AI for environmental sustainability

DCs and Sustainability

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The JRC and Data Centres

- *The JRC has been managing the EU CoC for DCs for many years*
- *More than 300 DCs*
- *Yearly Best Practices for DCs*
- *Average PUE of < 1.80*

EU CoC

Best Practices

Data Centres and Sustainability

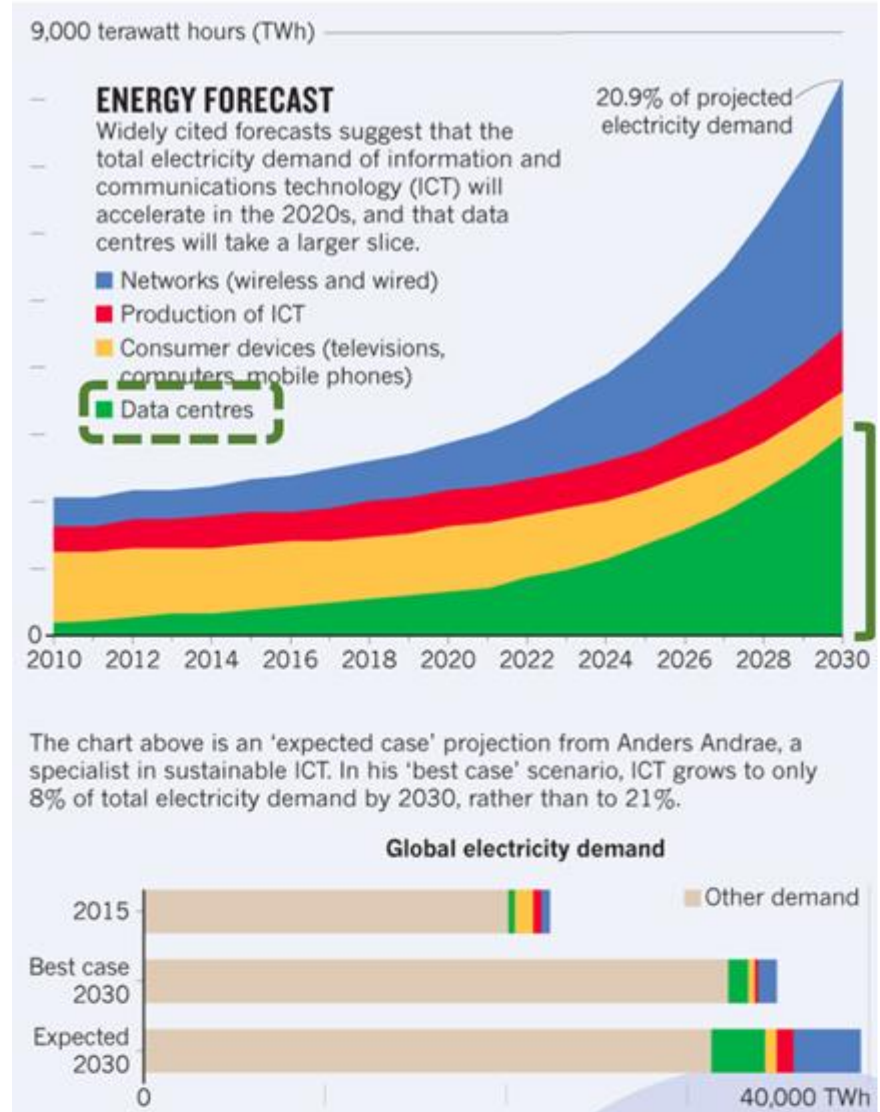
- *ENERGY*
- *WATER*
- *WASTE*
- *EMBEDED CARBON*
- *SOCIO-ECONOMIC IMPACTS*

- *MEASURING SUSTAINABILITY*

- *DCs and the SDGs*

Energy and DCs

- *Energy intensive industry (0.8% of electricity demand)*
- *Since 2010, the number of internet users worldwide has doubled while global internet traffic has grown 12-fold, or around 30% per year*
- *Demand for data and digital services is expected to continue its exponential growth*



Energy and DCs

- *Decline of RES prices*
- *Electricty up to 70% of DC costs*
- *Large ICT players also large RES buyers*
- *Onsite and through PPAs*
- *Opportunity to add flexibility to the grid*

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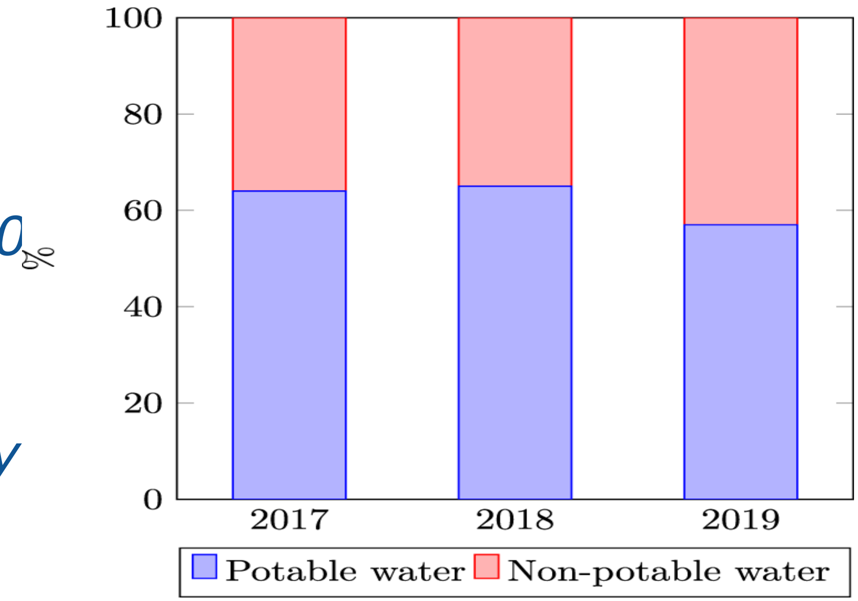
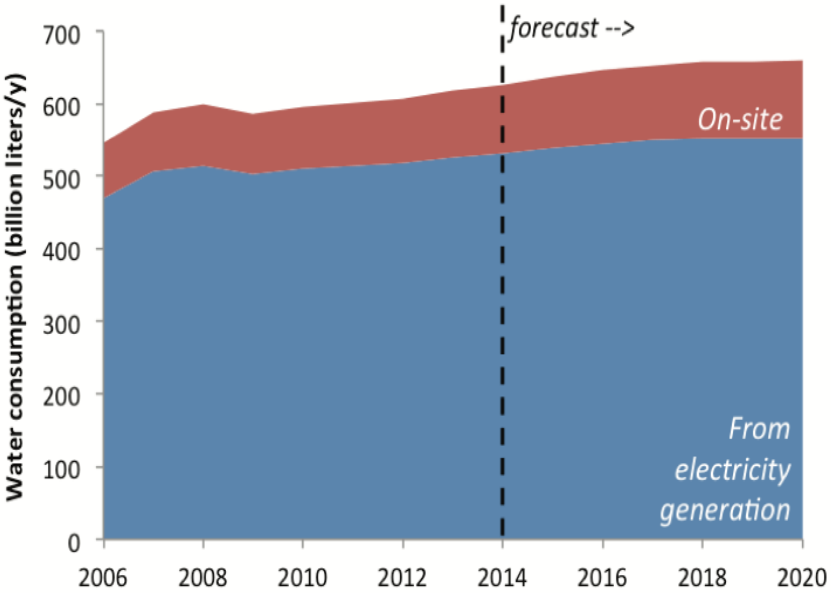
Water Consumption

- *Water consumption to increase by 55% between 2000 and 2050, ICT plays its part*
- *In DCs: Water used in electricity generation and for cooling*
- *Most water used in DCs from potable sources*
- *DCs often are placed in highly populated areas with high hydric stress.*
- *DCs need a water expert on top of energy experts*





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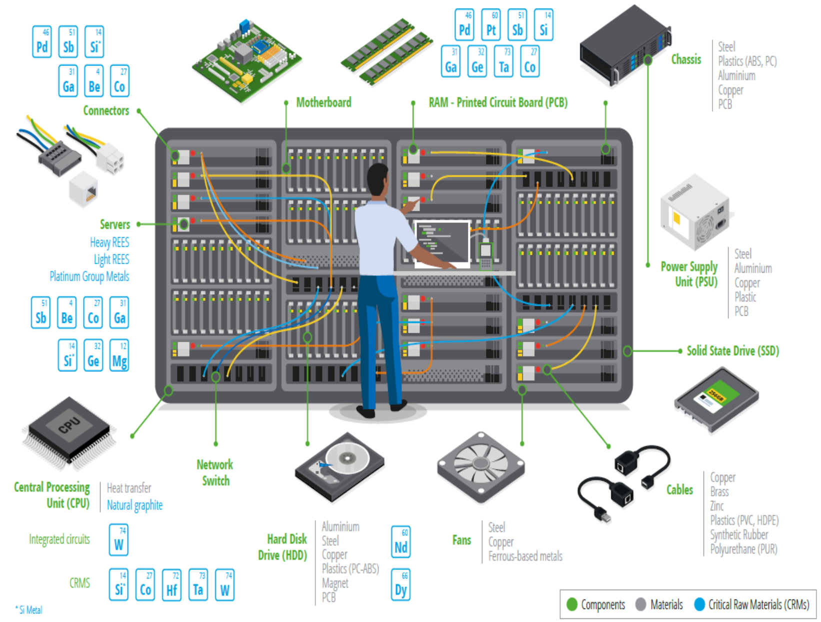
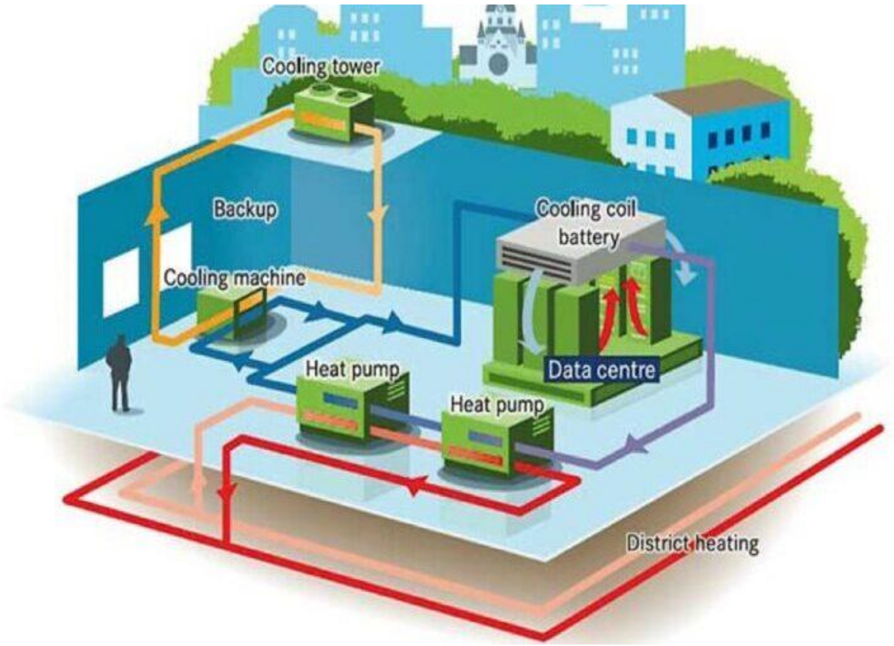
Waste

- ***E-Waste**: 21% increase in 5 years worldwide*
- *In DCs: Components need replacement*
- *99% of common metals and polymers*
- *1% of critical raw materials*



Waste heat

- *Not all waste is bad*
- *Energy intensity of DCs originates waste heat*
- *Can be used in heating the offices part of DC*
- *Can be injected in the district heating grid.*
- *e.g. Stockholm aims to have 10% of heat from DCs by 2035*



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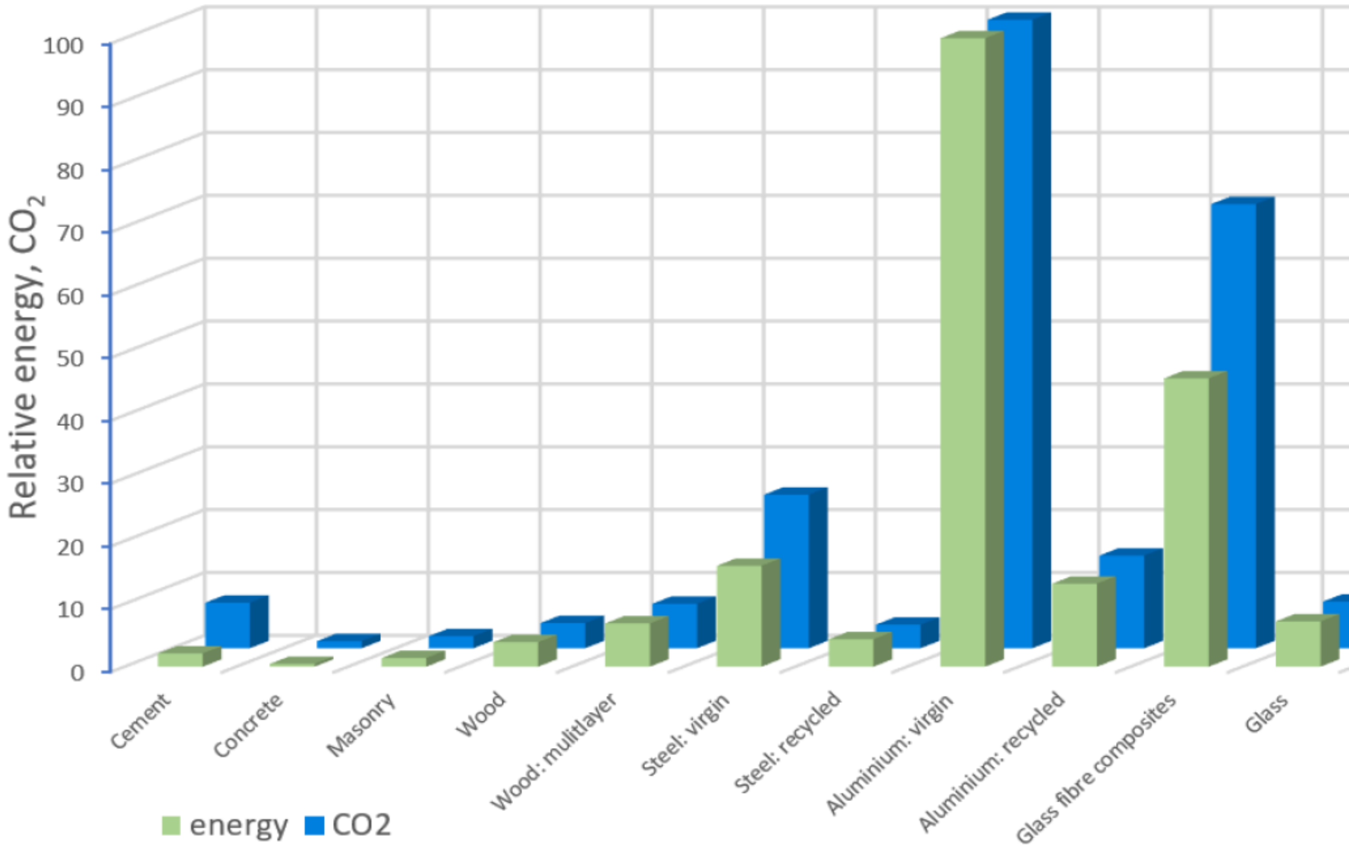
Embeded carbon of DCs

Cement, Steel, Aluminium are heavily energy intensive and carbon intensive

Carbon needs to be considered in the first stages of development



Source: (Mytton, 2021)

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Socio-Economic impacts of DCs

- *Big ICT companies have been trying to accomodate local concerns of the installation of facilities*
- *DCs may have only short-term influence in the communities (construction phase)*
- *Communities usually benefits of the installation of DCs in the long term*
- *Broader supply chain also benefits with the construction and operation and maintenance stages*
- *Little information on smaller DCs*

Measuring DC Sustainability

Acronym	Full Name	Unit	Objective	Optimal	Category
-	CO_2 Savings	Ratio	Maximize	1.0	Facility
CUE	Carbon Usage Effectiveness	$KgCO_2$/kWh	Minimize	0.0	Facility
EDE	Electronics Disposal Efficiency	Percentage	Maximize	1.0	Facility
ERE	Energy Reuse Effectiveness	Percentage	Minimize	0.0	Facility
ERF	Energy Reuse Factor	Percentage	Maxi		
GEC	Green Energy Coefficient	Percentage	Maxi		
GUF	Grid Utilization Factor	Percentage	Minimize	0.0	Facility
MRR	Material Recycling Ratio	Percentage	Maximize	1.0	Facility
Omega	Water Usage Energy / ω	Ratio	Minimize	0.0	Facility
TCE	Technology Carbon Effi	nds of CO_2/kWh	Minimize		
TGI	The Green Index	Ratio	N/A		
WUE	Water Usage Effecti	ters/kWh	Minimize		

Acronym	Full Name				
APC	Adaptability Power Curve				
CADE	Corporate Average Data Center Eff				
CPE	Compute Power Efficiency				
DCA	DCAdapt				
DCcE	Data Center Compute Efficiency				
DCeP	Data Center Energy Productivity				
DCiE	Data Center Infrastructure Efficien				
DCLD	Data Center Lighting Density				
DCPD	Data Center Power Density				
DCPE	Data Center Performance Efficiency				
DC-FVER	Data Center Fixed to Variable Ener				
DH-UE	Deployed Hardware Utilization Eff				
DH-UR	Deployed Hardware Utilization Ra				
DPPE	Data Center Performance Per Energy	Ratio	Maximi		ility
DWPE	Data center Workload Power Efficiency	Perf / Watt	Maximi		rver
EES	Energy ExpenseS	Ratio	Maximize		Facility
EWR	Energy Wasted Ratio	Ratio	Minimize	0.0	Facility
GEC	Green Energy Coefficient	Percentage	Maximize	1.0	Facility
H-POM	IT Hardware Power Overhead Multiplier	Ratio	Minimize	1.0	IT Equipment
ITEE	IT Equipment Energy			∞	IT Equipment
ITEU	IT Equipment Utilization			1.0	IT Equipment
OSWE	Operating System Workload Efficiency			∞	Facility
PDE	Power Density Efficiency			1.0	Rack
PEsavings	Primary Energy Savings			1.0	Facility
PUE_{1-4}	Power Usage Effectiveness Level 1-4			1.0	Facility
$PUE_{scalability}$	Power Usage Effectiveness Scalability			1.0	Facility
pPUE	Partial Power Usage Effectiveness			1.0	Facility
PpW	Performance per Watt			∞	Server
ScE	Server Compute Efficiency	Percentage	Maximize	1.0	Server
SI-POM	Site Infrastructure Power Overhead Multiplier	Ratio	Minimize	1.0	Facility
SPUE	Server Power Usage Efficiency	Ratio	Minimize	1.0	Facility
SWaP	Space, Watts and Performance	Ratio	Maximize	∞	Rack
TUE	Total-Power Usage Effectiveness	Ratio	Minimize	1.0	Facility

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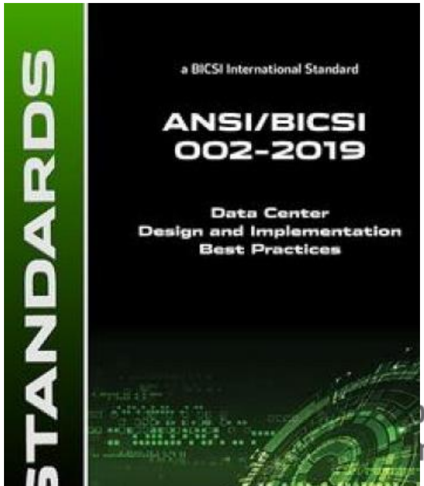
CODE OF CONDUCT



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DCs and the SDGs

DCs and the SDGs – Direct impacts

Highly energy intensive industry = water intensive

Location in less hydro stress areas, free cooling, non-potable water. Use of Water Usage Effectiveness indicator by professionals

Use of renewables onsite (PV) and PPAs

Edge DCs being smaller and nearer cities can increase the potential of the IoT making cities more sustainable and resilient

DCs and the SDGs – Direct impacts

Full lifecycle has to be considered. Embebed carbon from the early stages.

DCs actually help science in acting on the data collected by sensors and processed by DCs

Rejected water from cooling hyperscale DCs can influence biodiversity. High consumption can impact in the amount of water available.

Ideally DCs should be installed in brownfield. If not, prior EIA should be had in consideration to minimize the impact of the installation of DCs in nearby habitats or fighting desertification

Conclusion

DC industry does not excuse itself from its responsibilities in the different sustainability dimensions. Contributes to society and minimizes its impact.

Every year the efficiency values are being improved (PUE)

SDGs and other sustainability targets can only be achieved by daily concerted action on the whole stages of DCs life.

DCs have an importante role in the energy transition through RES production.

Thank you!

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