



COPENHAGEN CENTRE  
ON ENERGY EFFICIENCY  
SEforALL EE HUB



ITU-T Side Event-  
Towards a sustainable digital transformation and a net-zero emission with emerging technology

# Digital Infrastructure Development for Sustainable Digital Transformation

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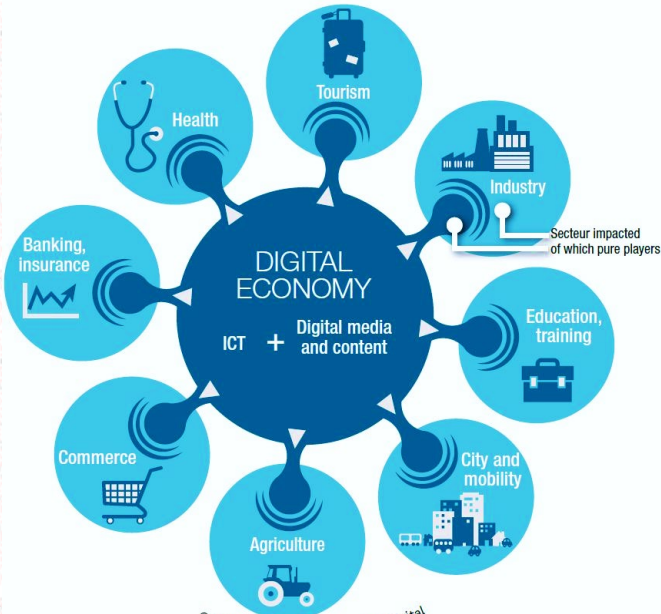
UNEP DTU Partnership, Copenhagen Centre on Energy Efficiency

Emerging Technology for Connectivity: Accelerating Digital Transformation in LDCs, LLDCs and SIDS  
8th July 2021

## Content

- Digital Economy and challenges**
- Introduction to digital infrastructure and digital ecosystem**
- Introduction to data centre**
- Energy and environmental impacts of data centres**
- Environmental efficiency solutions**

Digital technology spreads through the entire economy



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## RECENT TRENDS IN THE DIGITAL ECONOMY



The evolving digital economy is closely associated with several frontier technologies and fuelled by data

- Blockchain
- Data analytics
- Artificial intelligence
- 3D printing
- Internet of Things
- Automation & Robotics
- Cloud computing

Global Internet Protocol traffic, a proxy for data flows, has grown dramatically, but the world is only in the early days of the data-driven economy



## Still huge digital divides



Half of the world remains offline

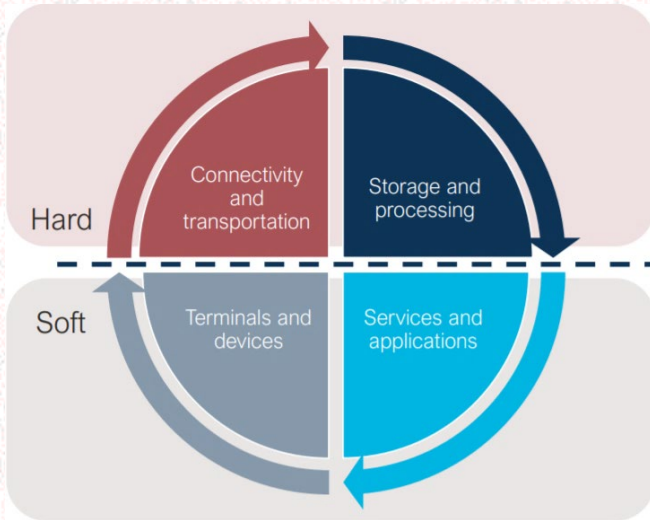


In LDCs only 1 in 5 people are online



Gender gap is the widest in the poorest economies





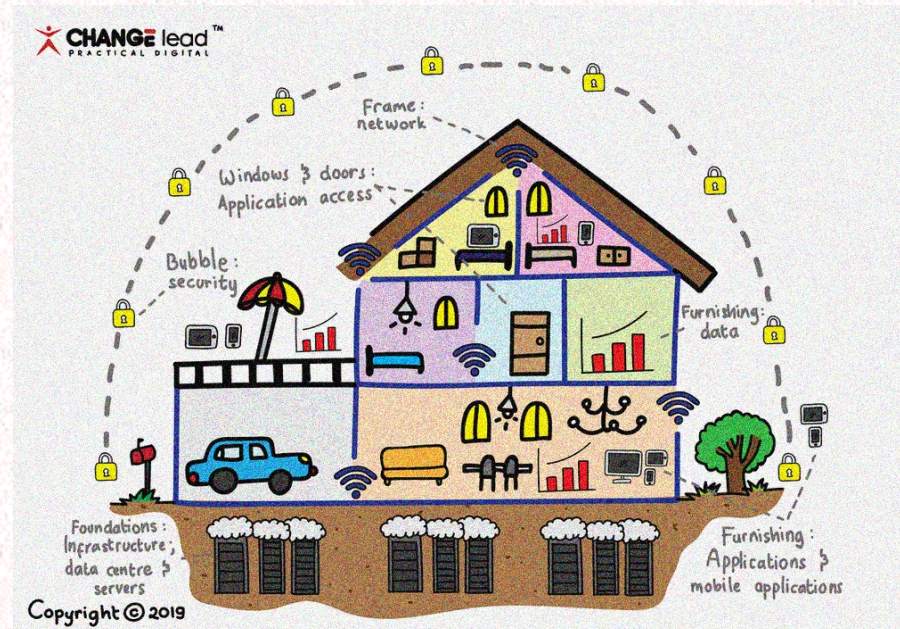
Digital Infrastructure is an integrated system including 2 categories:

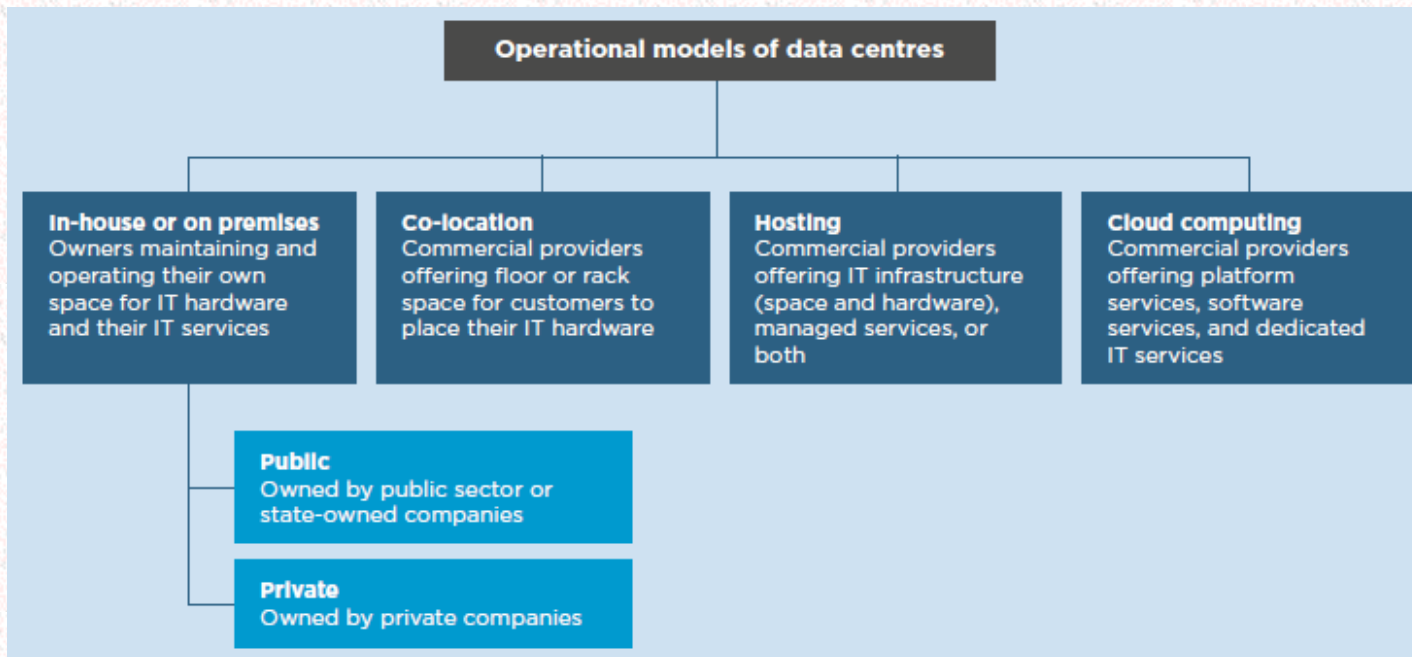
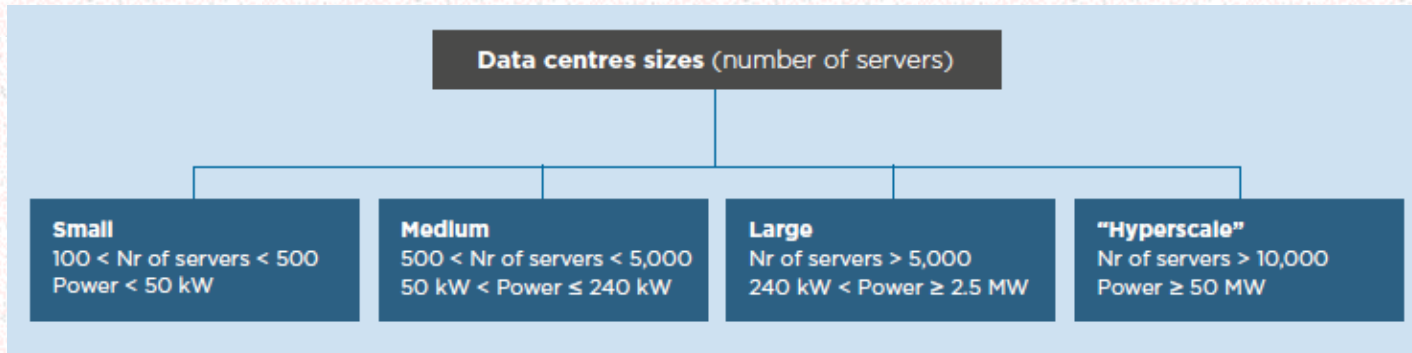
(hard) physical and (soft) non-physical

It is the foundation of the digital economy.

Digital Infrastructure is no longer limited to hard physical assets, structures, and facilities. It extends to the architecture that connects it and to the technological applications to operate it.

We need connectivity infrastructure and datacenter infrastructure to support locally-deployed digital services and the growth of a local digital ecosystem.





A data centre is a dedicated building, which houses the technology for data processing, data storage and data communication of one or more organizations.



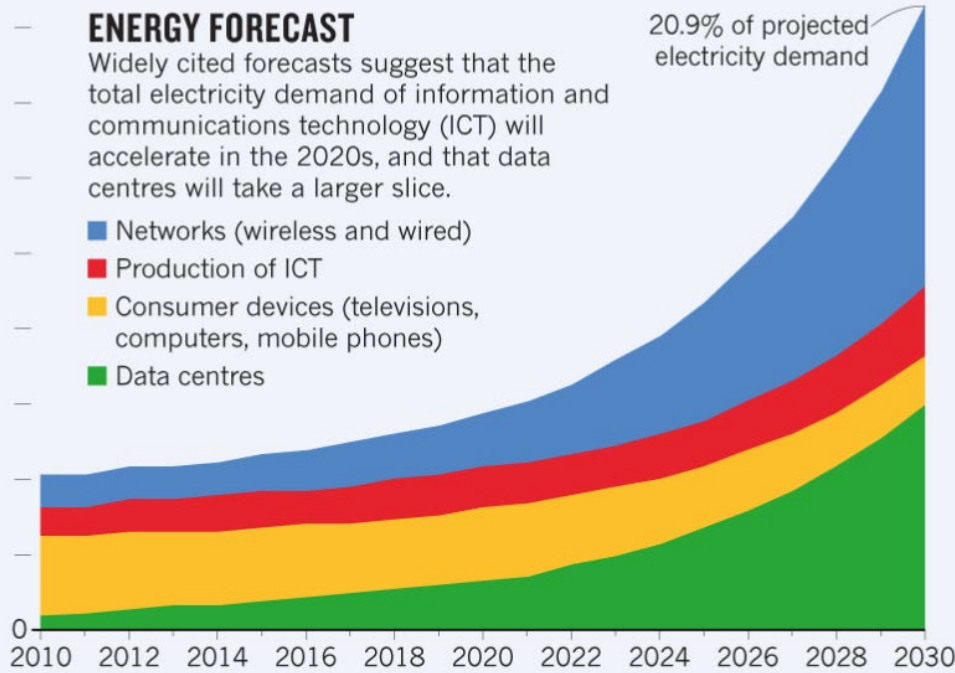
9,000 terawatt hours (TWh)

### ENERGY FORECAST

Widely cited forecasts suggest that the total electricity demand of information and communications technology (ICT) will accelerate in the 2020s, and that data centres will take a larger slice.

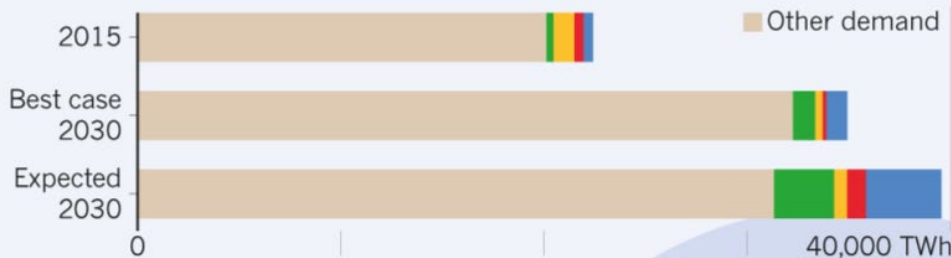
- Networks (wireless and wired)
- Production of ICT
- Consumer devices (televisions, computers, mobile phones)
- Data centres

20.9% of projected electricity demand



The chart above is an 'expected case' projection from Anders Andrae, a specialist in sustainable ICT. In his 'best case' scenario, ICT grows to only 8% of total electricity demand by 2030, rather than to 21%.

### Global electricity demand



### ENERGY SCALE

Global electricity demand

**20,000** TWh

Electricity use by ICT

**2,000** TWh

Data-centre electricity demand

**200** TWh

Bitcoin use by mid-2018

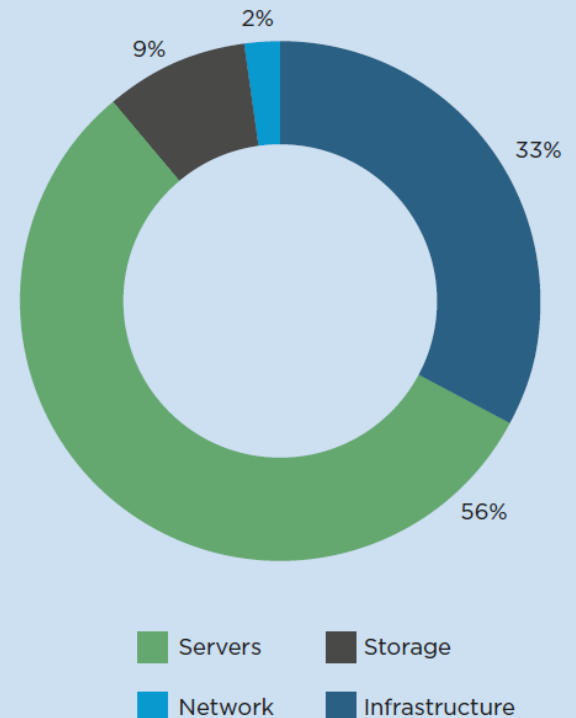
**20** TWh

©nature

Figures are approximate.

Sources: IEA/A. Andrae/Ref. 6

**Figure 3. Share of energy demand by different components in data centres globally (2020). Elaborated with data from International Energy Agency<sup>vi</sup>**



### Environmental Impact Analysis (EIA)

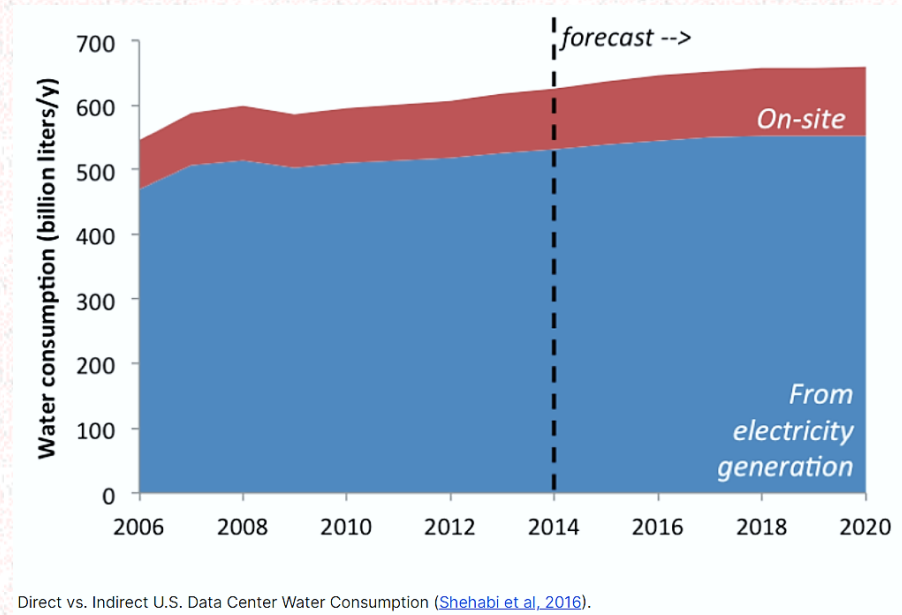


Source: rlb.com

An estimated 20 to 50 million metric tonnes of E-Waste is disposed globally every year depositing heavy metals and other hazardous waste into our landfills.

If measures are not taken, E-Waste is expected to grow 8% each year.

Water use in electricity was x4 greater than that used on-site for cooling: 7.6 litres of water is used for every 1 kWh of electricity generated compared to 1.8 litres per kWh of total data centre site energy use.



Direct vs. Indirect U.S. Data Center Water Consumption (Shehabi et al., 2016).



# THE GREEN DEAL NEEDS GREEN INFRASTRUCTURE



WE REUSE AND REPAIR SERVERS



WE PROVE ENERGY EFFICIENCY  
WITH MEASURABLE TARGETS



2020

Signing of the  
Climate Neutral  
Datacenter Pact.

2025

First milestones  
of the pact.



2030

Climate Neutral  
datacenters.



WE PURCHASE 100% CARBON-FREE ENERGY

Cloud computing is the technological force for change behind the European Green Deal & Digital Strategy. Cloud infrastructure providers & data center operators created a self-regulatory initiative for data centers to be climate neutral by 2030.



WE PRIORITISE WATER CONSERVATION



# Thank you!

<https://c2e2.unepdtu.org/sustainable-datacentres-and-ict/>

**DATA CENTRE BRIEF SERIES FEBRUARY 2020**

**BRIEF 1 Environmental sustainability of data centres: A need for a multi-impact and life cycle approach**

**KEY MESSAGES**

- The concerns over energy use of data centres and associated impacts on climate change have attracted efforts to reduce data centres' energy demand during operations.
- The focus on reducing climate change related impacts arising from data centres' operations can overlook relevant environmental impacts from other life cycle stages, including raw material extraction, equipment manufacturing, data centre construction, end-of-life of equipment and data centre buildings.
- To support the design of truly sustainable data centres, more comprehensive environmental sustainability assessments, encompassing the entire life cycle and focusing on a broad spectrum of environmental problems, are needed.
- This brief uses examples to showcase the substantial environmental impacts of data centres stemming from other life cycle stages than their operations and calls for the use of Life Cycle Assessment (LCA) to assess and address such impacts.

**DATA CENTRE BRIEF SERIES JULY 2020**

**BRIEF 2 Data Centres: Digitalisation Powerhouse and Energy Efficiency Potential**

**KEY MESSAGES**

- The digitalisation of the economy worldwide and technological innovations such as artificial intelligence (AI), Internet-of-things (IoT) and blockchain are driving exponential growth in the demand for data centres' services.
- Data centres use approximately 200 TWh of electricity annually, corresponding to roughly 1% of global electricity demand.
- To match the rapid growth in the energy use of data centres, it is key that the future demand for data centres' services will be met by energy efficient data centres and that their uptake of renewable energy is accelerated.
- Policy makers should establish robust mechanisms to collect data and publish statistics on the energy use of data centres, similarly to what has been done for other energy intensive sectors.

**DATA CENTRE BRIEF SERIES SEPTEMBER 2020**

**BRIEF 3 Reducing the energy use of video gaming: energy efficiency and gamification**

**KEY MESSAGES**

- Video gaming is an increasingly popular leisure activity worldwide, but it has environmental impacts due to the energy used during climate change and resource losses over the entire life-cycle of the gaming devices.
- Among electric equipment in households, gaming devices are gradually becoming more relevant in terms of their overall energy use.
- Playing video games on newer generation game consoles uses significantly less energy than playing on computers, when the unit energy consumption of the equipment is considered.
- Playing video games in the cloud, known as cloud gaming, can draw as much as a three-fold increase in energy use compared to local gaming.
- The energy used in gaming should be integrated into end-use energy demand forecasts and routinely updated with demographic, data and technology preferences, which can change quickly.
- Improved consumer information and the quantification of energy information are recommended strategies that can have a direct effect on behavior change.

**DATA CENTRE BRIEF SERIES JANUARY 2021**

**BRIEF 4 Innovative Data-Centre Cooling Technologies in China - Liquid Cooling Solution**

**KEY MESSAGES**

- The increased need to dissipate heat caused by the increased power consumption of IT equipment in data centres calls for energy-efficient cooling solutions. Liquid cooling, with its efficient heat dissipation and high energy-saving characteristics, is becoming greatly preferred in China and is now being widely used in successful business cases already on the market.
- Liquid cooling will face many challenges in the development process. There is an urgent need to promote the development of technology and industry by strengthening industry guidance, standardizing the evaluation system, and improving the industrial ecosystem, among other measures.
- This brief showcases the Alibaba and Tencent data centres' advanced liquid-cooling systems. Of the top leading Chinese internet companies, Alibaba has achieved large-scale deployment of liquid cooling technology.

**Digital Climate Emergency Series**

**Zero Carbon Emissions in Digitalization**

03 March 2020

DANISH DATA CENTER INDUSTRY

**Digital Climate Emergency Series**

**Beyond Energy Efficiency - Life Cycle Based Data Centre Sustainability**

02 July 2020

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