

Environmental Impact of ICT Industry

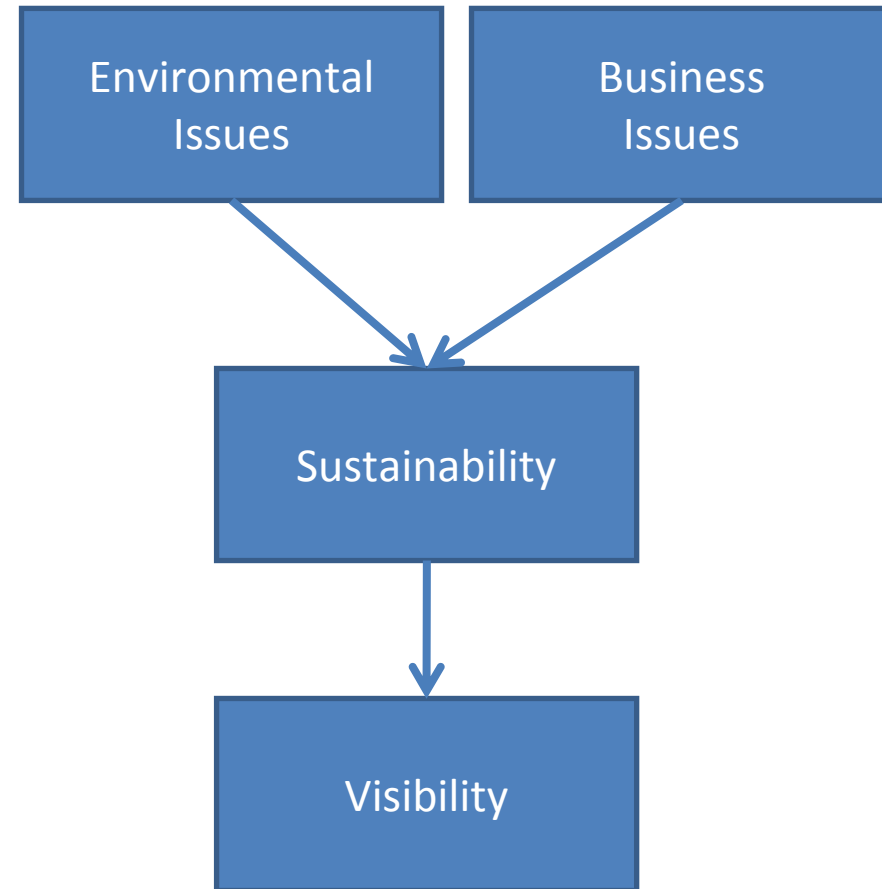
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Environmental Impact of ICT Industry

- Environmental Issues Specific to ICT Industry



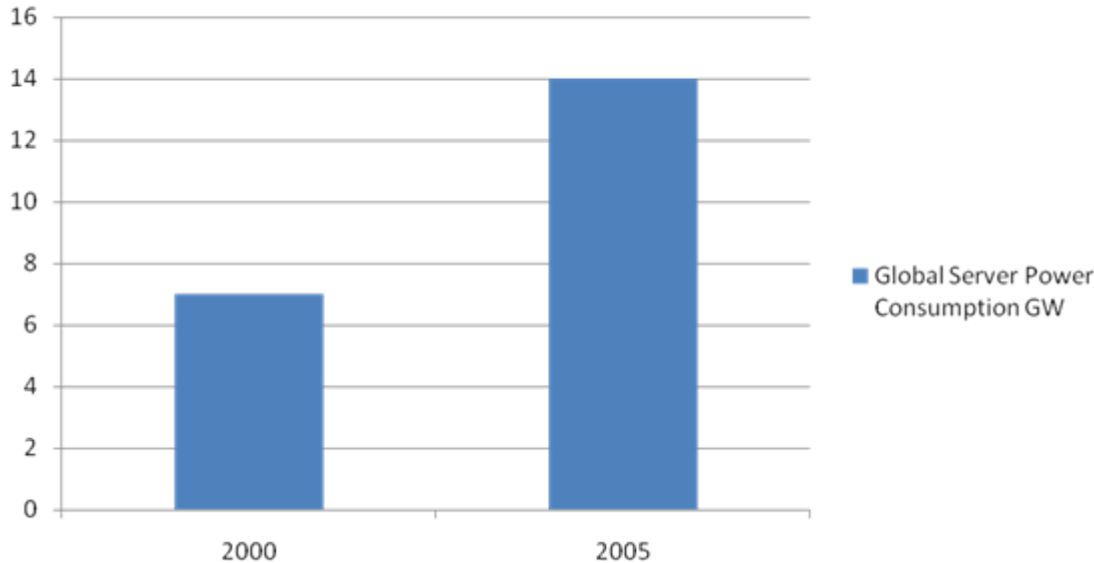
- Getting Visibility for Environmental Efforts

Environmental Impact of ICT Industry

- Environmental Issues Specific to ICT Industry
 - Energy Efficiency and Zero-Carbon
 - Servers
 - Mobile Networks
 - Recycling
 - Indirect Impacts of ICT
- Getting Visibility for Environmental Efforts

Server Energy Efficiency

Global Server Power Consumption GW



Energy and air conditioning costs can be measured in data centres and server farms, but end user equipment power requirements are treated as a general office expense. As a rule of thumb, lifetime energy cost = half hardware cost.

- Upgrading to more efficient servers
- Green Outsourcing



CIO convincing CEO on Server Upgrades

We have a very real issue with IT energy consumption. I need funding to upgrade to more energy efficient servers, so as to help the environment.



CIO

I'm all for the environment, but we've got a business to run, and times are tough.



CEO

Data centre energy usage will double between 2006 and 2011

U.S. Environmental Protection Agency

CIO convincing CEO on Server Upgrades

Here's the strategic plan for the data center:

1. We use virtualization to reduce the number of servers required.
2. We upgrade to more recent technology to improve response times to users.
3. The newer servers are also more energy efficient, reducing both power consumption and air conditioning costs. Plus we can cool them using air from outdoors in the winter.



CIO

This could help us gain visibility with ISO14001, EICC, and SustainIT. How much will it cost?

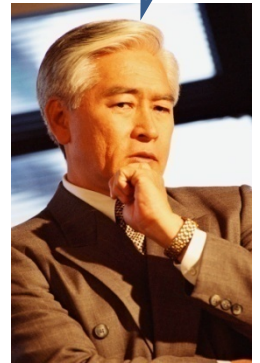


CEO

Cost Analysis

Current	20 servers	3KW each	
	A/C	6KW each	180KW
Proposed	10 servers	2KW each	
	A/C	2KW each	40KW
Saving			140KW
Power cost			0.08\$/KWH
Annual saving			98112\$
Equipment cost			150000\$

Makes good business sense to me



CEO



CIO

We save \$98K per year for the next 3 years for a capital outlay of \$150K

Energy Efficiency is not Enough We Need Zero-Carbon

Now that IT is cheaper, lets have more of it.



CEO

That will blow away the GHG reductions we just achieved.



CIO

You should purchase carbon offsets equivalent to your remaining GHG emissions, to become “zero carbon”. If you subsequently want to expand your data centre, you will need to buy more offsets.



Green Outsourcing

- **gigaCENTER™ Services Corporation**
- Opening December 2008 in Kelowna British Columbia
- Geologically stable: away from flooding, earthquakes, tornados
- Air and water cooling for servers
- 20 mega-watts of hydroelectric power , from Columbia River
- Back-up : natural gas and diesel generators
- High speed network access.
- 35,000 TeraBytes
- 300 Watts/sq ft
- Partners
 - Rackforce
 - IBM
 - Cisco



Kelowna, BC

Efficient power supply and efficient cooling make it cheaper to send my data to and from Kelowna than to have my own server farm.



Green Outsourcing



Sandgerdi, Iceland



Data Islandia
Digital Data Archive

- **Data Íslandia**
- Geothermal energy: highly reliable
- Wind cooling
- Architectural design blends with environment.
- Large-scale, long-term, archival data storage for international customers
- Stage 1: 2MW
- Stage 2: 10MW
- 4,000 m² ~ 300 W/sq ft.

Floating Data Centres

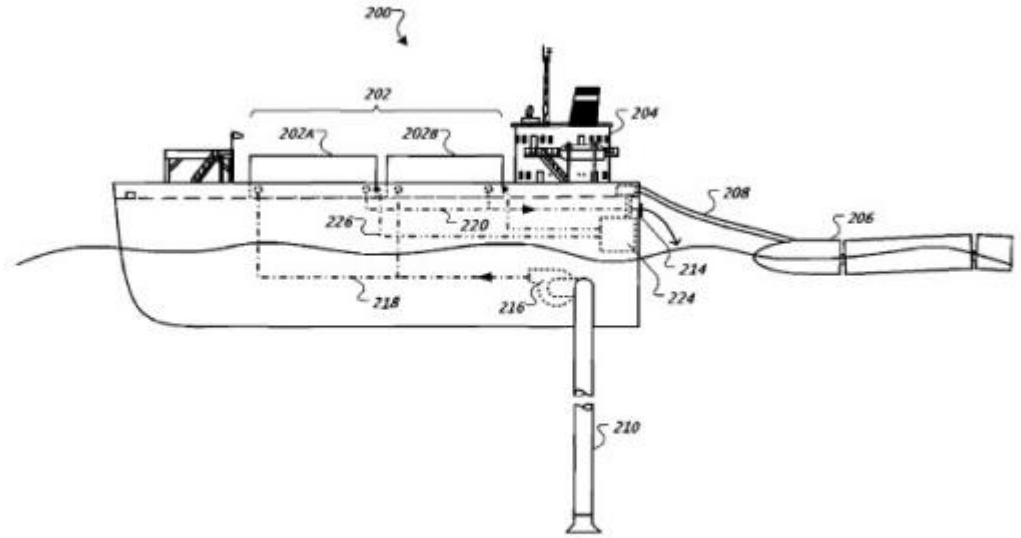


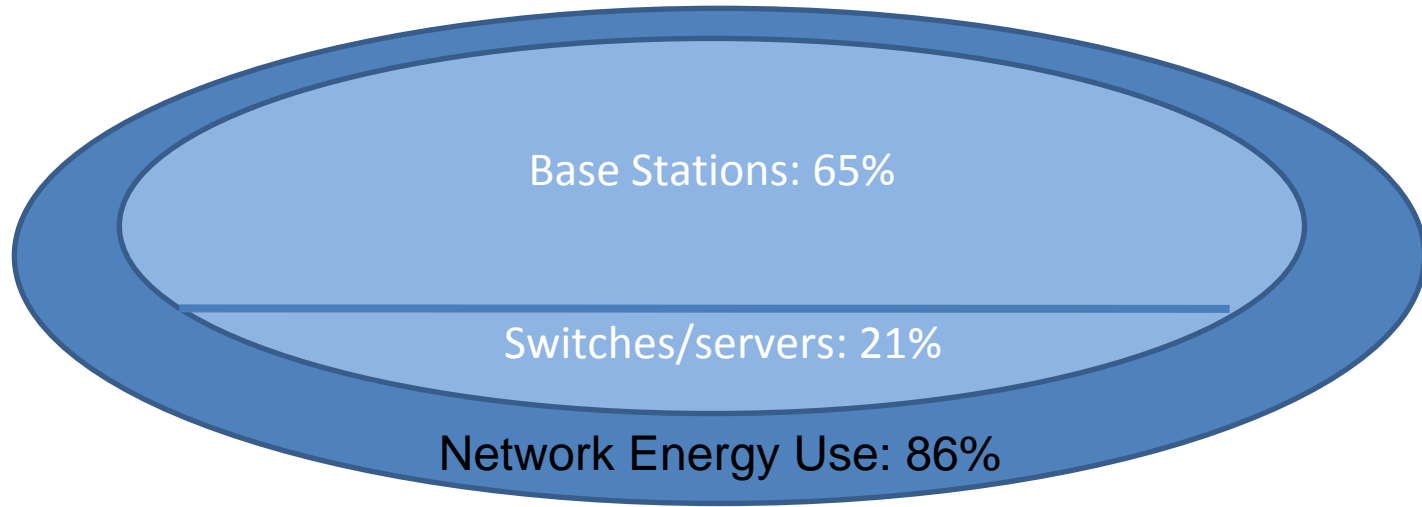
FIG. 2

- Google has filed a patent for a "floating data center"
 - Wave power
 - Ocean water cooling
- Pelamis Wave Power has a prototype wave generator in Scotland
- 1 square Km of ocean could produce 30 MW electricity.
- ?? Business issues related to being outside territorial waters ??

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Mobile Networks



T-Mobile Energy Use

Base Station

Regular

Rural

Regular Base Station Tower



Antenna

MIMO antennas

2-4 x data rate
for same energy

Feeder Cable
50% energy loss

Eliminate

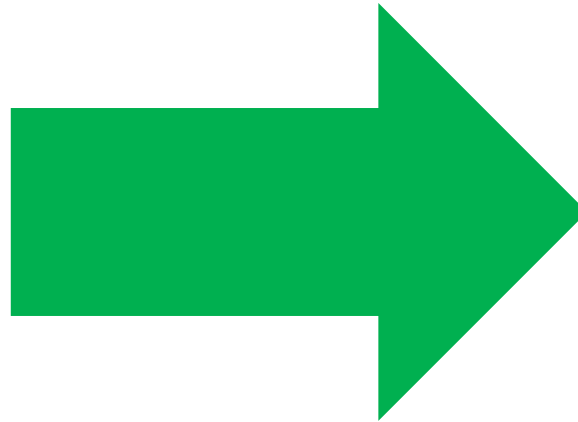
Base Station Electronics
Power Supply
Air conditioning

Electronics developments

less power
lighter weight
can move up tower
higher operating temp
cool by natural air flow
efficiency of RF amplifier
15% - 30%

MIMO: Multi Input Multi Output

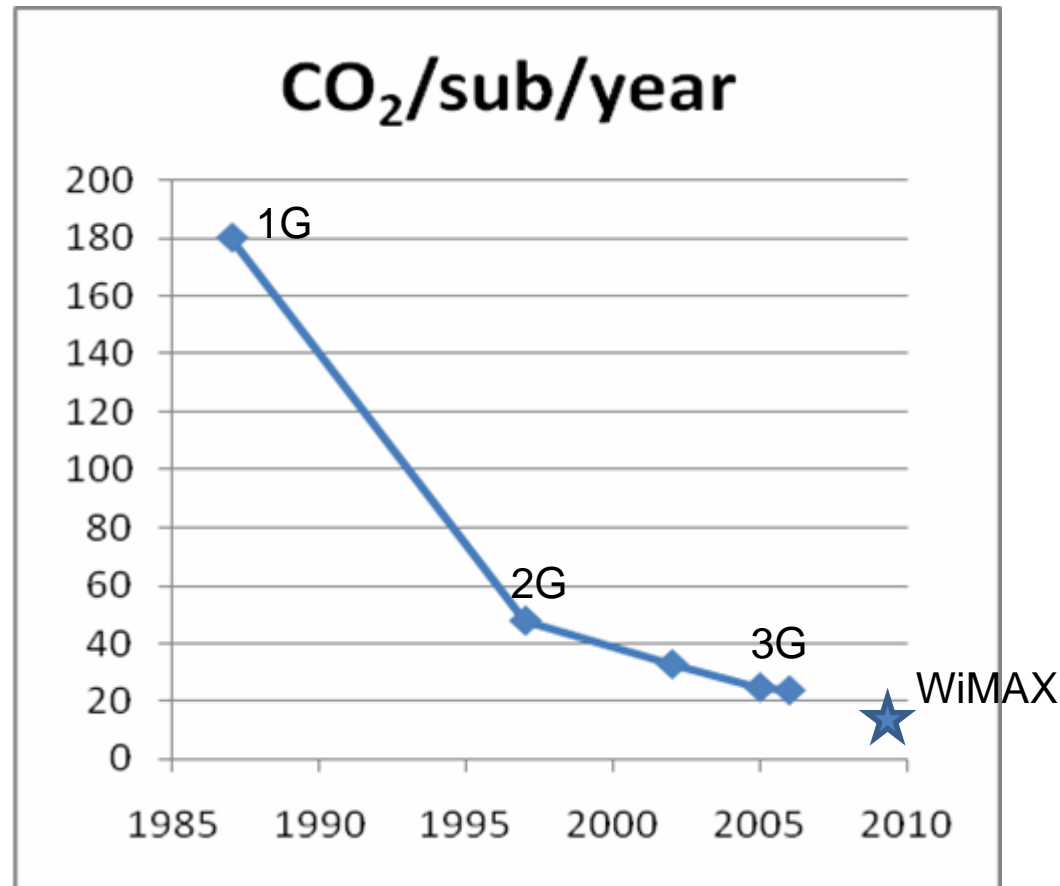
Wind Powered Base Station



Uppsala University & Ericsson

- Ericsson Tower Tube houses base stations and antennas
- CO2 emissions related to materials at least 30 percent lower.
- No feeders and cooling systems.
- 40% lower power consumption.

Effect of Developments in Electronics on Energy Use per Mobile Subscriber



Source: Adapted from Ericsson CSR Report

Rural Market for Mobile



We've sold mobile phone service to 3bn people. Where are we going to find the next billion people?



In rural areas


over 5% of regional new adds

Region	Dec 06	Dec 07
Africa	11.67	13.16
Americas	16.37	11.65
Asia Pacific	42.76	48.43
Europe: Eastern	12.29	9.00
Europe: Western	7.90	7.80
Middle East	4.01	6.22
USA/Canada	5.01	3.73
TOTAL	100.00	100.00

Algeria	Egypt	Nigeria	South Africa		
Argentina	Brazil	Columbia	Mexico	Peru	Venezuela
China	India	Indonesia	Vietnam		

Rural Base Stations

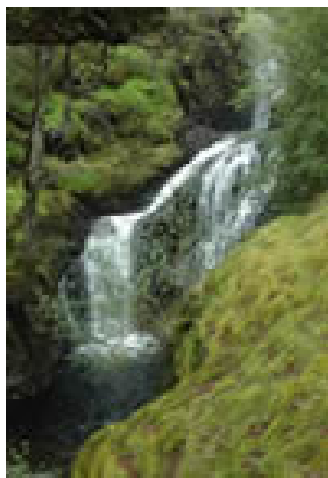
- Electric Grid
 - Non-existent
 - Unreliable
- Alternatives
 - Diesel (costly to deliver fuel to site)
 - Solar (inefficient, needs battery backup)
 - Wind (needs battery backup)
 - Hydro (needs to be near a river)



Insulated from
fluctuations
In oil prices

Rural Base Stations

- Base Station Power Requirement
 - 0.5 to 1 KW



Generator plus river produce 6 KW
Reliable source of power in hilly areas



Wind turbine required for 6KW



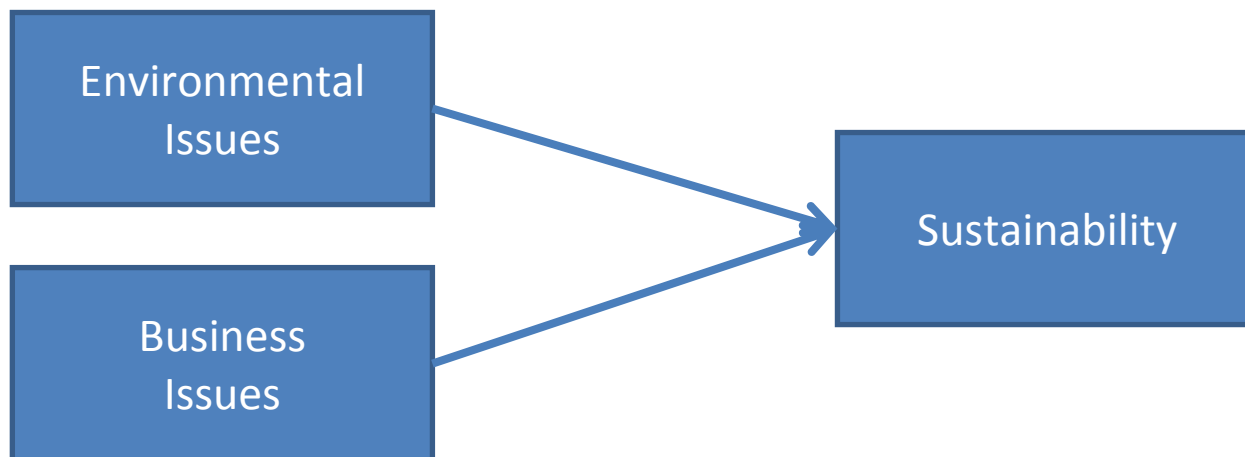
Solar panels required for 6KW

Business Issues with Rural Base Stations

- Reliability of power supply
- Provision of other services to rural areas
- ARPU: Average Revenue Per User
 - Algeria, Egypt, Nigeria, South Africa: \$14/month
 - Argentina, Brazil, Columbia, Mexico, Peru, Venezuela: \$21/month
 - China, India, Indonesia, Vietnam: \$6/month
 - Compare Canada: \$61/month

Energy Efficiency and Zero Carbon Conclusion

- Innovative engineering approaches are available to improve energy efficiency for servers and mobile networks.
- Carbon offsets can be purchased to achieve a zero-carbon footprint.
- The business case involves many other factors



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Materials Used in ICT Industry

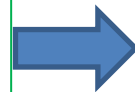
Material	ICT Use	Negative Aspects
Lead	Glass & gaskets in monitor. Solder	Damages nervous, blood, reproductive systems & kidneys
Cadmium	Surface mount devices, infra – red detectors, semiconductor chips	Toxic. Bioaccumulates
Mercury	Thermostats, sensors, relays, switches, lamps, batteries	Damages brain, kidneys, developing foetus
Chromium 6	Steel corrosion prevention, hardening, decoration	Easily passes through cell membranes. Toxic
Tantalum	Micro capacitors	“Blood-tantalum” from Democratic Republic of Congo
Heavy metals, Arsenic, PCBs, CFCs, HCFCs, Flame retardants (Br)	Various	Pollutants that leach from landfills. Fires in landfills release toxic dioxins & furans into atmosphere.

Source: B.R Balakrishnan, P.K. Anand, B.A. Chiya, (2007)
 “Electrical and Electronic Waste: A Global Environmental Problem”
 Waste Management and Research, 25(4) 307-318

WEEE: Waste Electrical and Electronic Equipment

EEE [1]	% by weight
Large Household Appliances	43%
ICT Equipment	40%
Other	17%

ICT WEEE Growing faster than other sources of waste due to declining lifespan of ICT EEE and low resale value



40% of lead in landfills
70% of heavy metals

Total WEEE: 14-20 Kg/capita in EU-15 [2]
<1 Kg/capita in China
90% goes into landfills

	PC[3]
Glass	25%
Plastic	23%
Iron	20%
Aluminum	14%
Copper	7%
Lead	6%
Other	5%

Sources: [1] Industry Council for Electronic Equipment Recycling (ICER) (2000) Status Report.
[2] Keynote, (2003) Waste Management: Keynote Market Report, 7th Ed, Keynote, Middx, UK
[3] International Association of Electronics Recyclers (IAER) (2003) Electronics Recycling Industry Report

WEEE Legislation

- Basel Convention (1992) controls import export of hazardous waste.
 - Signed by 164 countries.
 - Ratified by 161: all except Afghanistan, Haiti and USA.
- EU Directive on RoHS (adopted 2003)
 - Restrictions on Hazardous Substances used in production of EEE
- EU Directive on WEEE (in force 2005)
 - Free take-back of WEEE from households
 - Producers fund recycling
 - Incentive to design recyclable products
- E-Waste Recycling Act (2003) California:
 - Reduce hazardous materials in EEE
 - Narrower scope than RoHS
 - Environmental State purchasing policy



WEEE Recycling: Issues

- Tough to design commercial recycling systems
 - Variable composition of WEEE as technology and product mix evolves
 - Variable world prices for products, e.g. Cu & Au
- CRTs
 - Large volume
 - Lead
- Plastic
 - Variety of plastics
 - Variety of resins
- Trace elements not recycled
 - Ores continuously depleted
- Exports of WEEE justified as “donations”



“Informal” Recycling



- Some WEEE is (illegally) shipped to developing countries for “informal” recycling

Formal Recycling



- Ericsson
 - Product take-back program in Africa
 - WEEE shipped to South Africa
 - Separated into:
 - ferrous and non-ferrous metals,
 - electronics, cabling and plastics.
 - Separated items shipped to Singapore for environmentally responsible recycling

Recycling Conclusion

- EEE contains a diverse range of materials which cause issues with recycling:
 - Toxicity
 - Continuous depletion on non-recyclable trace elements
 - Export/import of hazardous wastes
 - “Informal” recycling

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Direct and Indirect Impacts of ICT

- The ICT sector contributes
 - 2% to global energy use and CO₂ generation,
 - 7% to global GDP.
 - 70% of global energy use and CO₂ generation comes from transportation, and environmental control of buildings
-
- ICT is not an Energy intensive industry
- ICT can impact More energy intensive industries

Indirect Benefits of ICT on Transportation

Benefit	Example	Effect (mil. tonnes CO2/ye ar)
Flexi-work	10% of EU-25 employees become flexi-workers	22.17
Audio conference	50% of EU-25 employees replace one meeting with an audio conference	2.13
Business-travel replacement	20% of business travel is replaced with a video conference	22.35
Online billing	All EU-15 Internet and mobile customers receive their bills online	0.49
Virtual answering machine	20% of EU-15 households use virtual rather than physical answering machines	1.03
Online tax return	All EU-25 employees complete their tax return online	0.20

Sources: WWF, ETNO

GPS navigation systems to find optimal route
avoid traffic congestion

Compelling content on mobile devices
users take the bus to watch the movie

Indirect Benefits of ICT on Environmental Control of Buildings

- Wireless sensor networks
 - Connect thermostats to electric utility
 - Zigbee smart energy standard 2008
 - Communications independent of
 - Thermostat manufacturer
 - Electric utility
 - avoid peaks in customer demand

Zigbee: alliance of 280 companies in 28 countries
Develops and promotes applications for wireless sensor networks

Indirect Impact of ICT

Conclusion

- ICT can assist in making other industries more resource efficient:
 - Some of these impacts can be quantified.

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- Getting Visibility for Environmental Efforts
 - International Visibility
 - UN Global Compact
 - Carbon Disclosure Project
 - Canadian Visibility
 - Corporate Knights
 - EthicsCan Canada
 - ICT Visibility

UN Global Compact

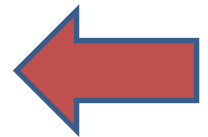
10 Principles

- [Human Rights](#)
- [Principle 1](#): Businesses should support and respect the protection of internationally proclaimed human rights; and
- [Principle 2](#): make sure that they are not complicit in human rights abuses.

- [Labour Standards](#)
- [Principle 3](#): Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
- [Principle 4](#): the elimination of all forms of forced and compulsory labour;
- [Principle 5](#): the effective abolition of child labour; and
- [Principle 6](#): the elimination of discrimination in respect of employment and occupation.

- [Environment](#)
- [Principle 7](#): Businesses should support a precautionary approach to environmental challenges;
- [Principle 8](#): undertake initiatives to promote greater environmental responsibility; and
- [Principle 9](#): encourage the development and diffusion of environmentally friendly technologies.

- [Anti-Corruption](#)
- [Principle 10](#): Businesses should work against corruption in all its forms, including extortion and bribery.



5500 corporate participants and stakeholders from over 130 countries.

UN Global Compact Canadian ICT Members

Company	Sector	Joined
Aastra Technologies	Fixed Line Telecom	2008
Ajilon Canada	Software & Com Serv	2005
BCE	Fixed Line Telecom	2006
Black Coral Inc	Software & Com Serv	2006
Triacta Power Technologies	Technology Hardware & Equipment	2008

UN Global Compact

Largest ICT Companies in Canada

Canadian Company	Global Compact		Multinational Company	Global Compact
Nortel Networks			IBM	
Celestica			HP	Y
BCE	Y		Microsoft	Y
Telus			Cisco Systems	Y
Rogers			Xerox	Y
CGI			Motorola	
RIM			Ericsson	Y
Shaw			Apple	
CAE			Oracle	
MacDonald Detwiler			Sun Microsystems	Y

Source of company listings: Branham Group, "Canada's Top 300 Tech Companies"

Global Compact ICT Companies International Comparison

Country	Software & Computer Services	Fixed Line Telecom	Technology Hardware & Equipment	Total
Canada	2	2	1	50
Korea (South)	1	4	1	135
Spain	16	6	9	571
Germany	8	1	10	148
Brazil	7	7	2	264

Environmental Responsibility of SMEs

- SMEs
 - 43% of private sector employment
 - 36% of GDP
 - 60% of CO₂e
 - 60% of commercial waste
 - Little knowledge of:
 - Environmental management systems
 - Business case for environmental sustainability
- UK Approach
 - Keep it voluntary
- Dutch Approach
 - Increase legislation, licensing, inspection

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Carbon Disclosure Project: 2008

Price Waterhouse Coopers

on behalf of

385 Investors with \$57trn Assets

- 500 Largest Corporations in FTSE Global Equity Index: (Global 500)
 - European and North American response rate: 82%
 - Asian response rate: 50%
 - Reported emissions CO₂e
 - Direct (scope 1): 2690 MTn (72% reporting)
 - Electricity consumption (scope 2): 494 MTn (70% reporting)
 - Indirect (scope 3) reporting) 4175 MTn (46%)

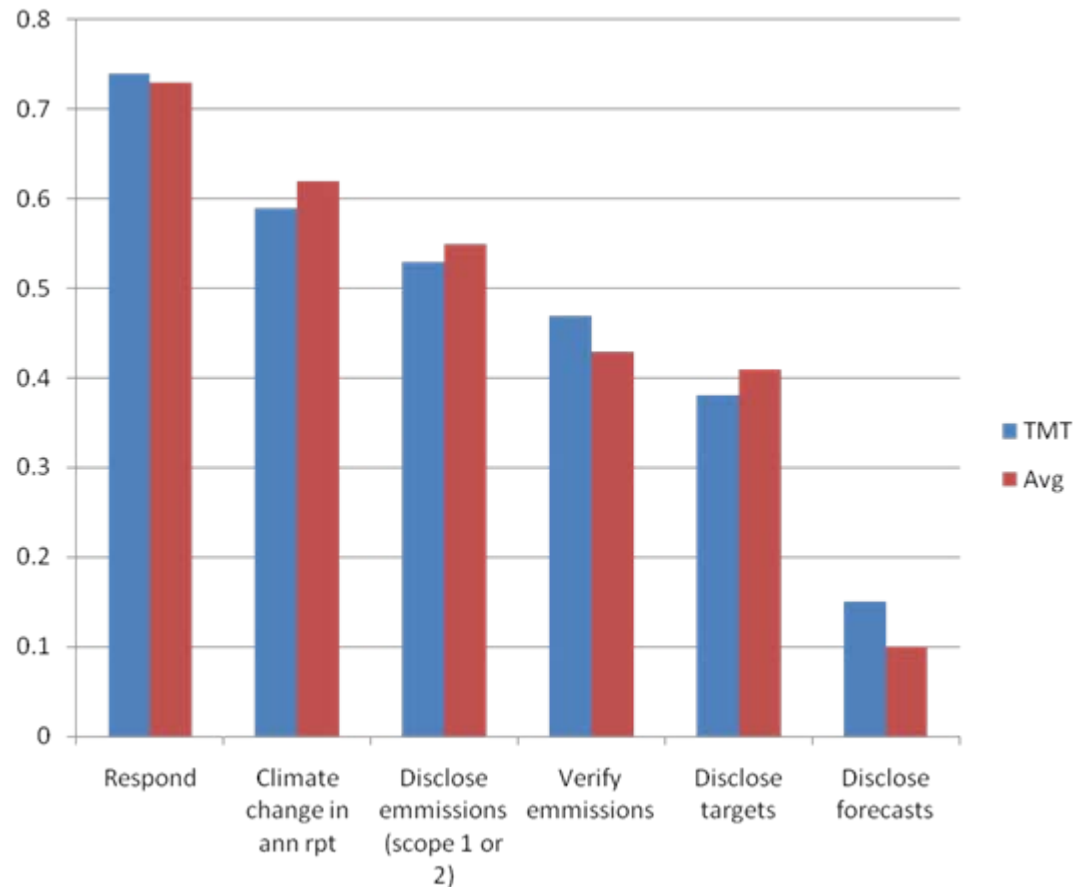
Carbon Disclosure Project Technology, Media and Telecoms

Top Disclosers

- BT Group
- Cisco Systems
- Dell
- EMC
- Nokia Group

Largest Non-Respondents By Market Capitalization

- America Movil
- China Mobile
- ComCast
- Research in Motion
- Singapore Telecom



Carbon Disclosure Project

Largest ICT Companies in Canada

Canadian Company	CDP Leadership Score		Multinational Company	CDP Leadership Score
Nortel Networks			IBM	95
Celestica			HP	88
BCE	90		Microsoft	71
Telus			Cisco Systems	96
Rogers	25		Xerox	
CGI			Motorola	78
RIM			Ericsson	88
Shaw			Apple	7
CAE			Oracle	61
MacDonald Detwiler			Sun Microsystems	

Based on CDP Global 500: 500 largest corporations in the FTSE Global Equity Index

Source of company listings: Branham Group, "Canada's Top 300 Tech Companies"

International Visibility

Conclusion

- Some Canadian SMEs have participated in the UN Global Compact
- Overall Canadian companies have a poor showing compared to
 - MNEs operating in Canada
 - Other countries

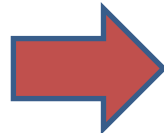
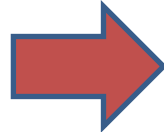
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Corporate Knights: Canadian Magazine for Responsible Business Best 50 Corporate Citizens: 2008

Baseline Indicators (Apply to All Industries)

- Tax gap
- Pension quality
- Pension health
- Board Diversity
- Board Independence
- Board SD Committee
- Executive Pay



KPIs (IT Industry Specific)

- EICC member
- Energy Efficiency of Products
- Eco-social product innovation
- Active technology transfer to developing world
- Prevention / mitigation of hazardous substances
- Proportion of products with SD differentiation

SD: Sustainable Development
EICC: Electronic Industry Citizenship Coalition

Corporate Knights

Best 50 Canadian Corporate Citizens: 2008

ICT Representation

- 1. IBM
- 34. Dell
- 42. BCE
- 47. Hewlett-Packard

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Ethicscan Canada

Corporate Ethics Monitor Vol 18(4) 2006

Ethical Performance of Telecomm. Companies



Environmental Management

- Policy
- Policy Updated (<5yrs)
- # FT Environmental Staff
- Senior FT Official
- Employee Training
- Board Committee
- # Reports to Board
- EH&S Report
- Signatory to International Principles



Environmental Performance

- Independent Audit Committees
- Commodities recycled
- Disclose qty recycled
- Workplace recycling
- Environmental awards
- Environmental convictions
- Waste reduction program
- Demands made on suppliers
- Giving to Environmental Organizations

Other factors considered:

Equity and Family
Management Practices
Employee Relations
Sourcing & Trading

Community
Corporate Governance
Staff Policies
Candor

Corporate Ethics Monitor Telecomm Report Card

Company	Environmental Management	Environmental Performance
BCE	B	C
Google Canada	D	E
Microsoft Canada	C	C
Nortel	B	D
Quebecor	C	D
Yahoo! Canada	D	E
For Comparison		
Banking (avg)	D	D-
Credit Unions (avg)	E+	D-

Canadian Visibility Conclusion

- MNEs achieve more visibility in Canada than Canadian companies

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EICC

Electronic Industry Citizenship Coalition

Code of Conduct

Labor

Health and Safety

Environmental

Management System

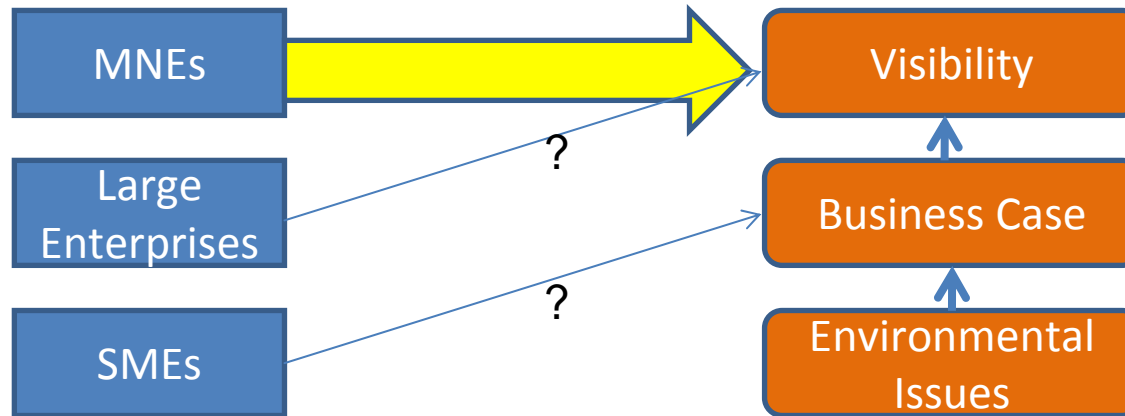
Ethics

- 1) Environmental Permits and Reporting
- 2) Pollution Prevention and Resource Reduction
- 3) Hazardous Substances
- 4) Wastewater and Solid Waste
- 5) Air Emissions
- 6) Product Content Restrictions

SustainIT

- **Understanding the relationship between ICT and Sustainable Development**
 - Quantitative and qualitative research
 - Demonstration projects
 - Policy advice and guidance
 - Award programmes and good practice dissemination
 - Development of on line tools and guidance materials
 - Debate and engagement activities

Overall Conclusion



- Suggested Canadian Approach

- Set up a group to:

- Share expertise on achieving visibility
- Demonstrate business case for environmental sustainability
- Implement green supply chains

- Group membership

- MNEs, Large Canadian Companies, SMEs, Trade Associations, Universities.

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