamination. A lawsuit brought this summer against IBM by residents of the town of Endicott, New York, for example, cites examples of congenital heart defects in children and kidney cancer in adults, making the link with toxic chemicals that were not properly treated or disposed of.

But what are the alternatives? Well, computers made from hardwood and metal are now available, helping consumers avoid plastics. And various labeling schemes have been developed to provide information about the use or avoidance of particular chemicals. For such schemes to work, there must be replacement products available, and these in themselves will have a manufacturing, distribution and end-of-life cost. It might not always possible to offset this cost against savings in energy and the pollution generated, because you may be comparing different pollutants.

Nevertheless, the Restriction of Hazardous Substances legislation coupled with careful procurement policies could make a massive difference and, as sector professionals, you are well placed to lead by example. The EU Directive helps provide a framework to reduce the environmental and health impact of some of the chemicals used in the IT sector, but the commitment of individual champions is also needed to fully realize the potential for even greater sustainability.

Procurement is a good starting point. Yet, just a couple of weeks ago, a non governmental organisation dedicated to raising awareness of working conditions and environmental pollution in the production of computers reported that the EU's Procurement Directives are not being systematically implemented at national level. It compared practices in 5 different member states - Austria, the Czech Republic, Germany, Hungary and the Netherlands – and found that the IT hardware sector exemplifies the failure to consider labor and human rights conditions within production chains when purchasing products and services.

The Public Procurement Directive sets out regulations that need to be followed for procurement processes within the European Union over a certain value. It also determines the awarding criteria and explicitly mentions the possibilities to purchase products which meet environmental and social criteria. So, this legislation, if used properly, can be a tool for sustainable procurement across the board and specifically in relation to IT.

Of course, procurement is as much about knowing when not to buy products as it is setting criteria for purchases. So, is there really any need to replace perfectly good PCs just because a new model is available? It is important to know what is on the market and whether a machine that eg uses less energy day to day will actually have a reduced energy footprint once you factor in every stage of

its life cycle – and how long it might be before you upgrade yet again.

When you do buy a new piece of equipment spare a thought also for the way it is packaged. A number of suppliers have recently responded to consumer pressure and are working to reduce the amount of packaging they use. Dell, for example, has been setting annual targets for the reduction of packaging since 2005. However, as with the overpackaging in the supermarket, suppliers respond best to pressure from consumers. As public sector purchasers, you have the opportunity to work together and demand that ICT suppliers reduce the amount of packaging used in new goods and thus the amount of waste that might end up in landfill or being incinerated.

Arguably, the most significant challenge concerning waste and the IT sector is not packaging, however – it is the disposal of old hardware. An estimated three million computers are decommissioned each year in the UK alone[2]. Given that over 1 million tonnes of waste electrical and electronic equipment goes to landfill in Britain a year - and most of it is toxic – there is an urgent need to both reduce IT related waste and carefully manage disposal. As in any sustainable waste system, the priority must be given to reuse or recycling.

[2] http://www.independent.co.uk/news/world/africa/how-recycling-your-computer-helps-developing-countries-427615.html

Computer Aid ships between 2,000 and 3,000 PCs a month to the developing world, the vast majority of which end up being used by hospitals and schools. Considering that a PC consumes 75% of the energy used across its lifetime during the production phase extending the life of a PC for as long as possible in order to claw back some of the carbon used in production, is a very green option. Computer Aid estimate that the machines they refurbish enjoy on average another 6,000 user hours.

There have been reports of a number of recyclers using export as a way to get rid of non working, very old equipment quickly - and making a profit from it as well. So, it is important to distinguish between schemes that are actually reconditioning and reusing machines and those that are seeking to avoid regulations by dumping toxic e-waste overseas. The EU's Waste Electronic and Electrical Equipment Directive, otherwise known as the WEEE Directive, requires suppliers to pay for the cost of waste treatment, recycling, and disposal. They must also ensure that a significant proportion of the products are re-used, or that they are recycled according to best available practices. In turn, the EU member states will promote products that can be easily dismantled and are designed for recycling.

Some producers have joined group schemes for dealing with WEEE. Others take their own products back directly. Greenpeace and many academics are clear that the latter is the better option. It gives

manufacturers a strong incentive to design the most easily re-useable or recyclable equipment; otherwise they will have to deal with the problem.

The collective take-back schemes do not give manufacturers who have incorporated ‘green’ design features enough of a commercial incentive. Moreover, according to Computer Aid, some of the original equipment manufacturers who are now running these take-back schemes are actually stripping down eg perfectly good Pentium 4 machines and recycling them as if that were a good thing for the environment. They are not targeting reuse because there is no money in it and it does not suit their interest to have a large refurbished market. So, whilst WEEE is one of the most far reaching pieces of waste legislation to emerge from the EU in recent years, it is not perfect and in future I hope that the Parliament will close loopholes that exist in relation to shipping waste abroad, for example.

Not everyone decides to recycle or throw away their old computer. About 20% of computers end up sitting under desks or in back rooms. People are loath to throw them away because they remember how much they cost. Yet each computer collecting dust in this way is an asset that is just depreciating- and that could be put to better use if re-used or recycled.

Staffordshire County Council recognised this ahead of most and has taken steps to prolong the working life of its ICT and to ensure that,

when it is no longer needed, it is either re-used or recycled. The objective? To maximise the financial return to the council and minimise potential harm to the environment. A central log of unwanted ICT equipment allows supply to be matched with demand, including that for spare parts. Recently the Council's 422 schools have been brought into the scheme and 'unwanted ICT collection rounds' are employed to minimise travel. Equipment that cannot be re-used is passed to a disposal company, which tests the equipment to see if it is suitable for re-sale, either as a whole unit or individual components. The county council receives 75% of any sale income. The remainder is processed in line with WEEE Regulations.

The way we use our IT equipment can also determine its overall environmental impact and this is particularly true when it comes to energy consumption.

A single PC in office mode actually costs an insignificant amount to run - £16.00 per annum based on 2007 energy costs- but generates 1.094 tonnes of CO2 in that same year[3]. This is equivalent to the CO2 produced by a single passenger flying from London to Cairo – and a tonne of CO2 per year is what each individual would be

[3] It is widely assumed that a typical computer uses about .65 kilowatts per hour (kWh) in use, or .35kWh (stand-by) and .03kWh in hibernate mode. Assuming that the computer spends 220 working days with 12 hours in operational mode (1716kW) and 12 hours in standby mode (924kW), and spends 24 hours in hibernate mode for the remaining 145 days (104kW), it will consume 2145 kW of electricity. According to UK government figures, 1kWh produces 0.51kg of carbon dioxide (CO2), and 1,960kWh produces 1 tonne of CO2. This makes allowance for the fact that with current nuclear capacity (which is reducing) some 15% of electricity is generated without producing any CO2.

entitled to emit if global emissions were capped to prevent runaway climate change and then divided equally between the world's population.

The big surprise for many is that PCs and monitors consume considerable amounts of energy when idle. This is significant, as the average office desktop spends only 26% of its time in active use, compared with 36% in sleep mode. PCs and laptops may also continue to draw some power even if switched off. Typically, a PC and monitor that have been switched off still draw on average 20 watts of power. That's like leaving a lamp on every night and every weekend all the time. Multiply this by the number of workstations in an average building and it is apparent that a noteworthy amount of energy is being wasted when the building in mostly unoccupied. The simple solution to this problem is to encourage people to switch off equipment at the plug before they leave the office.

The US Environmental Protection Agency (EPA) found that the use of power management plus complete night-time shutdown would halve the energy consumption of ICT equipment in the US. And power management could save more than 60% if Energy Star settings are used on PCs (sleep mode after 30 minutes) and monitors (sleep after 15 minutes of inactivity). Chesterfield Borough Council has recognised that reducing energy consumption saves money as well as delivering environmental benefits. The ICT service there has worked closely with employees to promote

awareness of electricity use and successfully introduced a campaign to get everyone switching off their computers at the mains each night. A spot check one evening revealed that of the 400 machines used in the building, only 60 had not been unplugged.

Modern IT systems provide more computing power per unit of energy (kWh) and thus reduce energy consumption per unit of computing power. Despite this, however, they are actually responsible for an overall increase in energy consumption, and for an increase in the cost of energy as a proportion of IT costs. This is because users are not simply using the same amount of computing power as before, nor are they using technology to leverage savings in energy costs or in CO2 production. Instead, users are taking and using the increased computing power offered by modern systems. New software in particular is devouring more and more power every year. Some software requires almost constant access to the hard drive, draining power much more rapidly than previous packages did.

As high-speed internet access is no longer charged by the minute, home-users tend to leave the connection on, pushing up their electricity usage. The Wuppertal Institute in Germany estimated that use of the Internet accounted for a staggering 1% (4,000 GigaWatts) of Germany's electricity demand in 2000. And e-mail is not necessarily a resource-free means of communication. One expert says, "You often see at the bottom of an e-mail 'Think

before you print'. I think it should say 'Think before you send this email'." Factors such as having too little RAM, regular defragmentation and reducing voltage can also impact on energy use.

Individual machines, however, are not the most voracious consumers of energy in large workplaces. Data centres have high power density per unit area of computing space — sometimes as high as 100W per square foot. Ever increasing space efficiency and high-density racking puts extra pressure on cooling systems, and in the average data centre these already account for about a quarter of electricity consumed.

**This phenomenal electricity drain has not escaped the notice of government. The UK government Market Transformation Programme estimated that servers and data centres account for 1.9% of the national electricity demand. In the USA, data centres currently consume approximately 59 billion kWh a year. This puts the sector just below the transport manufacturers and above the plastics industry. **

There are solutions – ranging from the installation of high efficiency fans, chillers and Computer Room Air Conditioning units (CRACs), which may incorporate variable speed fans and chillers so that electricity is only used as needed; to replacing inefficient servers and looking at eg liquid cooling systems.

Reading Borough Council looks set to be the first local authority to use the waste heat from data centres to heat its buildings, an initiative made possible because of a new office rebuild. And in Orkney they have the greenest data centre in the UK. This is housed in three recycled containers sited in a windy position - not difficult in Kirkwall - under the shade of trees, which is slightly more difficult, meaning that it needs no air conditioning whatsoever. The London Borough of Hillingdon, has invested in virtualisation to increase its data centre capacity, thus avoiding a 12 month, seven figure upgrade to the electrical infrastructure. Additional physical server capacity would have been 71.5% more expensive than the cost of virtualization, before taking into account ongoing savings on the electricity bill. And the predicted savings have been even greater when it comes to energy consumption – a massive 82% reduction.

Although servers and data centres are not covered by the EU's Energy-using Products Directive, a Code of Conduct for Data Centres[4] has very recently been devised. It proposes general principles and practical actions to be followed by all parties involved in data centres, to result in more efficient and economic use of energy, without jeopardising reliability and operational continuity. Whether or not this will deliver real results remains to be seen.

[4] http://sunbird.jrc.it/energyefficiency/pdf/CoC%20data%20centres%20nov2008/CoC%20DC%20v%201.0%20FINAL.pdf

Given that a survey for online computing magazine, The Inquirer revealed that only 1 in 20 IT managers bother to ask their IT suppliers about green issues, there is clearly a need for the IT sector as a whole to learn from the progressive approaches of the few who are already leading the way. So what can you do as pioneers for more sustainable ICT?

As Soctim's '*Green ICT?*' report states 'Do nothing is not an option.' Be it, addressing procurement or introducing carbon accounting; reducing replacement cycles or investing in multi-functioning devices to replace copiers, printers, scanners and fax machines; developing campaigns to encourage staff to switch off their PCs at night or simply switching to refillable printer cartridges; there are many ways that you can take action.

I have concentrated primarily on environmental issues today but, as I explained at the outset, sustainability is also about meeting social concerns. The scope for taking action to eg facilitate the democratisation of ICT may be limited if you are working within the public sector, but there are ways to engage with the delivery of social benefits. For example, public procurement criteria should include minimum wage levels and working conditions, as well as energy consumption or chemical use. And, of course, conserving natural resources or helping to reduce greenhouse gas emissions and

thus to tackle climate change, have a social value as much as an environmental one.

In an era marked by Microsoft's market domination, one of the most radical steps you can take is to use free or open source software. Greens in the European Parliament successfully led a campaign to oppose the patenting of software across the EU some 2 years or so ago. There is a thriving and creative software community in Europe and the interests of small companies involved in software development, as well as of consumer choice, are best served by protecting the collaborative development of free and shareware.

WWF have recently collaborated with the IT research firm Gartner to survey what some of the world's leading IT companies are doing to reduce their carbon footprint. The results were disappointing with some companies refusing to even answer questions. Yet, as WWF point out, there is evidence that taking a leadership role in climate change can create a competitive edge. They go on to say that demonstrating or proving relative "greenness" is very difficult for ICT providers. A lack of standards and metrics against which greenness can be measured exacerbates the problem. This also means that there is no level playing field. So, the plan is to develop a system which allows companies' achievements to be measured and compared, with a particular focus on a standard approach and methodology for life cycle assessments (LCAs). Such a system could

also be used by the public sector to further stimulate good practice, as well as the sharing of information and expertise.

Without doubt, the future of the IT sector relies on it being able to reduce its carbon footprint, as well as address wider issues around sustainability. I hope that today I have given you a flavour of just some of the ways that this can be done and assured you that green IT needs to be much more than a marketing exercise. The public sector is already leading the game and it is up to you, as pioneers for green IT, to keep up the great work. Thank you for asking me here to speak and I want to end with some advice. If you do just one thing as a result of today's conference – read this report! (Tim and Andrea's report – I will print you off a copy)