Green IT 3.0 in HBO-i

HBO-I platformvergadering 30 januari 2019

Anda Counotte

Voorzitter Special Interest Group ***Groene ICT en duurzaamheid***, SURF

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Frank Croes,
Leonieke Mevius,
Paquita Perez Salgado,
Gerard Verwoolde,
Rene Visser,
Rob de Vrind

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Agenda

- Voorstellen
- Wat is green IT?
- Waarom is green IT belangrijk?
- Waarom is het belangrijk om Green IT op te nemen in curriculum HBO-i?
- Stappen naar opnemen in curricula

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SIG *Groene ICT en duurzaamheid*

Opgericht 2010 door Gerard van Westrienen (SURF), Hans Gankema (RUG), Albert Hankel (SURF), Toon de Jong (HRo), Henk Plessius (HU), Anda Counotte (OU)

Doelstelling: bijdragen aan het stimuleren en bevorderen van **duurzaamheid van en door ICT** in onderwijs, onderzoek en bedrijfsvoering binnen de sector hoger *onderwijs en middelbaar beroepsonderwijs*

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Kernteam 2019 SIG *Groene ICT en duurzaamheid*

Anda Counotte, Open Universiteit (voorzitter, aandachtsgebied Groene IT in het IT curriculum) (lid sinds 2010, vz sinds 2017)

Frank Croes, Hogeschool Arnhem Nijmegen, minor Circulaire Economie (sinds 2019)

Paquita Perez Salgado, Open Universiteit (sinds 2018)

Leonieke Mevius, contactpersoon SURF (sinds 2018)

Gerard Verwoolde, Hogeschool Utrecht (aandachtsgebied Duurzame gebouwen) (sinds 2017)

Rene Visser, Hogeschool Rotterdam (aandachtsgebied Groene IT in het IT curriculum) (sinds 2015)

Rob de Vrind, Koning Willem I college (aandachtsgebied Duurzaam MBO) (sinds 2017)

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Netwerk

SIG: lid programmaraad NDDHO, zie https://nddho.surf.nl/
met RVO, Groene Brein, Green IT Amsterdam, Student van Morgen

Patricia Lago (VU), Joost Visser (RU en Software improvement group),
Paola Grosso (UvA), NL ICT (Jeroen van der Tang, Ivo Poulissen)

Anda:

Colin Pattinson (UK), Lorenz Hilty (CH), Stefan Nauman (DE), Grit Behrens (DE)

Enviroinfo: http://enviroinfo.eu/enviroinfo-2019

EISTER: Europese cursus **Introduction to Green IT** 2014

Erasmus Mundus Joint Master Degrees

Rene:

Exin: Werkboek en examen **Green IT** Foundation

Open Green IT Policy framework

Paquita: UNESCO-leerstoelhouder 'Knowledge Transfer for **Sustainable Development supported by ICTs**'

Rob: https://www.duurzaam**mbo**.nl/

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Onderzoek naar Groene IT in het IT-curriculum

- 2012 inventarisatie Groene IT in ICT curricula
- Januari 2014 sessie op NDDHO ism
  - Dirk Jan Schagen HBO-I
  - Erik Barendsen, innovatiecentrum academisch beta-Onderwijs
  - Patricia Lago, master computer science track Software engineering and green
- Juni 2014 bestuurlijk beraad
- September 2018 contact ivm universitaire curricula

Nog steeds geen concrete stappen om het onderwerp te borgen

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What is green IT?

The term **green** refers to **technologies and processes** that are environmentally friendly, i.e., which have a lower negative (or a higher positive) **impact on the natural environment** than conventional ones.

Environmental Sciences

	Human intervention	Character	Example
Level ↓	Pollution	Addition	Chemicals, radiation
	Depletion & overexploitation	Removal	Renewable (wood), non-renewable (rare metals)
	Degradation	Change of ecosystem	Climate change due to CO_2-imbalance

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Wat is het probleem?

Er is maar één aarde en op = op

1972 Rapport van de *Club van Rome* en ontstaan milieubeweging

~1980 Milieukunde als apart interdisciplinair vakgebied:

- β: inzicht in mechanismen van stoffen en kringlopen
- γ: inzicht in mechanismen van actoren en samenleving

Verontreiniging, uitputting, aantasting

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Waarom probleem: thema's van milieubeleid

verandering van klimaat (CO_2)

verwijdering (afval, riolering, bodemsanering)

verspreiding (van stoffen en gemodificeerde organismen)

verspilling (opraken van voorraden, begrip ecologische voetafdruk)

verstoring (warmte, stank, geluid)

verdroging (koelwater)

verzuring (door SO_2, NO_x en NH_3)

vermesting (door stikstof en fosfaat)

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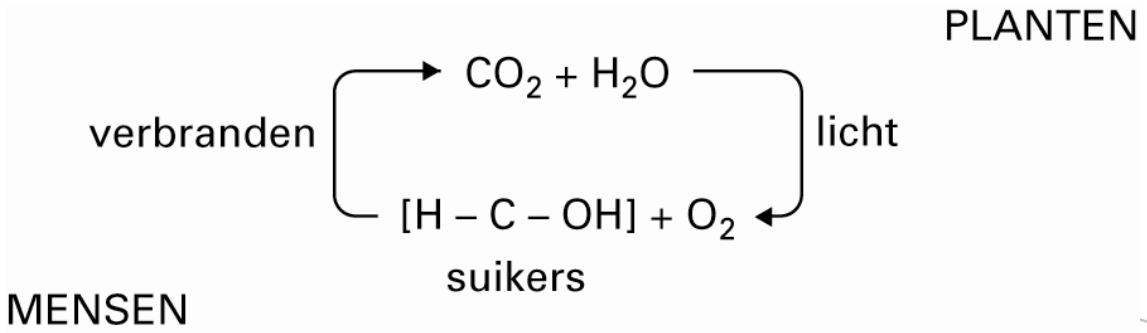
Waarom probleem: broeikaseffect

Aarde gesloten systeem: kringlopen

Verandering van klimaat:

verstoren van kringlopen -> **versterkt** broeikaseffect



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Hoe kan het worden opgelost?

Sluiten van de kringlopen door:

- gedrag
- technologie

De overheid kan hierop sturen via:

- juridisch: zweep
- financieel: peen
- communicatief: preek

Vaak via een combinatie -> MVO, gebaseerd op PPP

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Hoe kan het worden opgelost; uitgangspunten van milieubeleid

jaren 80

- stand still beginsel
- bestrijding aan de bron
- best uitvoerbare technieken
- de vervuiler betaalt
- omkering van de bewijslast, aantonen dat een activiteit zo min mogelijk vervuilt (o.a. MER)

jaren 90

duurzame ontwikkeling door:

- integraal ketenbeheer (LCA, cradle to cradle)
- energie extensivering en dematerialisatie
- Kwaliteitsbevordering

jaren 2000: **circulaire economie:** alle kringlopen sluiten

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Gedrag

Copyright 2007 by Randy Glasbergen.
www.glasbergen.com

"I need 10,000 copies of a 500 page report on how we can start using less paper."

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Gedragsverandering: ASE-model

Gedrag wordt bepaald door:

Attitude: hoe staat iemand er tegenover
(o.a. individueel belang <-> collectiefbelang)

Sociale invloed: wat vindt de omgeving

Eigen effectiviteit: hoe vaardig is men
(o.a. hoe gemakkelijk is gedrag)

Deze factoren worden beïnvloed door:

Aansluiten bij de belevingswereld

Kennis: voorlichting en **educatie**

Straffen en belonen: heffingen, subsidies

Competitie: milieuprijs, milieukeur

Gemak: voorzieningen zoals een inzamelsysteem

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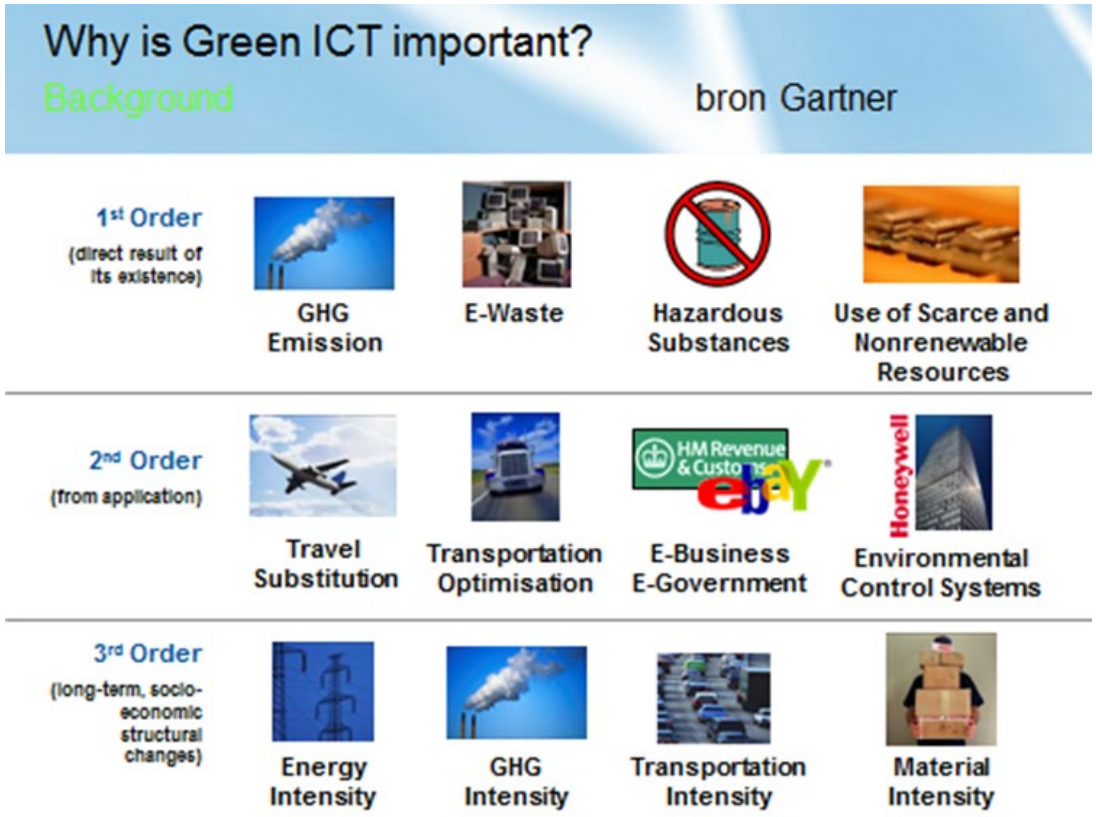
How can IT make technology green?
Three levels model of green IT



Green **of** IT (lifecycle)

Green **by** IT; green IS

Paradigm change to green behavior (internalize)

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Hilty, L.M. and Aebischer, B. ICT for Sustainability: An Emerging Research Field, in Hilty, L.M. and Aebischer, B. (eds) (2015), *ICT Innovations for Sustainability*, Advances in Intelligent Systems and Computing, Switserland, Springer, p25

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Waarom is Green IT belangrijk?

Energiegebruik door IT blijft stijgen

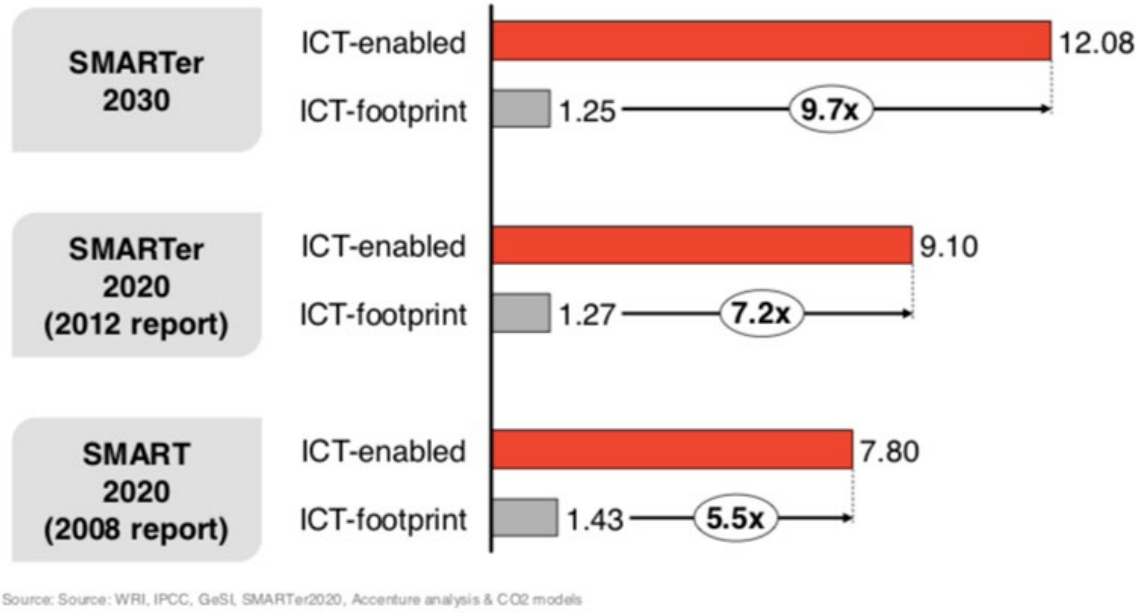
In 2008 al vergelijkbaar met luchtvaart

Grote energieslurpers bijgekomen: Facebook, Bitcoin

Schaarse metalen

E-waste

Bedreiging **en** kans



GeSI. (2015). ICT Solutions for 21st Century Challenge. Retrieved from http://smarter2030.gesi.org/downloads/Full_report.pdf

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E-InfraNet Project EISTER

Sustainability for the Data Centre, November 2014

dr. Anda Counotte,

Open Universiteit (The Netherlands)

Professor Colin Pattinson

Leeds Beckett University (UK)

Agenda

- Sustainability
- The IT lifecycle
- Measurement
- The future - first step, study our course!

Sustainability

A Wikipedia definition

- From the Latin *sustinere* (*tenere*, to hold; *sus*, up).
- Since the 1980s *sustainability* has been used more in the sense of human sustainability on planet Earth and this has resulted in the most widely quoted definition of sustainability as a part of the concept *sustainable development*, that of the Brundtland Commission of the United Nations on March 20, 1987:

Sustainable development:

Brundtland 1987

Sustainable development (SD) is a pattern of **economic growth** in which resource use aims to meet **human needs** while preserving the **environment** so that these needs can be met not only in the present, but also for generations to come.

-> PPP: People, Planet, Profit

by CSR: Corporate Social Responsability

Sustainability, Efficiency, Saving

- Sustainability
  - Able to be maintained
- Efficiency
  - Maximum productivity with minimum wasted effort or expense
- Saving
  - Reducing energy use

IT and sustainability

- Addressing the IT lifecycle
  - Manufacture, use, disposal
  - "Greening *of* IT"
- Using IT to improve the sustainability of other human activities
  - Greening *by* IT

Why is sustainability important?

In alphabetical order:

- Compliance with legislation
  - Carbon reduction commitment (UK)
  - Compulsory carbon trading (UK)
- Corporate social responsibility
  - Consumer (and employee) pressure
- Cost saving
  - energy = money
  - Energy saving = money saving

Why do anything..?

- Climate Change => warming, disasters (fires and floods), loss of biodiversity, less to go round more
- Population growth, 2000 to 2030 of 2.2 billion, of which 2.0 billion likely to be located in cities (World Urbanization Prospects: The 2001 Revision)
- Rising consumption, 5 billion people consume 20% and 1 billion consume 80% *(Ericsson)*
- Resource depletion, 2.5 planets for all to have US/EU living standards

  => rising energy, food and resource costs and the recession

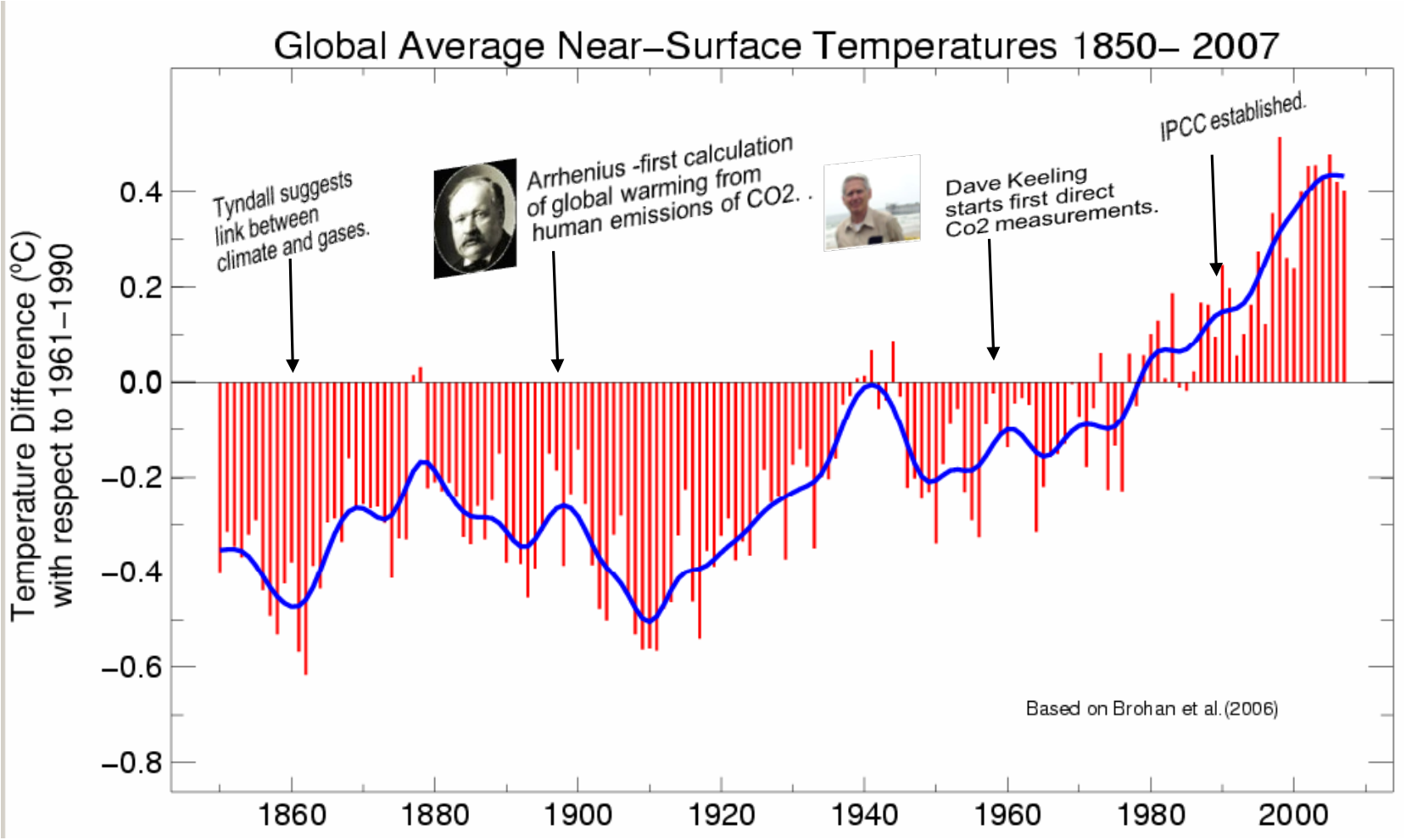
  => "we have to do more with less" (*Buckminster Fuller*)

  > energy

  > resources

  > emissions

Reality of Climate Change



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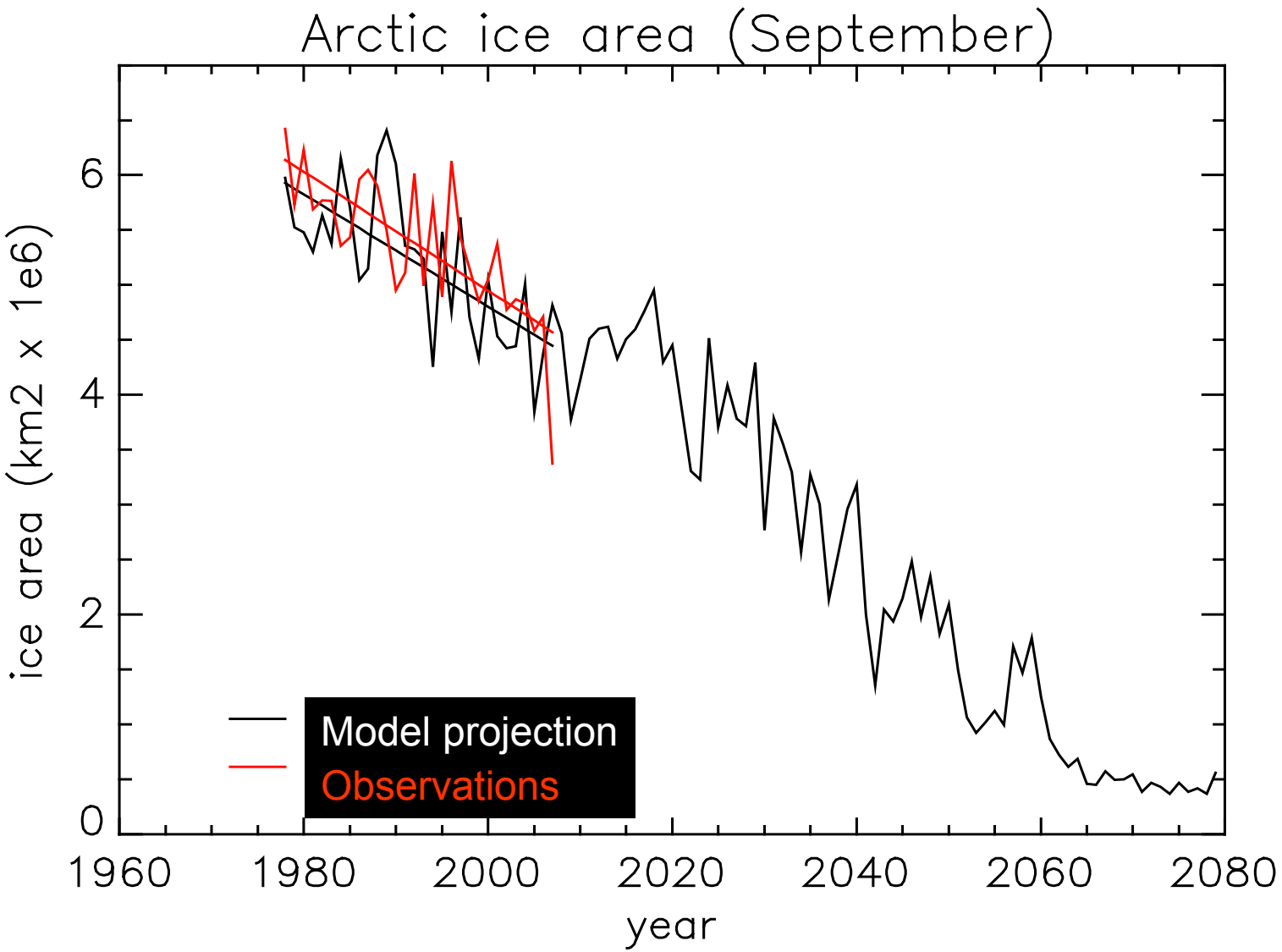

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Some perspectives on IT...

Globally

- ICT Manufacture, use and disposal accounts for 2%+ of global CO2 emissions being equal to the aviation industry
- Man-made CO2 emissions add up to around 49 billion tonnes pa 1 billion + tonnes from ICT.
- Data storage capacity growing by ~ 40% annually and in 2011 passed the zettabyte mark for stored data
- Worldwide data centres + comms predicted to consume ~ 2000bn kW-h by 2020

- In UK
  - 10 million office PCs, nearly 50% of adult population use PCs at work expected to grow to 70% by 2020
  - IT consumes 15% of office power, rising to 30% by 2020

References : (Berkeley National Labs + Global Action Plan + IPCC + Energy Saving trust + Carbon Trust)

Servers

- A medium-sized server has roughly the same annual carbon footprint as an SUV vehicle using 18 litres of fuel per 100 Km
- The power required for a rack of high density server blades can be 10-15 times greater than a traditional server
  - And we “need” to cool it with air con units consuming perhaps half as much power again

An inefficient truth – GAP (Dec 2007)

The cloud

- A paradigm shift in the computing landscape for businesses and consumers
  Computing is now a utility
- In addition to the 2.4 Billion humans, there are 100's millions of computer devices generating data and information every day
  - "The Internet of Things"
- By 2020, it is anticipated that 50 Billion (non-human) devices will be communicating on the internet

Interesting Facts about the Cloud

- Google processes more than 24 petabytes per day , a volume that is a thousand times the quantity of all printed material in the U.S Library of Congress
- The 800 million users of YouTube upload over 1 hour of video per second.
- Facebook members “Click” or comment 3 billion times per day
- The storage capacity needed by the average Fortune 1000 company doubles every 10 months

… and the scale of the problem

- Typically for every $2 spent on server power, $1 is spent on cooling it. In 2005, 1.5% of the U.S electricity was consumed by server farms and data centres.
- In 2005, $26.1 billion was spent powering and cooling the global installed server base.
- $41.4 Billion in global revenue (28% of the total data centre market) will be spent on the Green agenda in data centres over the next 5 years.
- Data centre energy consumption worldwide has doubled since 2000 and is expected to double by 2020.
- The EU data centre community will constitute 15-20% of Europe's total CO2 emissions.

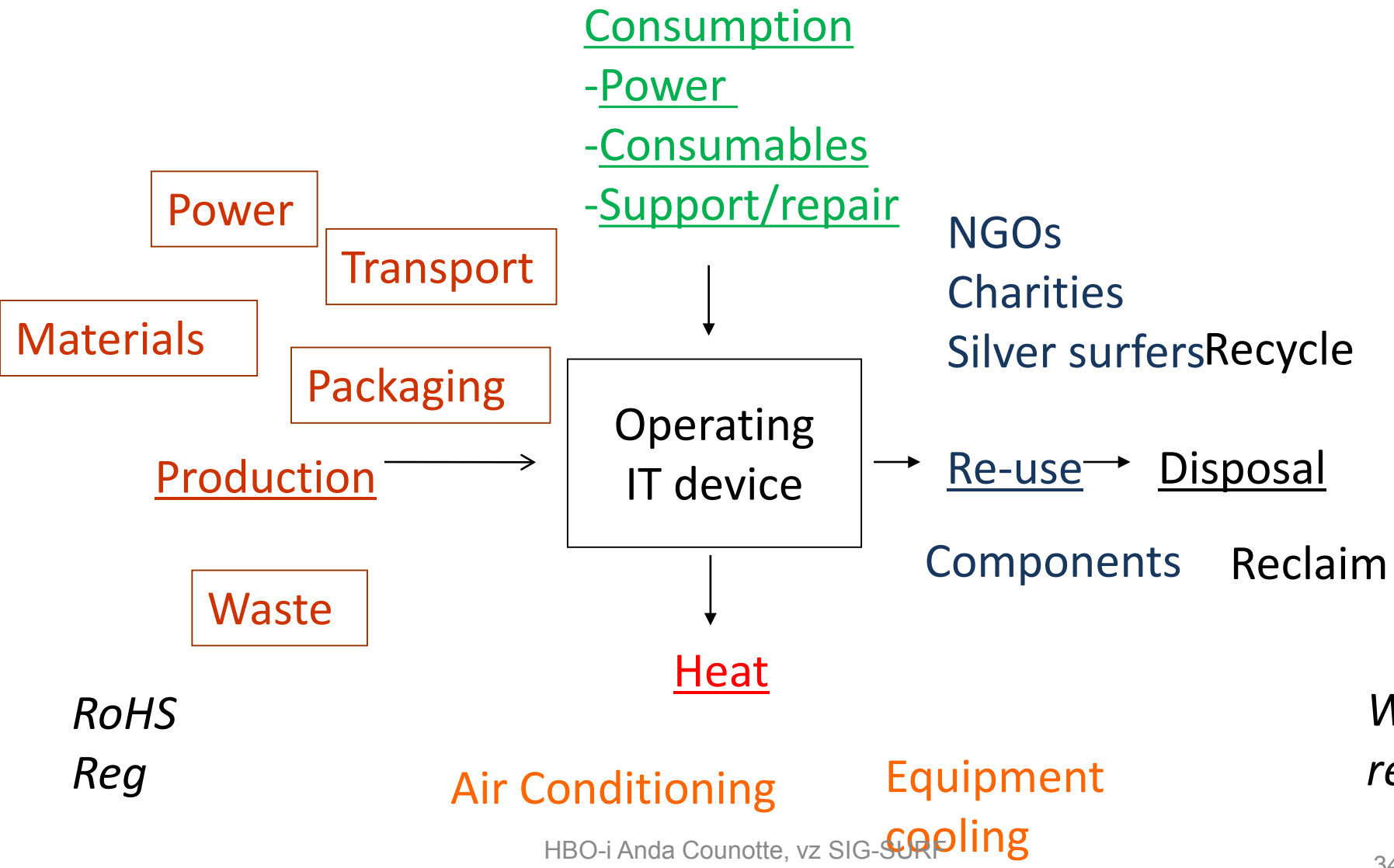
Moore’s law meets Jevons's Paradox

- Moore’s law
  - Processing power doubles every 18 months
- Jevons's Paradox
  - Increasing the efficiency of a resource increases the rate at which that resource is used
- As data processing and storage becomes more easily available, we process and store more data
  - We do not handle the same volume of data more efficiently

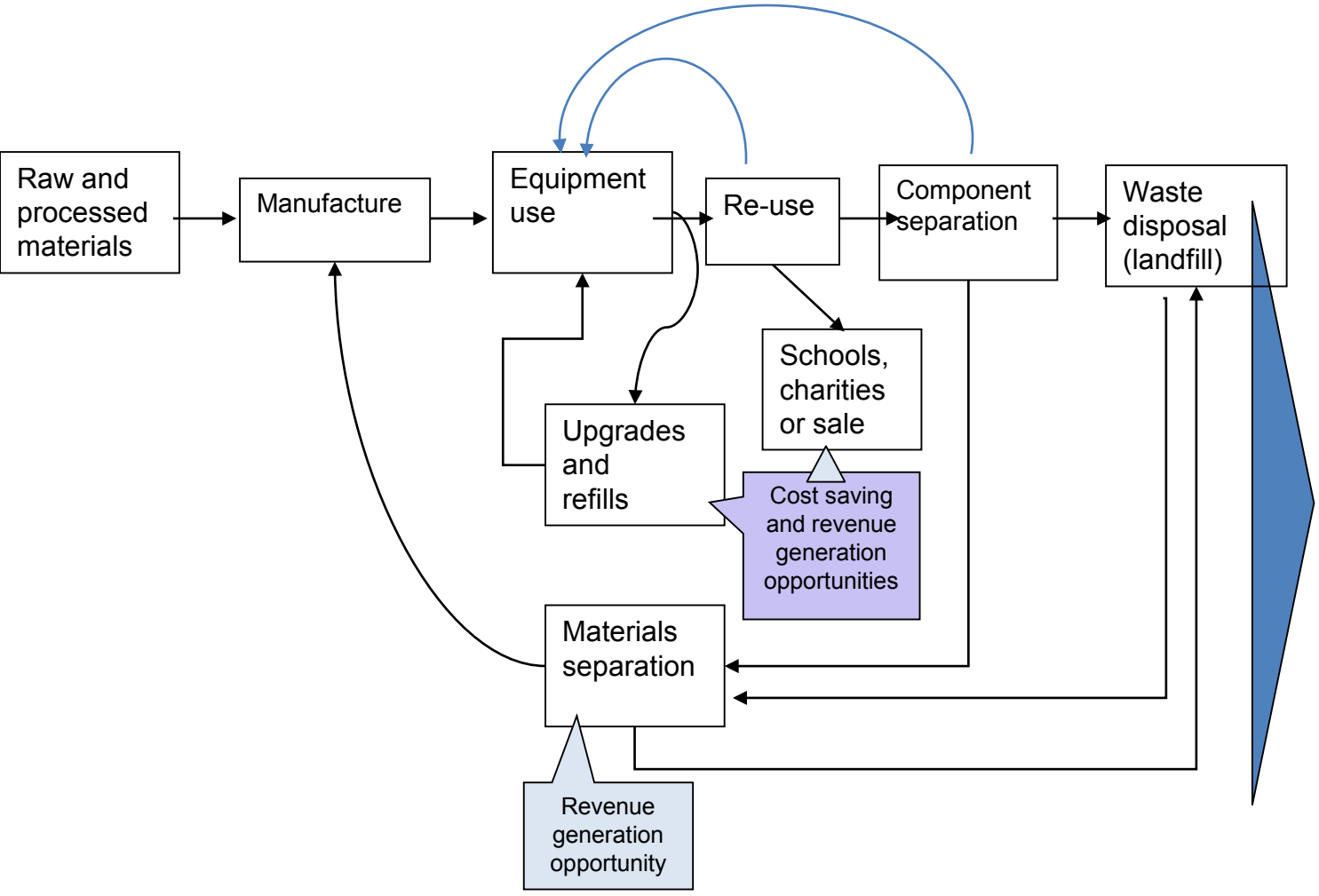
The IT system life cycle

- Environmental impacts during:
  - manufacture
  - use
  - disposal
- Embedded carbon; hazardous chemical content
- Identifying choices which enhance sustainability

Managing the lifecycle

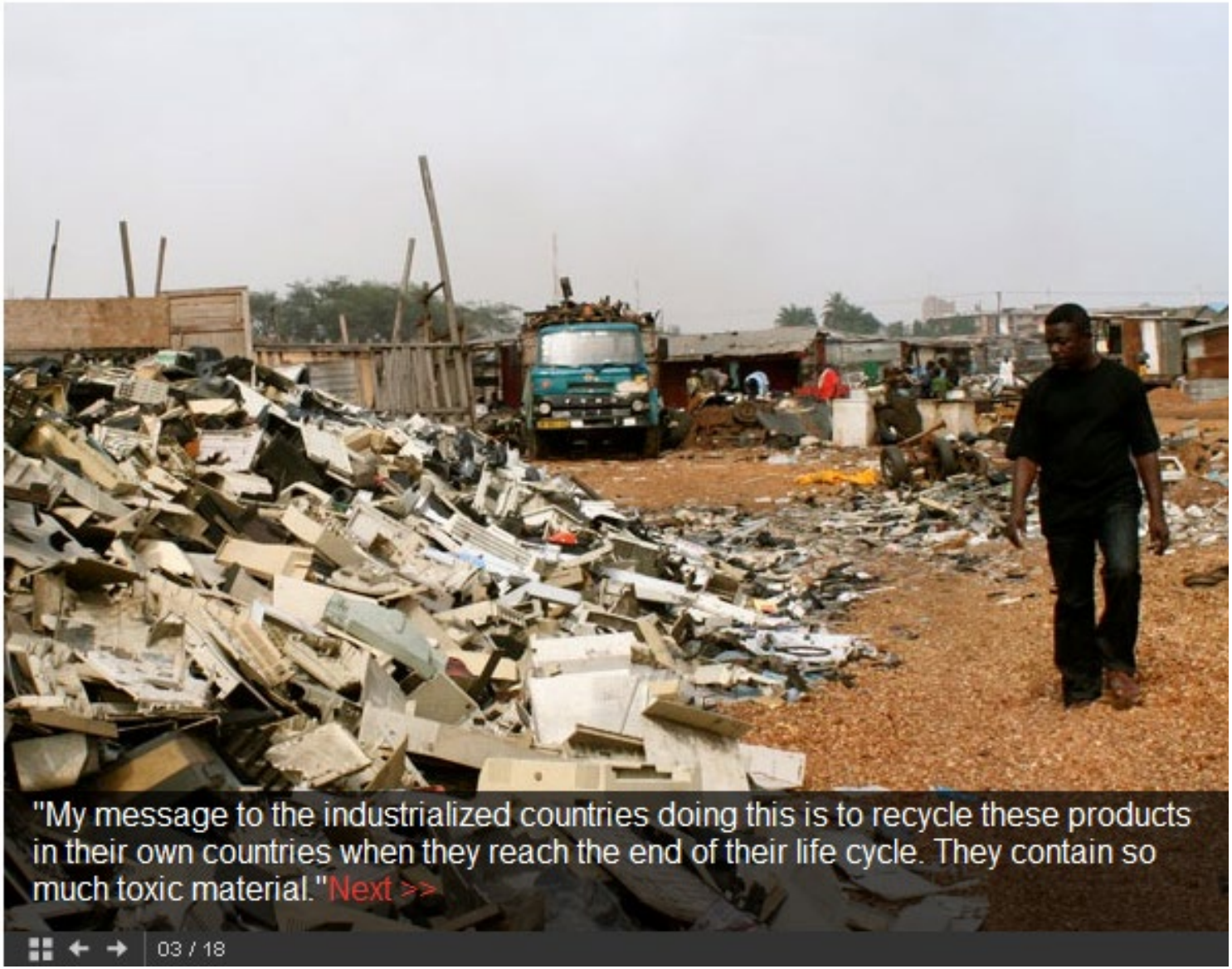


Recycling and Disposal



- Re-use a source of significant cost savings (up to 90% cheaper to refurbish than to make a new purchase)
- Disposal of working equipment after refresh exercise can generate revenue
- Separate components before crushing, can be worth a lot e.g. £1,800/tonne for RAM
- Waste disposal suppliers should be ISO 14001 accredited to ensure compliance with relevant legislation

Source: SCC; EU; Defra; Eric Williams et al (UN University, Tokyo); NAO; team analysis



FRONTLINE/World Ghana: Digital Dumping Ground | PBS

http://www.pbs.org/frontlineworld/stories/ghana804/slideshow/slideshow.html

FRONTLINE/World Ghana: Digital Dumping Ground | PBS

http://www.pbs.org/frontlineworld/stories/ghana804/slideshow/slideshow.html

Manufacture/distribution

- Sourcing of materials
  - beware location/ transport costs
- Building products
  - build to re-use/ re-cycle/ upgrade – a longer life
- Energy efficient processes
- Move from commodity to service revenue streams
- Marketing - eco-labelling, green washing, credibility
- Delivering - transport, packaging, installation

Measuring usage: PUE and DCiE

- Measures of data centre efficiency
- **P**ower **U**sage **E**ffectiveness =

$$\frac{\text{Total Facility power use}}{\text{Power delivered to computing equipment}}$$

- **D**ata **C**entre **I**nfrastructure **E**fficiency =

$$\frac{\text{Power delivered to computing equipment}}{\text{Total Facility power use}}$$

- PUE values below 1.2 seen as “good”
- Many current PUE ~ 2.0
- Relative measures of performance

The Future

- Transformation to a sustainable society
- Transformation by technology and behaviour
- Sustainable IT
- Sustainable data centres
- What are the best practices of the Code of Conduct on Data Centres (CoC)?
- Why and how?
- **Study this course and find the answers!**

E-InfraNet Project EISTER

Sustainability for the Data Centre, November 2014

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Waarom opnemen in curriculum HBO-i?

Student van Morgen (sinds <jaartal>) Sustainabul

Scholierenstakingen deze maand

-> **Jonge mensen** willen dat het verandert

Grote IT-bedrijven zijn voorlopers in duurzaamheid -> wens **bedrijven**

Verandering door

- Gedrag (<- attitude<- kennis)
- Technologie (<- kennis)

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Raamwerken

Domeinbeschrijving HBO-i 2018

E-competence framework

Sfia

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HBO-i Domeinbeschrijving

2.2 Professionele skills

2.2.1 Toekomstgericht organiseren

“De organisatorische context van ICT-opdrachten verkennen, zakelijke, **duurzame én ethische** afwegingen maken en alle aspecten van de uitvoering van de opdracht managen.”

NB de links op p88 naar Body of Knowledge werken niet

Ethiek komt verder voor bij

2.2.3 Persoonlijk leiderschap: verantwoordelijkheid nemen

3.1.1 Gebruikersinteractie/analyseren

3.2.1 Activiteiten/analyseren

Dublin descriptor Oordeelsvorming:

“Is in staat om oordelen te formuleren op grond van onvolledige of beperkte informatie en daarbij rekening te houden met sociaal-maatschappelijke en ethische verantwoordelijkheden, die zijn verbonden aan het toepassen van de eigen kennis en oordelen.”

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European-e-Competence-Framework-3.0_CEN_CWA_16234-1_2014.pdf - Adobe Acrobat Pro DC

Bestand Bewerken Beeld Venster Help

Start Gereedschappen European-e-Comp... ×

Aanmelden

11 / 53

68,3%

Delen

European e-Competence Framework 3.0 overview

Dimension 1 5 e-CF areas (A – E)	Dimension 2 40 e-Competences identified	Dimension 3 e-Competence proficiency levels e-1 to e-5, related to EQF levels 3–8				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. IS and Business Strategy Alignment				■	■
	A.2. Service Level Management			■	■	
	A.3. Business Plan Development			■	■	■
	A.4. Product/Service Planning		■	■	■	
	A.5. Architecture Design			■	■	■
	A.6. Application Design	■	■	■		
	A.7. Technology Trend Monitoring				■	■
	A.8. Sustainable Development			■	■	
	A.9. Innovating				■	■
B. BUILD	B.1. Application Development	■	■	■		
	B.2. Component Integration		■	■	■	
	B.3. Testing	■	■	■	■	
	B.4. Solution Deployment	■	■	■		
	B.5. Documentation Production	■	■	■		
	B.6. Systems Engineering			■	■	
C. RUN	C.1. User Support	■	■	■		
	C.2. Change Support		■	■		
	C.3. Service Delivery	■	■	■		
	C.4. Problem Management		■	■	■	
D. ENABLE	D.1. Information Security Strategy Development				■	■
	D.2. ICT Quality Strategy Development				■	■
	D.3. Education and Training Provision		■	■		
	D.4. Purchasing		■	■	■	
	D.5. Sales Proposal Development		■	■		
	D.6. Channel Management			■	■	
	D.7. Sales Management			■	■	■
	D.8. Contract Management		■	■	■	
	D.9. Personnel Development		■	■	■	
	D.10. Information and Knowledge Management			■	■	■
	D.11. Needs Identification			■	■	■
	D.12. Digital Marketing		■	■	■	
E. MANAGE	E.1. Forecast Development			■	■	
	E.2. Project and Portfolio Management		■	■	■	■
	E.3. Risk Management		■	■	■	
	E.4. Relationship Management			■	■	
	E.5. Process Improvement			■	■	
	E.6. ICT Quality Management		■	■	■	
	E.7. Business Change Management			■	■	■
	E.8. Information Security Management		■	■	■	
	E.9. IS Governance				■	■

Zoekhulpmiddelen

PDF maken

Bestanden combineren

PDF bewerken

PDF exporteren

Pagina's indelen

Verzenden voor revisie NIEUW

Opmerking

Invullen en ondertekenen

Adobe Sign

Scans verbeteren

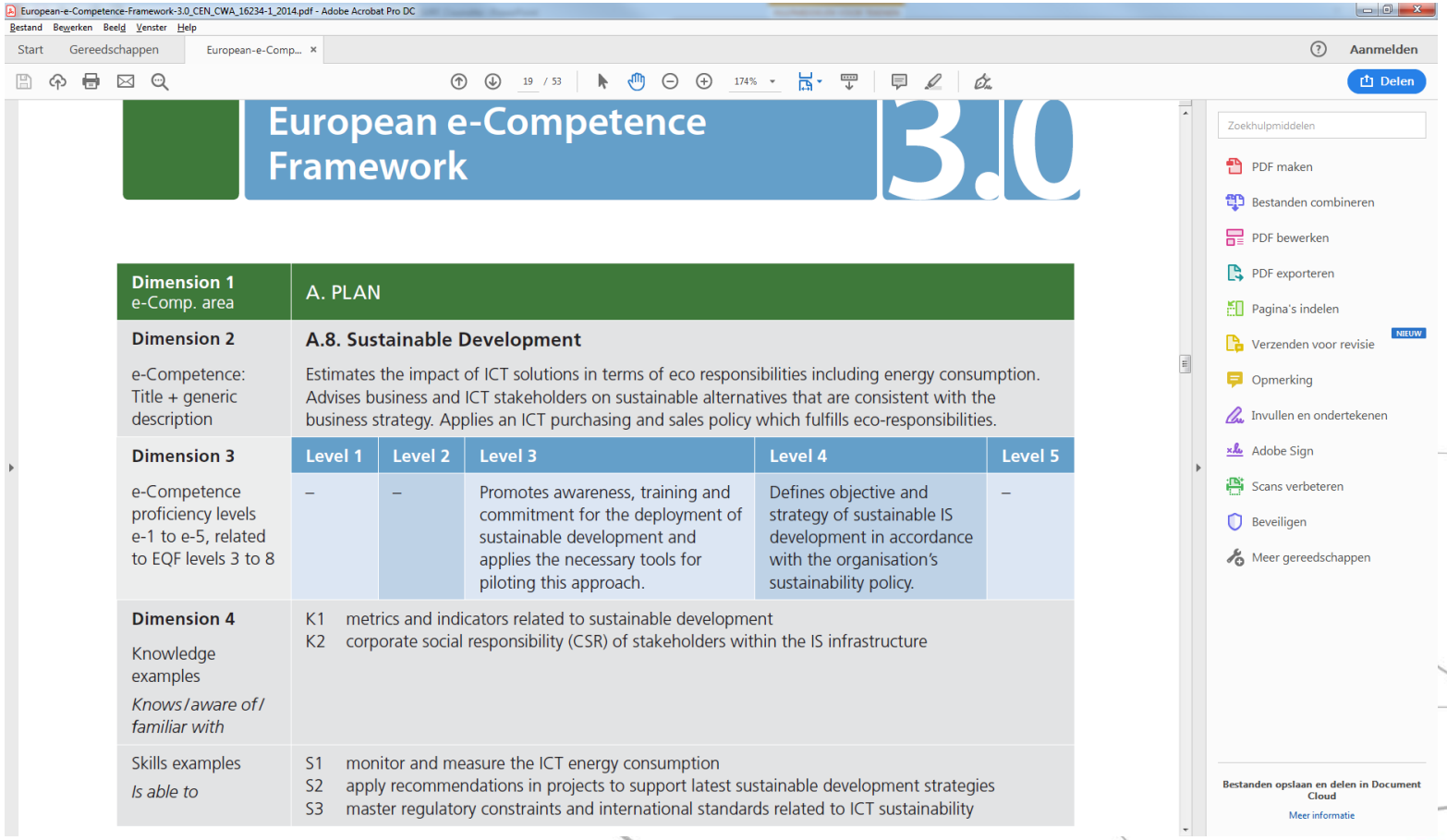
Beveiligen

Meer gereedschappen

Bestanden opslaan en delen in Document Cloud

Meer informatie

E-Competence Framework: A8



Dimension 1 e-Comp. area	A. PLAN				
Dimension 2 e-Competence: Title + generic description	**A.8. Sustainable Development** Estimates the impact of ICT solutions in terms of eco responsibilities including energy consumption. Advises business and ICT stakeholders on sustainable alternatives that are consistent with the business strategy. Applies an ICT purchasing and sales policy which fulfills eco-responsibilities.				
Dimension 3 e-Competence proficiency levels e-1 to e-5, related to EQF levels 3 to 8	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
	–	–	Promotes awareness, training and commitment for the deployment of sustainable development and applies the necessary tools for piloting this approach.	Defines objective and strategy of sustainable IS development in accordance with the organisation's sustainability policy.	–
Dimension 4 Knowledge examples *Knows/aware of/ familiar with*	K1 metrics and indicators related to sustainable development K2 corporate social responsibility (CSR) of stakeholders within the IS infrastructure				
Skills examples *Is able to*	S1 monitor and measure the ICT energy consumption S2 apply recommendations in projects to support latest sustainable development strategies S3 master regulatory constraints and international standards related to ICT sustainability				

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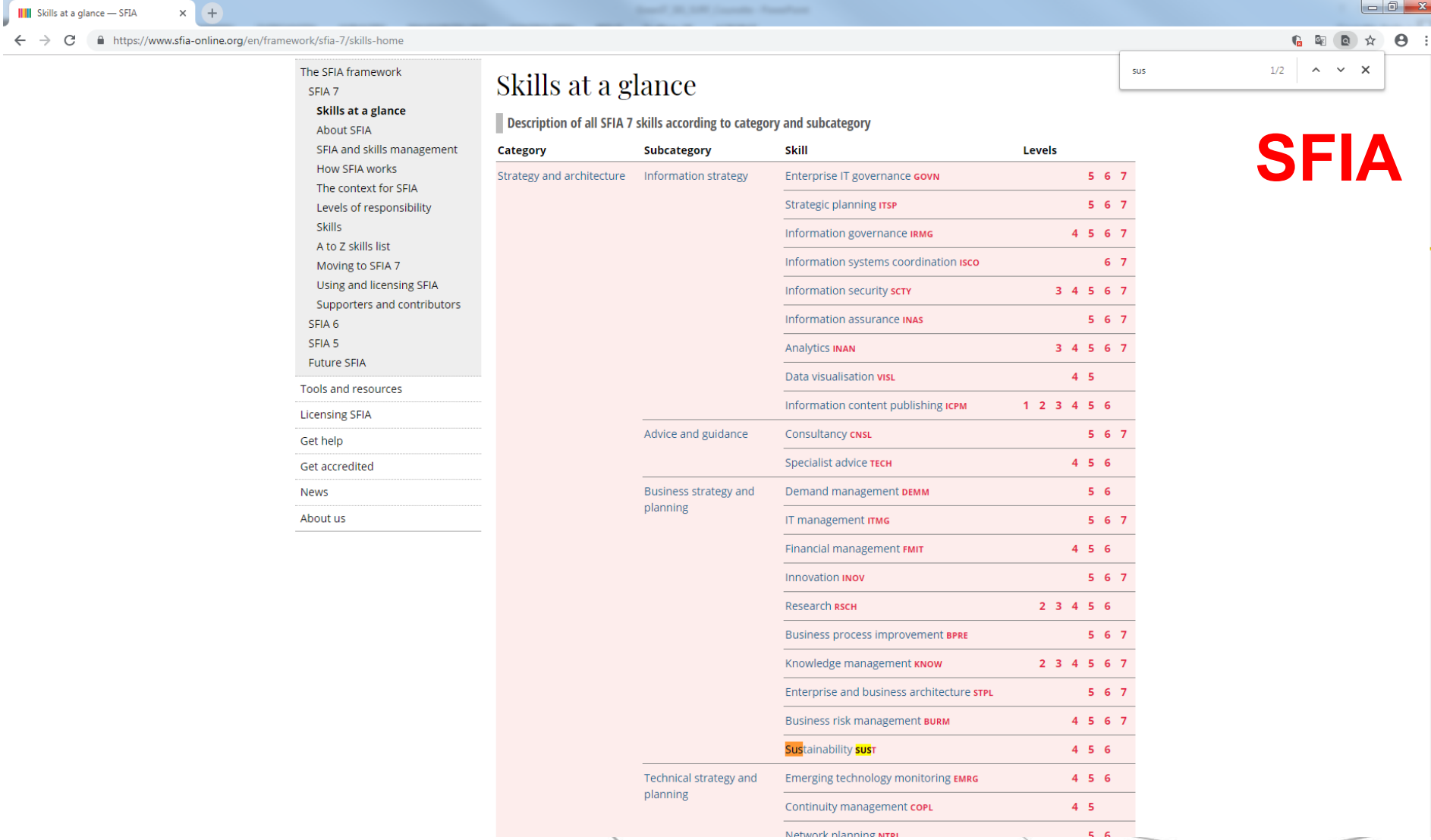

SFIA

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SFIA: category>subcategorie>skill>level

Sustainability SUST

The provision of advice, assistance and leadership to enable the organisation to minimise negative environmental impact.

Sustainability: Level 6

Develops and promotes organisational strategies, policies, standards, and guidelines for sustainability. Leads the introduction and use of sustainability techniques, methodologies and tools.

Sustainability: Level 5

Provides expert advice and guidance on planning, designing and implementing sustainability solutions. Evaluates and selects sustainability methods, tools and practices to be used in line with agreed policies and standards. Identifies and recommends improvements to the organisation's approach to sustainability.

Sustainability: Level 4

Assesses and reports on how different tactical decisions affect sustainability. Evaluates factors and risks (political, legislative, technological, economic, social) that impact on operational processes and strategic direction. Evaluates and reports on implementation of sustainability measures in specific areas.

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Stappen naar opnemen Green IT 3.0 in curricula HBO-i??

- HBO-i platform opnemen in HBO-i domeinbeschrijving
- Iedere opleiding opnemen in curriculum
- …
- …
- …
- …
- …
- SIG levert graag expertise

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Thank you!

Discussie

www.surfspace.nl/sig/3-groene-ict-en-duurzaamheid/

www.linkedin.com/groups/Groene-ICT-3694062/about

https://www.surf.nl/themas/groene-ict-en-duurzaamheid -> kennisbank

Email: anc@ou.nl

European Course on Green IT:
https://www.ou.nl/web/green-sustainable-data-centres/home

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