Digital Connectivity Webinar Series

European Commission's Directorate-General for International Partnership (DG INTPA) Unit F5

22, 25, 26, and 27 April 2022

Webinar 4: Regulations, Case Study and Greening Digital Connectivity

Today´s Webinar Outline:

Part 1: Regulatory frameworks, supporting elements, and business environment

- Common telecommunications regulatory frameworks
  - Telecommunications, Data, and Intertwined Infrastructure regulations.
- Supporting elements and business environment: energy, telecom data regulations, institutional set up, etc
- Case study: Digital Belt of Ceará, Brazil
  - Public Private Partnerships in Digital Infrastructure
- Quiz: Supporting elements and business environment
- Q&A

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Today´s Webinar Outline:

Part 2: Greening digital connectivity and data infrastructures

- Overview of digital connectivity and data infrastructure, energy use
- Possible areas of interest for greening digital connectivity and ways of reducing energy consumption
- Examples
- Q&A

Learning outcomes:

- understand the most common telecommunications regulatory frameworks, as well as the supporting elements and the business environment of the digital connectivity sector.
- engage in an in-depth case study analysis of a public-private partnership initiative to bridge the connectivity gap in a developing country.
- gain knowledge on implications of mainstreaming digitalisation for the Green Deal in partner countries within the framework of DG INTPA's work.
- application of Copernicus as part of the Delegations' work with institutional partners
- understand strategies to promote environmental monitoring, environmental diplomacy, and co-creation processes through digital technologies.

Regulations, Case Study and Greening Digital Connectivity

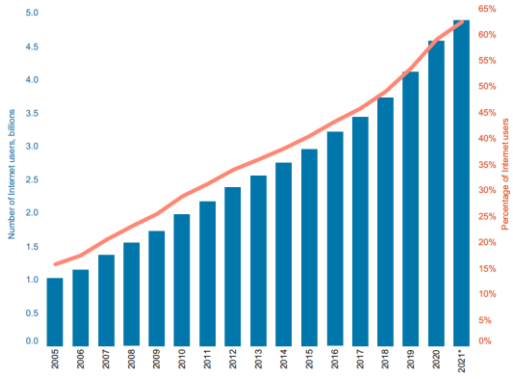
Part 1 - Regulatory frameworks, supporting elements, and business environment

Regulatory telecommunications evolution: overview

- Reforms in the 1990s has fueled the transition from monopoly structures to competitive ones
- New technologies and services have placed the telecommunications in the center of national economies and the growth of international trade in telecommunications services
- Two major setbacks:
  - Dot.com bubble burst at the beginning of the 21st century, resulting in a steep drop in stock market value for major operators. The crash in the telecommunications market affected numerous companies
  - Global economic crisis: mobile wireless market nears saturation in most industrialized countries. Since 2010 the global telecommunications landscape has been particularly shaped by the rapid take-up of the Internet and mobile wireless communications across the world

https://openknowledge.worldbank.org/bitstream/handle/10986/13277/74543.pdf?sequence=1

Regulation in a context of technology transformation



Source: ITU, 2021

Highlights

- Digital technologies are changing the ways in which most people live, work, play and interact with each other
- Given the speed of technological innovation, it is not surprising that ICT regulation has had to evolve rapidly
  - The new framework continues the shift to less sector-specific and more ex-post regulation linked to broader policy objectives concerning inclusiveness, innovation, job creation, growth, energy and environmental issues

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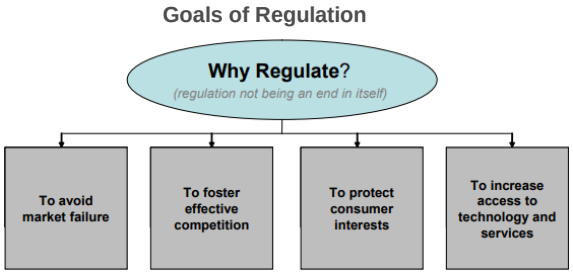
Evolution of regulatory reforms



Source: ITU, 2021

Regulatory reforms must include measures aimed at:

(I) creating functional regulators to oversee the introduction of competition

(II) allocating and managing scarce resources in a non-discriminatory way;

(IV) expanding and enhancing access to telecommunications and ICT networks and services;

(v) promoting and protecting consumer interests, including universal access and privacy.

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Ex-ante and Ex-post Regulation

***Ex Ante* Regulation**

- Prevent socially undesirable actions or outcomes in markets, or Direct market activity towards socially desirable ends
- Concerned with market structure, *i.e.* the number of firms and level of market concentration, entry conditions, and the degree of product differentiation

***Ex Post* Regulation**

- Addresses anti-competitive behavior or market abuse
- Redress proven misconduct through a range of enforcement options including fines, injunctions, or bans
- Concerned with market conduct — the behavior of a firm with respect to both its competitors and its customers

Source: ITU, 2021

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Digital technologies challenge the way governments regulate

Forward-looking regulatory scenarios

I. **regulation acts as a facilitator:**
   - enables innovation and enhances competition in markets.

II. **regulation acts as a deterrent:**
   - aims to de-risk market participants by limiting both the depth and breadth of the applications of disruptive innovation.

Source: Deloitte, 2019

Challenges

- **the pacing problem:**
  - digital technologies tend to develop faster than the regulation or social structures
- **designing "fit-for-purpose" regulatory frameworks:**
  - new forms of regulatory intervention may be needed to address emerging market failures
- **the regulatory enforcement challenges:**
  - it makes it more difficult to apportion and attribute responsibility for damage or harm caused by the use of technology to end users
- **the institutional and transboundary challenges:**
  - digitalisation pays no regard to national or jurisdictional boundaries

Source: OECD, 2021

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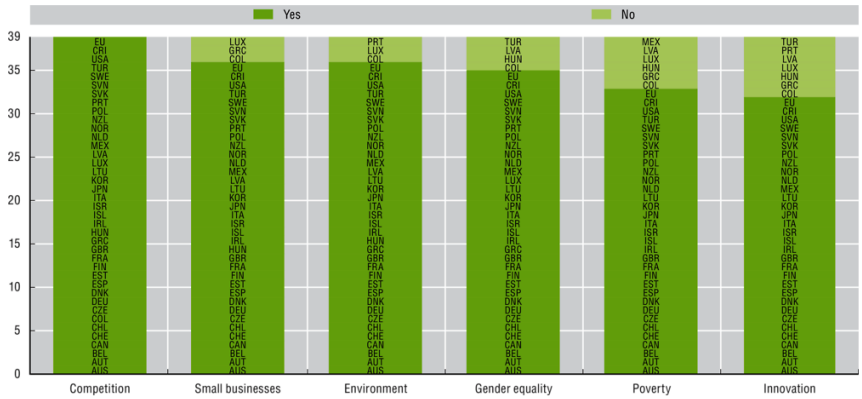
https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/financial-services/deloitte-uk-digital-transformation-meets-regulation-part1.pdf

https://www.oecd.org/gov/regulatory-policy/Regulatory-effectiveness-in-the-era-of-digitalisation.pdf

Types of impacts required to be assessed in RIA



Regulatory Impact Assessment (RIA)

- systematic process used to identify and quantify the costs and benefits likely to flow from a regulatory or non-regulatory option for a policy under consideration.
- identify potential solutions, analyze benefits and costs, and explain how the proposal will be monitored and evaluated

Source: OECD, 2021

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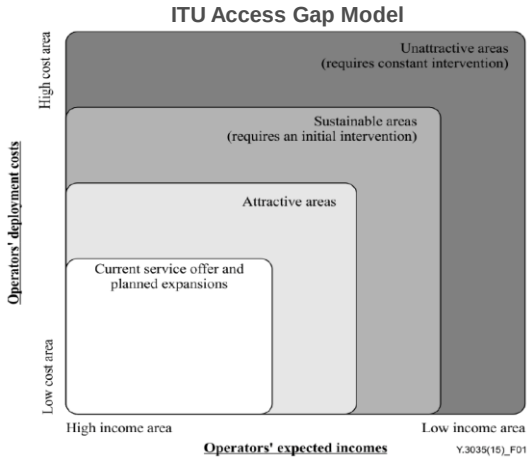
https://stats.oecd.org/Index.aspx?QueryId=85336

https://www.oecd-ilibrary.org/sites/4bff5b26-en/index.html?itemId=/content/component/4bff5b26-en

Quick reminder: Service



The ITU Access Gap consider four layers of service provision:

- **Current served area and planned expansions:**
  - telecommunication services are already provided or are planned to be provided in a short timeframe
- **Attractive area:**
  - telecommunication services are not provided yet despite of its high-income potential
- **Sustainable area:**
  - becomes economically attractive only after an initial incentive by the government in the infrastructure deployment;
- **Unattractive area:**
  - telecommunication services is only viable with continuous regulatory intervention

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Source: ITU, 2013

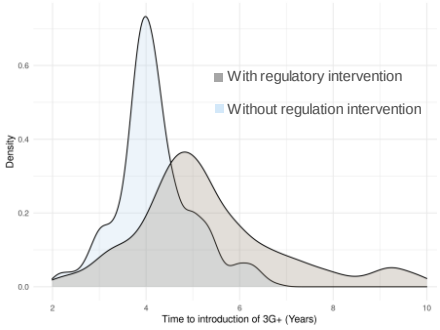
1. **Objectives and rational:** The Gaps Model
2. **References:**

https://www.itu.int/rec/T-REC-Y.3035-201506-I/en

- https://openknowledge.worldbank.org/bitstream/handle/10986/5927/518390PUB0REPL101Official0Use0Only1.pdf;sequence=1
- **3. Notes:**
- The Gap Model is a general analytical framework. This model divides underserved areas into two different segments or “gaps”.
- The market gap refers to the difference between the level of penetration that can be reached under current plans and conditions and the level that the market could achieve by means of an ideal regulatory and legal environment.
- The access gap, on the other hand, represents that portion of the market that even under an ideal legal and regulatory environment would not be covered by operators due to its high cost and/or low income level.
  - Within the access gap, there is a level of penetration that is worth noting - the sustainability frontier. This frontier divides those projects that are expected to recover their operational costs and remain profitable and those that will not be profitable in any circumstances and will need continuous subsidies.

Regulation intervention: empirical evidences

Distribution of the time to introduction of 3G technology or better under alternative regulatory regimes.



Source: Almeida, 2021

Highlights

- the regulation intervention reduces the average time to 3G introduction significantly – by 1.15 years, on average
- the regulation also considerably reduces the dispersion in the time to introduction of 3G
- eliminating a national manufacturer's products leads to increases in wholesale prices between 0.003% and 0.677%;
- retail prices decrease by 0.027%-4.210% due to downstream pricing incentives

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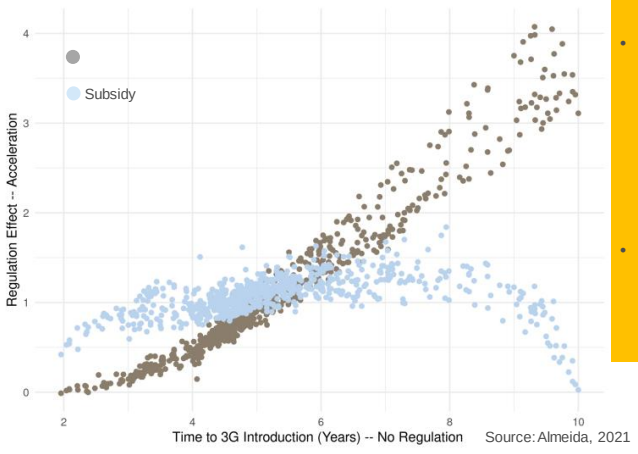
https://repository.upenn.edu/cgi/viewcontent.cgi?article=5968&context=edissertations

Regulation intervention: empirical evidences



Highlights

- relatively competitive municipalities are regulatory neutral
  - The introduction of 3G in these municipalities in the absence of regulation is relatively fast (under 3.5 years, on average, compared to just over under 5.5 years in relative lower competitive municipalities)
- a **flat subsidy** increases the acceleration of 3G introduction in some localities where there seems to be little need for regulation, and has smaller effects in some municipalities where regulation seems to be particularly important.

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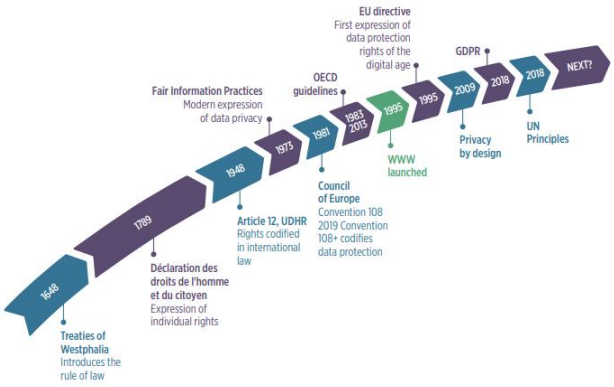
https://repository.upenn.edu/cgi/viewcontent.cgi?article=5968&context=edissertations

The evolution of data regulation



Source: World Bank, 2021

Highlights

- Safeguarding personal data to better address underlying concerns about the power asymmetries between individual and data processors and collectors

Types of Rights

- **Substantive rights:**
  - measures preventing the unauthorized disclosure of personal data and the use of personal data for unwarranted surveillance, unfair targeting, exclusion, discrimination, unjust treatment, or persecution.
- **Procedural rights:**
  - necessity, transparency, accountability, proportionality, and due process. They include rights to receive notice about and to object to how data are used and rights of access to correct and erase data

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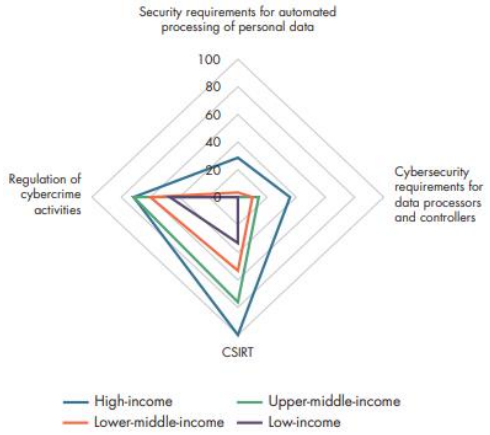
https://openknowledge.worldbank.org/bitstream/handle/10986/35218/9781464816000_Ch06.pdf

Gaps in the regulatory framework across income groups

Gaps in the regulatory framework across country income Groups (example Data/cybersecurity)



Highlights

- A key element in establishing trust in the data ecosystem for both personal and nonpersonal data is ensuring the security of the network infrastructure and elements over which data flow.

"None of the low-income countries included in the survey [80 countries] has legally imposed a full range of security measures on data processors and controllers."

Source: WB, 2021

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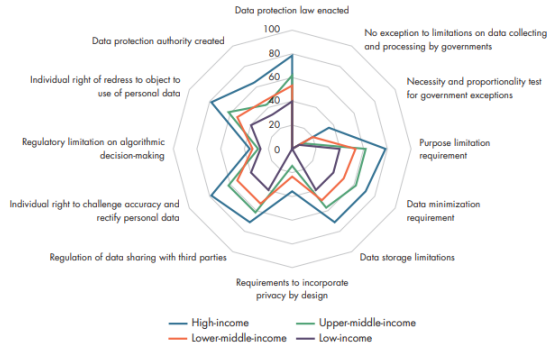
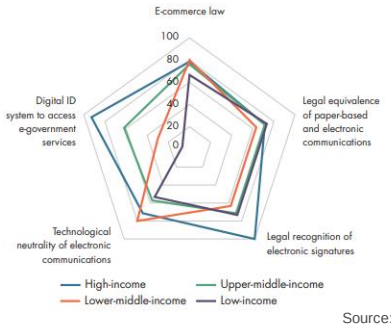
CSIRT: Computer Security Incident Response Team

Regulatory inequality across country income groups

Progress on personal data protection legislation differs markedly across country income groups



Adoption of e-commerce and related legislation is widespread across country income groups



Source: WB, 2021

- The uneven quality of data protection legislation affects in practice the effectiveness of safeguards for personal data
- Need for good-practice regulatory framework for enabling data use and reuse are in place

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https://openknowledge.worldbank.org/bitstream/handle/10986/35218/9781464816000_Ch06.pdf

Supporting elements and business environment

building sustainable and competitive economies: actions to accelerate the twin climate and digital transitions and support the economic recovery

Foreign investment and trade in goods and services

- Designing single window digital solutions for traders interacting with authorities
- Developing internationalization strategies
- Identifying regulatory barriers, enhancing administrative capability to attract foreign direct investment
- Developing an action plan for the introduction of artificial intelligence for investment and trade agencies

Better regulation, Licensing and Inspections

- Reviewing, simplifying and streamlining legislation and regulatory mechanisms
- Supporting the establishment of a regulatory environment for complex and innovative business models
- Providing capacity building to authorities
- Preparing an action plan with a road map of measures.
- Proposing institutional changes and new governance structures

Competition and Consumer Policy

- Improving the system of detecting competition infringements
- Effectively using IT tools in competition investigations
- Evaluating competition and consumer protection decisions and providing recommendations.
- Carrying out impact assessment of
- State aid schemes
- Enhancing functionalities of State aid registries

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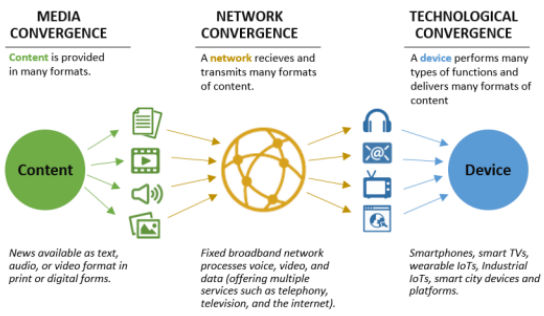
https://ec.europa.eu/info/sites/default/files/ht0120284enn.pdf

Complementary infrastructure sectors and the need for regulatory convergence

Technological, Media, and Network Convergences



Energy and telecom sectors intertwined

- As more consumers use the same infrastructure more frequently, the unit cost for all consumers goes down.
- Regulatory barriers prevent energy companies, especially electricity transmission operators, from commercializing their telecom assets.
- On the other hand, insufficient regulatory stimuli can limit action in this direction.
- Energy sector companies lack familiarity and knowledge of how to deal with the telecom sector and don't have a full appreciation of the commercial and social returns of infrastructure sharing.

Source: WB, 2021

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https://sgp.fas.org/crs/misc/R45746.pdf

https://blogs.worldbank.org/ppps/infrastructure-sharing-energy-and-digital-development-takeaways-cross-sectoral-cooperation

Discussion (10+10 min)

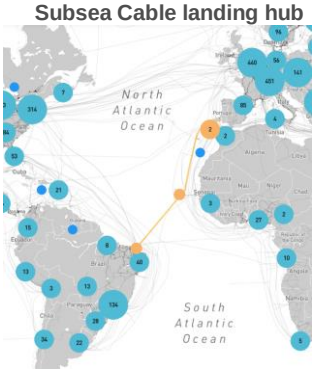
- Connectivity and data regulatory frameworks are set to allow a fair balance between incentives for competition, innovation and investment, as well as for consumer protection and fair use of digital technologies.
- EU has been playing a standard-setting, leading hole in telecommunications and data regulation during the last 30 years.
- The DSA and the DMA are in final debates among EU countries, and they are set to be the next regulatory frontier in the digital ecosystem.
- Question for discussion:

What instruments and programs are available or could be created by EC HQ and delegations to pro-actively influence countries around the world to adopt new regulatory frameworks set by the EC (e.g., the DMA and DSA)? Please discuss past experiences and ideas of new programs that could be created.

Case Study: Ceará Digital Belt (CDB), Brazil

From Europe to the deep Brazil in 60 ms

Subsea Cable landing hub



- Ceará is a hub for submarine cables landing in Brazil
- Various submarine cables have been landed in Ceará including the EllaLink

Cinturão Digital do Ceará

- Initiative of the Ceará State/Brazil to provide high-speed and quality Internet access to 82% of the urban population

Fortaleza is an entry Hub for International subsea Fibres

Source: ETICE, 2021

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https://ella.link/2022/03/09/ellalink-and-de-cix-announce-strategic-partnership/

https://ddtoolkits.worldbankgroup.org/broadband-strategies/case-studies/broadband-brazil

https://cetic.br/media/docs/publicacoes/2/20201123121817/tic_dom_2019_livro_eletronico.pdf

https://www.etice.ce.gov.br/2021/04/23/cinturao-digital-do-ceara-historia-e-promocao-da-transformacao-digital/

Fact sheet about the Ceará Digital Belt

Facts

- Begin on 17, December 2008
- 8,060 km in length
  - Public company (4,150 km),
  - Private partners 3,910 km
- It covers 105 municipalities in Ceará
- Economic impact R$1.5 billion
- Connects around 90% of the Ceará State´s countryside municipalities
- Provides free access to public institutions
- Provides high-speed and quality Internet access to 82% of the urban population of these municipalities

Source: ETICE, 2021; WB, 2015; Freitas et al., 2021

Business Model

1st - public agencies and the State Court of Justice in the Capital and metropolitan region were interconnected

2nd - fiber optic launched in the State countryside

3rd - connect city halls in the State countryside municipalities

4th - Concession for service providers in exchange of:

- Network maintenance
- Price cap for Broadband services

Investment

- CAPEX
  - State Budget: 54%
  - Federal Budget: 31%
  - World Bank: 15%

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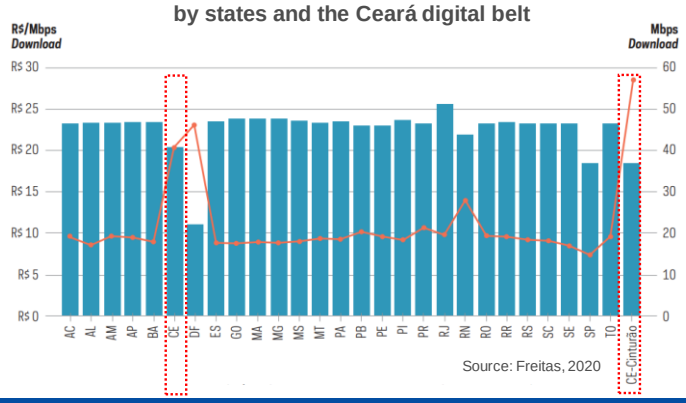
Local Impact

Speed and average price of broadband services in Brazil, by states and the Ceará digital belt



Source: Freitas, 2020

- CE- Cinturão stands for those municipalities where the digital belt pass through
- CE stands for the entire Ceará State

Highlights

- increase in the average download capacity
- reduction in consumer price for Internet services
  - second lowest average price/Mbps in Brazil
- enabled the connection of 1.5 million users
- increased the installed capacity of data transmission by 50%
- Induced connectivity in neighboring areas
- Around 80% of government agencies operate through the Ceará Digital Belt

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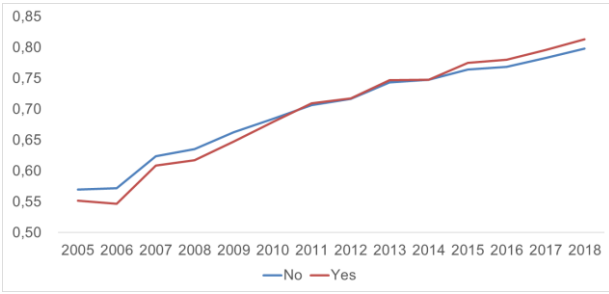
https://cetic.br/media/docs/publicacoes/2/20201123121817/tic_dom_2019_livro_eletronico.pdf

Further Socioeconomic and connectivity references

Human Development Index (HDI) for municipalities with and without the CDB



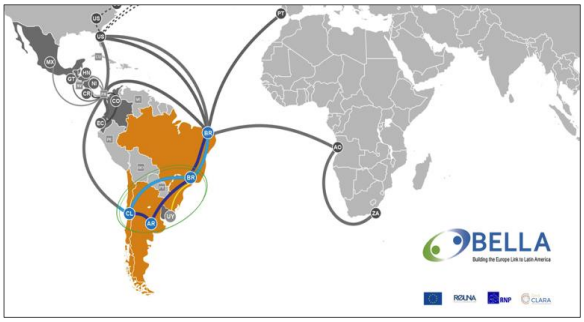
Source: IBGE, 2019

Highlights

- **Estimated economic impact**
  - US$ 320 millions (2020)
- **Fixed Broadband Density (access / 100 people):**
  - Brazil: 7,97
  - CDB municipalities: 9,83
- **Average YoY HDI growth (2005-2018):**
  - Brazil: 2,7%
  - CDB municipalities: 3,1%

Case Study: BELLA-T (terrestrial)

Evolution of the BELLA Program to Connect EU and LATAM



Source: IBGE, 2019

Highlights

- Terrestrial optical fibre network infrastructure in LATAM for research and education
- Synergies with NRENs in LATAM will enhance capillarity and equal access to intercontinental services for all research and education end users in Latin American.

With 6,070 km of infrastructure, and capacity of up to 600 Gbps, the stretch between Porto Alegre (BR), Buenos Aires (AR) and Santiago (CL) will bring numerous benefits to astronomical research in Brazil and to the Copernicus Program in Chile.

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NRENs – National Research and Education Networks

Source:
https://www.rnp.br/en/news/inauguration-bella-t-milestone-scientific-cooperation-between-european-union-and-latin-america

Discussion

- The BELLA Program has focused on increase transcontinental data transmission capacity between EU and LATAM.
- The Ceará Digital Belt is a great example of how public incentives to middle-mile networks can enable huge positive socioeconomic effects.
- The COVID-19 pandemic has inaugurated a new era for digital connectivity, as it finds now much more agenda among policymakers, international institutions, and development banks.
- Question for discussion:

In your view, or what should be the role of the European Commission in fostering development of digital connectivity throughout the world in the next decade? Please discuss main goals a high-level path to achieve them.

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Part 1 - Quiz

Regulations, Case Study and Greening Digital Connectivity

Part 2 - Greening digital connectivity and data infrastructures

Content of part II

1. Intro ‘The twin transition’
2. Overview of digital connectivity and data infrastructure, specifically data centres;
3. Energy use by a data centre
4. Possible areas of interest for greening digital connectivity and ways of reducing energy consumption by a datacentre
5. Examples on how to green a datacentre
6. Q&A, Discussion

1. The '*twin transition*' of '*sustainability and digitalisation*'

- The Corona pandemic has demonstrated the importance of the ICT sector.
- The **Fourth Industrial Revolution**, 4IR, or Industry 4.0 is described on Wikipedia,

> *"it conceptualizes rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and smart automation (Wikipedia)".*

The time is said to be right for the ICT sector, to take the lead and green as a sector.

1. Intro: Some criticism

In the Netherlands comedian Arjan Lubach made a video on green datacentres. Lubach describes these mainly benefit the larger foreign companies, such as Google and Microsoft, that use the datacentres and the Netherlands as a 'hard disk for Africa and the Middle East'. While Dutch citizens are paying for the installation of the datacentres and get large windmills in their backyards, they do not benefit from the generated energy supply by the large wind parks. Public opinion is now shifting and becoming more critical towards the opening of new green datacentres in villages and cities that solely benefit foreign partners and businesses.

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Source: https://youtu.be/OiPoR9OvD0Y

2. Overview: How does a datacentre work?

- A data centre data centre is a building, a dedicated space within a building, or a group of building is **used to house computer systems and associated components,** such as telecommunications and storage systems.
- **Since IT operations are crucial for business continuity**, it generally includes redundant or **backup components and infrastructure for power supply**, data communication connections, environmental controls (e.g., air conditioning, fire suppression), and various security devices. A large data centre is an industrial-scale operation using as much electricity as a small town.

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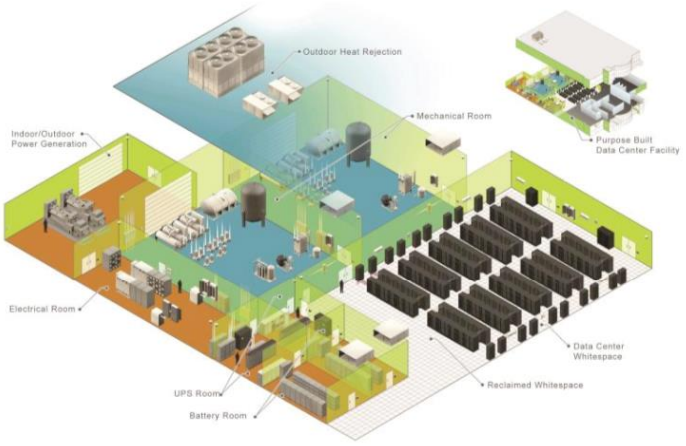
Source: Wikipedia, https://en.wikipedia.org/wiki/Data_center

2. Overview: Typical datacentre layout



- A data centre data is a building, to house computer systems and associated components, such as telecommunications, servers and data storage systems.

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Source: Nicholas Dodd, Felice Alfieri, Miguel Gama Caldas (JRC) Larisa Maya-Drysdale, Jan Viegand (Viegand Maagøe), Sophia Flucker, Robert Tozer, Beth Whitehead (Operational Intelligence), Anson Wu (Hansheng) Fiona Brocklehurst (Ballarat Consulting) (2022). Development of the EU Green Public Procurement (GPP) Criteria for Data Centres, Server Rooms and Cloud Services https://ec.europa.eu/environment/gpp/pdf/jrc118558_2020_0605_data_centres_technical_report_jrc_clean_with_id.pdf

2. Overview: How to measure effectiveness

- **Power usage effectiveness (PUE)** is a ratio that describes how efficiently a computer data centre uses energy; specifically, how much energy is used by the computing equipment (in contrast to cooling and other overhead that supports the equipment).
- PUE was originally developed by a consortium called The Green Grid. PUE was published in 2016 as a **global standard** under ISO.
- An ideal PUE is 1.0. Anything that isn't considered a computing device in a data centre (i.e. lighting, cooling, etc.) falls into the category of facility energy consumption.

$$\mathrm{PUE} = \frac{\text{Total Facility Energy}}{\text{IT Equipment Energy}}$$

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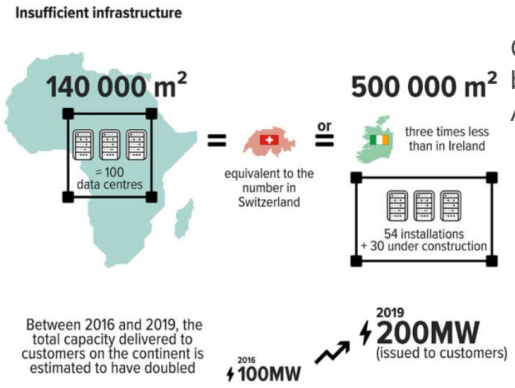
Source: Wikipedia

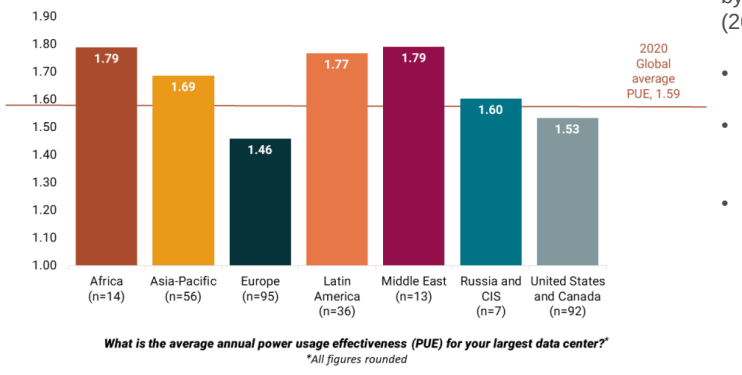
2. Overview: Datacentres in Africa



China business Huawei has plans to build on existing relationships with Africa and aims to expand datacentres:

https://www.theafricareport.com/148875/africa-why-data-centres-are-crucial-for-the-continents-sovereignty/

2. Overview of datacentre efficiency per region



According to this survey by the Uptime Institute (2020):

- Europe has the lowest PUE.
- Africa, and the Middle east have the highest PUE
- Followed by Latin America and the Asia Pacific region.

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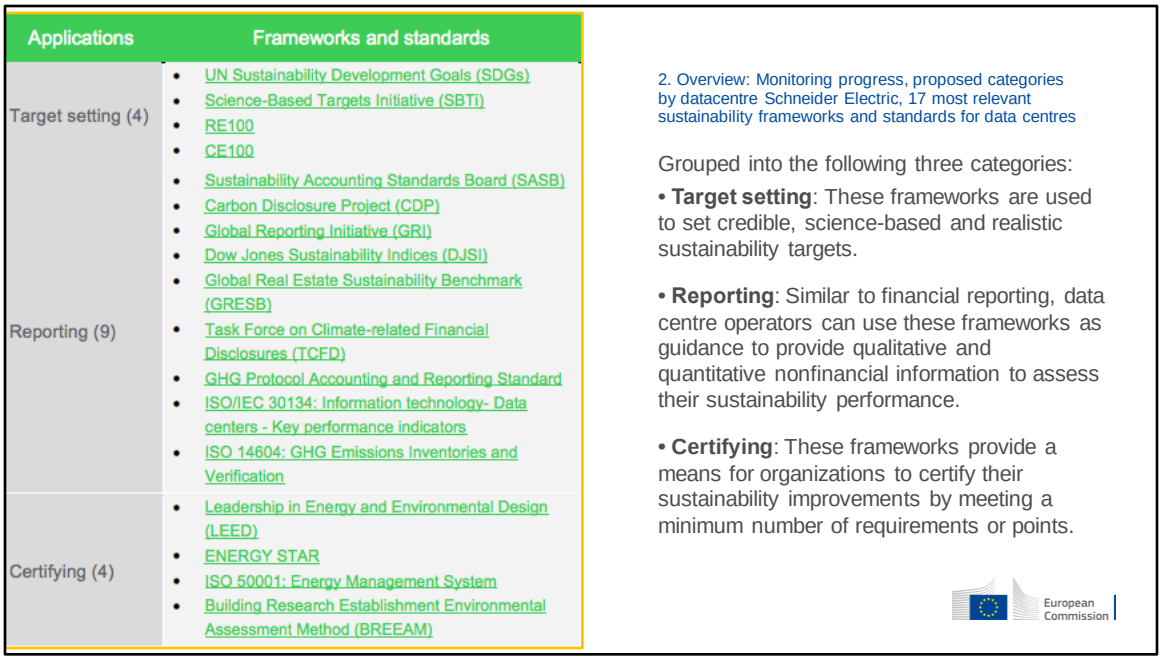
Source: Uptime Institute Global Survey of IT and Data Center Managers 2020 no. 313
https://uptimeinstitute.com/2020-data-center-industry-survey-results
Cited in: https://journal.uptimeinstitute.com/datacenter-energy-efficiency-by-region/



Notes: Standardizing these metrics will help with adoption, improve benchmarking, and progress sustainability within the industry. We propose five categories, which include 23 key metrics for data centre operators who are in the Beginning, Advanced and Leading stages of their sustainability journey. We also identify the 17 most relevant sustainability frame- works and standards to guide data centre operators in target setting, reporting, and certifying.

Source: Schneider Electric, Lin, P. Bunger, R. Guide to Environmental Sustainability Metrics for Data Centers
https://download.schneider-electric.com/files?p_enDocType=White+Paper&p_Doc_Ref=WP67_SPD_EN

3. Power usage, energy use in a datacentre

Data centres use approximately 1 % of global electricity use (IEA) for:

- Storing data; Backups components and infrastructure for power supply,
- data communication connections,
- environmental controls,
- cooling (water or air (conditioning)),
- fire suppression,
- various security devices.

A large data centre is an industrial-scale operation using as much electricity as a small town.

3. Energy use by data centres, internet traffic

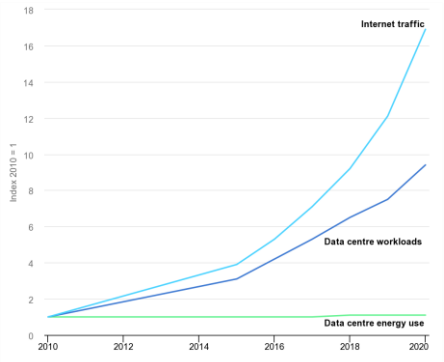
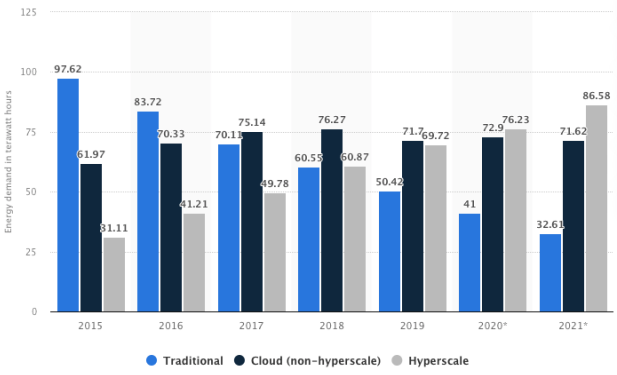


Chart by International Energy Agency, shows an exponential growth in Internet traffic. And it also shows that data centres workload increased, while energy use remained constant in the past ten years, at a similar level as in 2010.

European Commission

Source: https://www.iea.org/reports/data-centres-and-data-transmission-networks

3. Energy use traditional, cloud, hyperscale data centres



- Traditional data centres globally have decreased their energy demand, from around 97.6 terawatt hours in 2015, to some 50 terawatt hours in 2019, and a forecast indicated that this figure will reach nearly 33 terawatt hours by 2021.

On the other hand, **hyperscale data centres have doubled their energy demand** in the same period of time (Statista.com).

European Commission

Source: Statista.com. https://www.statista.com/statistics/186992/global-derived-electricity-consumption-in-data-centers-and-telecoms/

3. Green power usage of a datacentre

ICT companies purchasers of renewable energy

- **Hyperscale data centre** operators in particular **lead in corporate renewable energy** procurement, mainly through **power purchase agreements (PPAs)**.
- Google (12 TWh in 2019), Apple (1.7 TWh in FY2020) and Facebook (7 TWh in 2020) purchased or **generated enough renewable electricity to match 100% of their operational electricity consumption**.

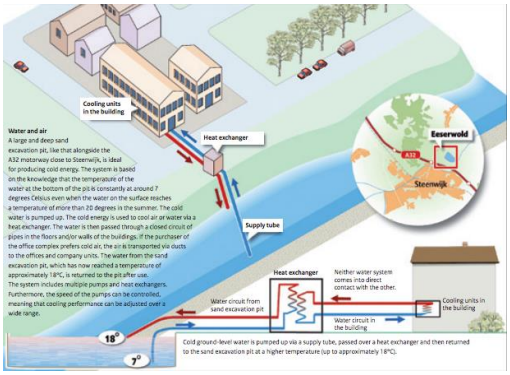
Efficiency improvements limited energy demand

- Strong growth in demand for data centre services continues to be mostly offset by **ongoing efficiency improvements for servers**, **storage devices, network switches and data centre infrastructure**, as well as the high and growing share of services met by highly efficient cloud and hyperscale data centres.

European Commission

Source: https://www.iea.org/reports/data-centres-and-data-transmission-networks

4. Ways used to reduce energy consumption – Lake Source Cooling



Example Eesermeer, the Netherlands by NL Agency, Dutch Ministry of Economic Affairs, Agriculture and Innovation.

Lake Source Cooling (LSC) is an interesting concept in this respect. It uses the natural cold energy present in deep lakes, which is automatically replenished by the cold air during the winter.

European Commission

Source: NL Agency, sustainable cooling for data centres: https://www.rvo.nl/sites/default/files/2013/11/Sustainable%20cooling%20data%20centres.pdf

4. Several technologies increase efficiency and decrease energy consumption in data centers.

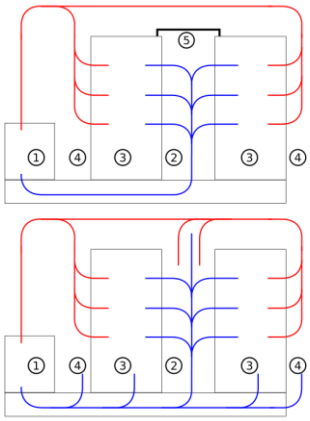
- **Low-power servers** are more energy-efficient than conventional servers in data centres.
- **Modular datacentres**; a modular datacentre is a portable datacentre which can be placed anywhere data capacity is needed.
- **Free air cooling systems** uses outdoor air instead of traditional data-center computer room air conditioner (CRAC) units.

European Commission

Source: Wikipedia, https://en.wikipedia.org/wiki/Green_data_center

4. Several technologies increase efficiency and decrease energy consumption in data centers.

- **Hot and cold aisle containment**. In this method, the rows of racks are aligned with the backs of the servers facing each other; the aisles are enclosed, to capture the air.



European Commission

Source: Wikipedia, https://en.wikipedia.org/wiki/Green_data_center

4. Several technologies increase efficiency and decrease energy consumption in data centers.

- Data centers use electric power, releasing more than 98 percent of this electricity as heat. **Waste heat** can be actively **reused**, and a data center becomes a closed-loop heating system with no waste.
- **Ultrasonic humidification.** Large, white, square building under dark clouds. Ultrasonic humidification **uses ultrasound to create moisture**, using 90 percent less energy than conventional methods such as resistance steam humidifiers.
- **Evaporative cooling**. Evaporative cooling reduces heat by the evaporation of water.

European Commission

Source: Wikipedia, https://en.wikipedia.org/wiki/Green_data_center

5. Example, ways used to reduce energy consumption – Green Mountain, Norway

Green Mountain is Norway's Fjord cooled data center:

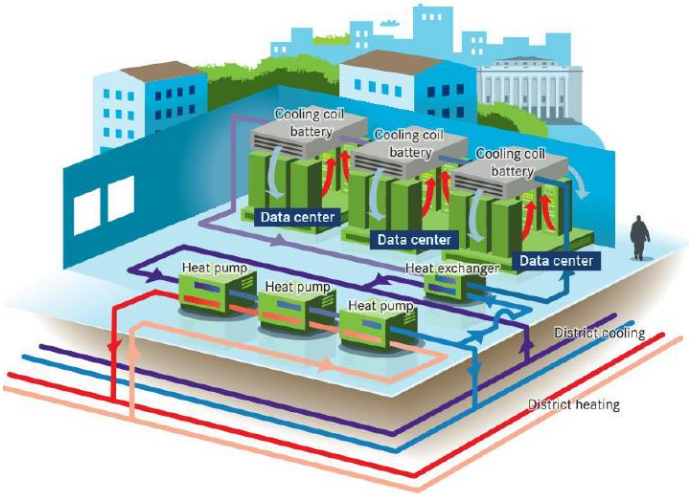
"Green Mountain data centers are some of the world's greenest. Our unique location enables us to use 100% renewable hydropower to operate and cool our award-winning, high efficiency facilities, located deep inside Norwegian mountains".

Off-the grid cooling system

European Commission

Source: https://greenmountain.no/

5. Example. Disctrict heating systems in Europe



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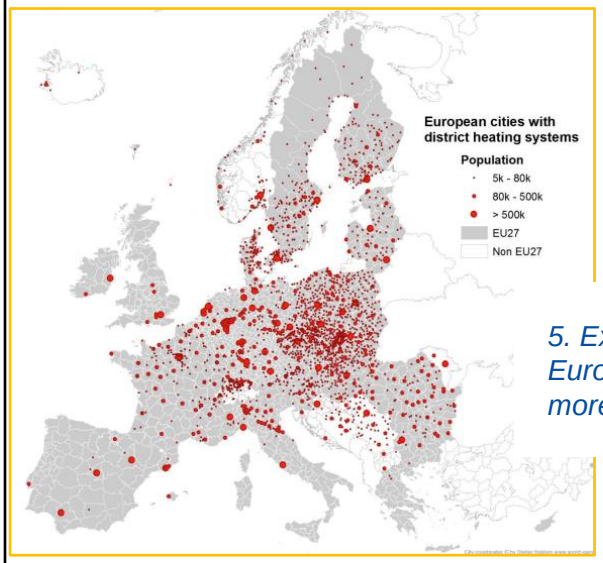
Source: https://celsiuscity.eu/wp-content/uploads/2020/01/122_fig1.png



5. Example District heating systems in Europe by city size and for cities having more than 5000 inhabitants.

Image left: District heating systems in Europe by city size and for cities having more than 5000 inhabitants. The map shows 2428 cities with 2779 systems. Source: Halmstad University DHC Database. Heat Roadmap Europe 1 First Pre-Study for the EU27 Connolly, David; Mathiesen, Brian Vad; Østergaard, Poul Alberg; Möller, Bernd; Nielsen, Steffen; Lund, Henrik; Trier, Daniel; Persson, Urban; Nilsson, Daniel ; Werner, Sven. Cited in: https://ec.europa.eu/environment/gpp/pdf/jrc118558_2020_0605_data_centres_technical_report_jrc_clean_with_id.pdf

Some suggestions made by Dutch experts...
How useful are these for developing countries?

Some tips mentioned in a discussion on Youtube on greening datacentres

- More frequent use of **eco-modus** on servers;
- **Consume less** data;
- **Increased consciousness** on footprint when using data;
- **Greening software**: a user interface that uses less power, e.g. dark modus, more attention for green software in general;
- In the Netherlands the 'Climate Neutral Datacenter Pact' **policy formulated** with target PUE's in line with the Green Deal;
- **Green loans**, you pay less for a loan when achieving PUE results, but you pay more for that same loan when under performing;

Source: https://youtu.be/remoN1jFeZY

Some tips mentioned in a discussion on Youtube on greening datacentres

- **Continued dialogue with sector** and amongst professional and businesses on how to improve the greening of entire supply chains;
- Look at the **wider arena of data infrastructure**, not only at the greening of datacenters;
- Increased use of **hydrogen fuel cells** as a backup system, instead of diesel generators. The backup system might not be used on a continuous basis, but it is tested once a month;
- **Data driven improvements**;
- **Policy makers need to set goals**, such as the Paris Agreement and the Green Deal to make change happen.

Source: https://youtu.be/remoN1jFeZY

Some tips mentioned in a discussion on Youtube on greening datacentres

- A reward might also be thinkable for actions that are hard to quantify, such as ‘Do you turn your server off?’ and ‘What kind of server are you using?’
- **Reuse of materials** in data servers;
- **Rules and regulations** are leading for the larger enterprises to actually change their behaviour to become more sustainable and are guiding;
- Financing research in the **greening of software** and standardisation;
- An **integral approach**, looking at the issue from different points of view;

European Commission

Source: https://youtu.be/remoN1jFeZY

Greening datacenters, warm or cold climate (5+5 minutes)

A cooler climate, such as in Europe, has advantages when it comes to cooling datacenters and thus in achieving a lower PUE.
Discussion: How useful are these suggestions by Dutch experts, when focussing on the differences between greening datacenters in developing countries or European countries?

- Is there a practical example by any of the participants on the greening of a datacenter (possibly in a developing country)? What points of interest can we share with participants?
- What other experiences can we share in relation to sharing areas for imporvement in achieving a lower PUE in developing countries? What are possible opportunities and hickups for EC delegations on the greening of datacenters in developing countries?

Part 2 - Quiz

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