



University of Sydney



Environmental sustainability  
considerations for ICT areas

Consumption and Conservation of materials



# Discussion outline

- **'the big picture'**
- **'Good environmental Principles' to guide our actions'**
- **what we have found' / How does it relate to USYD?**
- **Some good examples of IT staff leading the way**
- **What we've done so far/ 'what we are looking into'**
- **What we're up to/Options**
- **Messages we hope to take to uni community:**
- **What we want from you today**



# Impacts of Computers

- Material use (fossil fuels, chemicals water) in production and use,
- Possible long-term health effects due to chemical exposure during manufacturing,
- Exposure to toxic materials in computers or arising from recycling.

## Health impacts on semiconductor workers

- Hundreds of chemicals used, many toxic.
- Possible increased incidence of cancers and birth defects;
- Series of lawsuits filed against firms by workers (IBM, National Semiconductor)
- Some empirical work showed link between glycol ethers and miscarriage rate

# At the end-of-life

- Contain some toxic materials, e.g. lead in CRT monitors and solder and brominated flame retardants in casings and circuit boards
- Ought to be properly managed with recycling/treatment systems
- Much greater risk when computers are recycled in developing countries (e.g. Chinese town of Guiyu)



Pictures from Guiyu, China  
Source: "Exporting Harm" report,  
Silicon Valley Toxics Coalition

Treating circuit boards with acid baths  
to recover metals



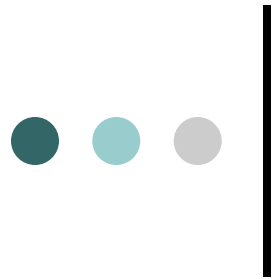
# Wafer Fabrication

## ○ Inputs

- Chemicals 45 g
- Elemental gases 556 g
- Silicon wafer 0.16g
- Electricity 1.5 kWh
- Direct fossil fuel 1MJ
- Water 20 L

## ○ Outputs

- Fabricated wafer 0.16-0.94cm<sup>2</sup>
- Waste water 17kg
- Solid waste 7.8kg
- Air emissions ?



## Fossil fuel, chemical, and water use

For 1 memory chip, *lower* bounds are:

- Fossil fuels consumed in production = 1,200 grams
- Fossil fuels consumed in use = 440 grams
- Chemicals “destructively” consumed = 72 grams
- Water use is 36,000 grams per chip.

Total fossil fuel and chemical use to produce  
2 gram memory chip > 1.7 kg



# So what's being done?

- Internationally
  - European Commission, 2002:
    - Waste from Electronics and Electronic Equipment (WEEE) – prevent computer waste by encouraging reuse, recycling and other recovery.
    - Restriction of Hazardous Substances (RoHS) Directives – bans sale of new electrical and electronic equipment containing lead, cadmium, hexavalent chromium, polybrominated biphenyls from 1 July 2006.



# Internationally

## ○ Asia

- Taiwan 1998 first country to require recycling of used computer hardware. As of October 2000, 1.4 billion used computers had been recycled, 75% of all used computers
- Japan 2003, computer manufacturers are required to collect and recycle used home computers



# Internationally

- United States of America
  - No national mandate for collection and handling of e-waste
  - More than 4.6 million tons entered U.S. landfills in 2000, expected to grow fourfold in next few years
  - State and local governments developing own disposal guidelines, eg California passed first recycling law, states are banning cathode ray tubes from landfills



# Australia

- No nationally coordinated programs currently but DEH working with producers to develop National Environment Protection Measure for computers, likely to implemented end of 2008.
- 2.1 million computers entered Australia in 2002, adding to the 9.2 million already in use
- In 2002, 3 million computers reached their end-of-life, one million in NSW
- Estimated 98% of computer equipment stored by households or small businesses will end up in landfill.
- ACT has levied landfilling of computers \$16/monitor, \$12 box or \$100/tonne



## Estimates of PCs disposed in Australia

Disposal Option	2001	2006	2011
Recycled	281,700	494,000	509,600
Landfilled	926,500	1,632,800	1,694,700
Sent to storage	1,331,000	1,792,800	1,839,800
Total already in storage	3,618,200	5,260,400	5,479,700



# Computer acquisition at USYD

- In 2005, ~3000 leased, ~3000 purchased through Central or P-Card
- Carol Lam student thesis 2005 estimated 17,000 end-of life computers stored across Uni
- HP Sustainability Compact – design, RoHS Directive, energy efficiency, product recycling
- At end-of-life, University computers generally end up in landfill



# University computer purchases

[2005 Central and P-Card purchasing totals ~3000 units]

component	content (%)	per computer (kg)	cumulative weight (kg)
plastics	22.9907	6.207489	18,622
lead	6.2988	1.700676	5,102
aluminium	14.1723	3.826521	11,480
iron	20.4712	5.527224	16,582
tin	1.0078	0.272106	816
copper	6.9287	1.870749	5,612
nickel	0.8503	0.229581	689
zinc	2.2046	0.595242	1,786
gold	0.0016	0.000432	1
manganese	0.0315	0.008505	26
silver	0.0189	0.005103	15
cadmium	0.0094	0.002538	8
mercury	0.0022	0.000594	2
arsenic	0.0013	0.000351	1
silica	24.8803	6.717681	20,153

Based on  
27kg computer



## Areas to improve

- Prolong working life of equipment. Could leases be extended from 3-4 years?
- Promote leasing rather than purchasing  
Include cost of responsible disposal or recycling in purchase arrangements
- Formalise spare parts program
- Sale through Asset Disposal Registry 'E-Bay'
- Donation through Re-Connect.NSW
- Formalised collection of end-of-life computers



# Computer Disposal proposals

[A] Broad Scale Collection across campus over set periods

[B] E-Service and Asset Disposal ongoing work requests



# Proposal A – Broad Scale Collection

<b>Timeframe</b>	One week project
<b>Asset Disposal Form</b>	Required but can be done in summary sheet
<b>Communication / Promotional methods</b>	Through IT managers Uni news item Website information Email all staff
<b>Collection potential</b>	Large scale
<b>Storage requirements</b>	None, just on-site temporary skip bins Security overnight or lockup
<b>Logistics costs</b>	~\$1200 for 3 contractors/3 days
<b>Recycling costs per computer</b>	\$6 for trial, then \$16 ongoing
<b>Recycling costs per computer</b>	University wide through CP&S
<b>Cost centre</b>	High due to free and coordinated service
<b>Risks</b>	-Potential to be costly as at this stage quantity is unconfirmed-



# Proposal B - Ongoing E-service Desk request

<b>Timeframe</b>	On going
<b>Asset Disposal Form</b>	Required per logged service request
<b>Communication / Promotional methods</b>	On Asset Disposal Form On E-service desk Through IT managers Website information
<b>Collection potential</b>	Ad hoc
<b>Storage requirements</b>	Ongoing at Institute building till bulk delivery required
<b>Logistics costs</b>	Approx \$25 per computer based on \$55/hour recovery External transfer costs uncertain
<b>Recycling costs per computer</b>	\$16
<b>Recycling costs per computer</b>	School/admin unit based
<b>Cost centre</b>	Only wealthier or environmentally responsible schools/depts may comply due to costs or 'green' values
<b>Risks</b>	-Computers still dumped in alleys and sent to landfill if process not followed. -Recycling prices may increase over time



# Other consumables

- Toner Cartridges
  - Australians throw away 18 million used cartridges each year = 5,000 tonnes of waste
  - Warranties are guaranteed when buying remanufactured cartridges
  - Buying remanufactured cartridges keeps waste from landfill, and reduces construction materials.
  - Can be supplied and collected by
    - Corporate Express,
    - Office Max
    - Ivory Moon
    - SCRAP with a rebate
    - Kyocera suppliers





**A OfficeMax Replacement Printer Tone**

- A consistent alternative at a substantial discount to manufacturers product
- Equivalent yields and print densities to the OEM pn
- An environmentally friendly recycling program
- OfficeMax stipulated specifications
- Manufacturers warranty covering the printers and 1 that use the product
- A new drum in every cartridge

1329413	EPN/NK (82274A)
1329421	EPL/X (82275A)
1329456	EPN/NK (82291A)
1329472	EPN/NK (82295A)
1329464	EPL/EX (82298A)
2361299	EPL/EX High Yield (82298X)
1329465	EPN/EX (C2903A)
1322354	EPN/XX (C2903A)
1422829	EPN/XX (C2906A)
1329499	EPL/EX High Yield (82289X)
2281976	HP1010/1015 (82812A)
1434508	HP1100 (C4092A)
2284281	HP1150 (82824A)
2282113	HP1200 (7115A)
2282303	HP1300 (82813A)
1434497	HP1300 (C4096A)
2282111	HP2300 (82810A)
1434489	HP4000 (C4127X)
2281882	HP4100 (82818A)
2282338	HP4200 (G11338A)
2281818	HP4300 (G11338A)
2284469	HP4500 Black (C4193A)
2283895	HP4500 Cyan (C4193A)
2284817	HP4500 Magenta (C4193A)
2284668	HP4500 Yellow (C4193A)
2282282	HP4600 Black (C8723A)
2282270	HP4600 Cyan (C8723A)
2282289	HP4600 Yellow (C8723A)
2282237	HP4600 Magenta (C8723A)
1904604	HP5000 (C4129X)
2325195	HP8100, 8150 (C4182X)

**Laser Toner Compatibility Chart**

Printer Model	Toner Cartridge	OfficeMax Order Code	HP Order Code
Canon LBP 8N, 1260, 1260+	EPL	1329464	127198
HP LJ 4, 481, 4, 481+, 5, 581, 5N	EPL	1329421	126371
Canon LBP 4, 4+, 4 Lite HP LJ 8P, 8P+, 8P	EPS	1329472	-
Canon LBP 8N, 8N	EPN	1329413	126631
HP LJ 8, 8D, 8, 8D	EPN	1329456	-
Canon LBP 4V, 4L, 430W, HP LJ 4L, 4ML, 4P, 4MP	EPN	1329456	-
Canon NX Engine Printers	EPN	1329456	-

## Toner Recycling Program

As part of our commitment to the recycling process, Corporate Express has developed a Toner Cartridge Collection Program that facilitates the return of used toner cartridges, to be used in the remanufacturing process.

The Corporate Express Toner Recycling Program is an environmental initiative that has gained Corporate Express a reputation as one of the major sources of used toner cartridges being returned to recycling centres.

**Did you know?**

- About 30% of toner cartridges used by Australian businesses are recycled, the remaining 1.8 million approximately a year, end up as landfill.
- Toner cartridges take between 500 years to decompose in landfill.
- In 2005, Corporate Express collected and returned over 120,000 toner cartridges to Cartridge Rescue!

**Toner Recycling Program How this program operates:**

- Order a Used Cartridge Collection Carton from Corporate Express with your next order. Our Re-order code is 86661340. This is a no-charge item.
- Use the carton to store your empty cartridges.
- Once you have a minimum of 10 empty cartridges, call Cartridge Rescue (Toll-Free on 1800 628 854) to arrange collection.
- Your used cartridges will be collected and returned to Cartridge Rescue at no cost to you.

Warning: The business of collecting empty toner cartridges for remanufacturing is becoming increasingly competitive. We have been informed that some engaged in this process practice unethical and misleading methods of cartridge collection, including falsely claiming a portion of the benefits from cartridges collected will be donated to charity or used to fund job creation schemes. There are, of course, other legitimate collectors who do donate proceeds to various worthy causes. If you are in doubt as to the claims made by, or authenticity of, anyone representing a collection company, ask for suitable identification before admitting access, or please contact us.

- University of NSW - tender on remanufactured toners and collection coordination
- ANU – Environment program facilitates recycling initiatives



# Paper

- University of Sydney consumes over **100 million sheets** of paper a year, equal to over 300,000 trees worth
- 2003 waste audit found only 16% of paper in recycling bins was printed double sided
- A key focus of waste minimisation group for 2006 to reduce paper consumption across campus
- Student environment campaign to reduce paper use and increase uptake of recycled content



# Recycled Content Paper

- Recycled content paper can go into most printers, faxes and copiers without causing problems
- Pre-consumer vs post consumer waste
- Examples: Xerox Supreme, Evolve, Canefields (made from sugarcane waste)
- UPS sells 100% post consumer waste recycled paper at a competitive rate
- CP&S trialled 3 recycled content papers in 2004 and has since used A4 Xerox Supreme saving over 200 trees.



# Reducing paper use

- Don't print unnecessarily, especially emails
- Set up email signatures at server level to include message such as:

**Please consider our environment before printing this email.**

- Reduce font, margins, spaces
- Set printer defaults to 'Double-side'
- Shrink pages 2:1, set up draft paper trays
- 200 Kyocera printers across uni can print double sided



# Kyocera – setting up the duplex defaults – it's easy!

- A waste audit conducted last year showed that only 16% of all paper used at the University is double sided.
- To access the duplex unit:  
Start /Printers & Faxes /Right click on Default printer /properties /on device settings, click duplex unit.
- To set duplexing as default  
Right click on chosen printer /printing preferences /layout /click print on both sides /flip on long edge.



# Messages to the ICT community

- Utilise leasing of computers, and lengthen upgrade turnovers wherever possible
- Cost in disposal of items in budgets
- Proper disposal/recycling of computers will reduce pollution and promote resource recovery
- Purchase remanufactured toner cartridges and recycle used ones
- Use less paper, print on post-consumer recycled content paper
- Enable equipment and staff/students to print/copy double-sided



## So now can you tell us....

- Estimate quantities of end-of-life computers in your departments
- Problems you have experienced with new products & procedures and how you have overcome them
- Strategies to increase double-sided printing/copying by staff/students
- Anything else we should know



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