ODYSSEE-MURE

ODYSSEE-MURE fits for 55 (2022-2025)
Second regional meeting,
25-26th September 2024, Rome

Round table on monitoring the use of waste heat, including for EED Art 12

Led by Lea Gynther, Motiva Oy, Finland

Motiva

Presentations and briefings

Waste Heat – Fueling the discussion, Lea Gynther, Motiva Oy

Data Centres in Germany, Wolfgang Eichhammer, Fraunhofer ISI

Waste heat – Ireland, Emily Byrne, SEAI

Collecting data on waste heat in the framework of a regulation on the service sector in France, Lucie Bioret, Ademe

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Waste Heat – Fueling the discussion

Lea Gynther, Motiva Oy, Finland

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Contents

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- MURE and waste heat
- Odyssee and waste heat

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Waste heat in the EED

The EED emphasises the need to monitor and recover waste heat.

Article 12 / Commissions delegated regulation (EU) 2024/1364 covering reporting on waste heat reuse from data centers into the European database.

Article 26(7): ”… Member States shall ensure that an installation level cost-benefit analysis … is carried out where the following installations are newly planned or substantially refurbished:

- (b) an industrial installation with an average annual total energy input exceeding 8 MW…;
- (c) a service facility with an annual average total energy input exceeding 7 MW, … ;
- (d) a data centre with a total rated energy input exceeding 1 MW level…”

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MURE and waste heat

MURE does to contain any specific ’identifiers/attributes’ for policies targeting waste heat, i.e. it is not easy to search for policies and measures.

Multiple policy and measure types can and are being used to promote waste heat utilisation: obligations, urban planning, energy audits, voluntary agreements, subsidies, tax benefits, ESCOs, model contracts etc.

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Odyssee and waste heat

- Significant amount of waste heat is generated in industrial processes and at service (e.g. data centers, malls and supermarkets), and some in agriculture, but only a fraction is recovered.
- When recovered, different use-cases exist:
  - Waste heat generated and re-used on-site reduces the need to procure energy and is, therefore, captured by statistics and well reflected at the Odyssee.
  - Heat sold is extracted from heat procured in statistics, i.e., also well captured.
  - When heat is generated in a process from other energies or from exothermic processes and sold, this is not credited and does not improve the “indicators” for the sector selling it.
- Odyssee-Mure concentrates primarily on the demand side, not supply side. However, waste heat is a system integration matter, in between the supply and demand sides improving system level efficiency.
  - Can this be credited in ODEX or can it be made visible in any other way in the indicators?
  - Are there ideas for data collection?
- Is it possible/meaningful to add the average energy reuse factor (ERF) of data centers in each Member country from the Commission’s new database for data centers?

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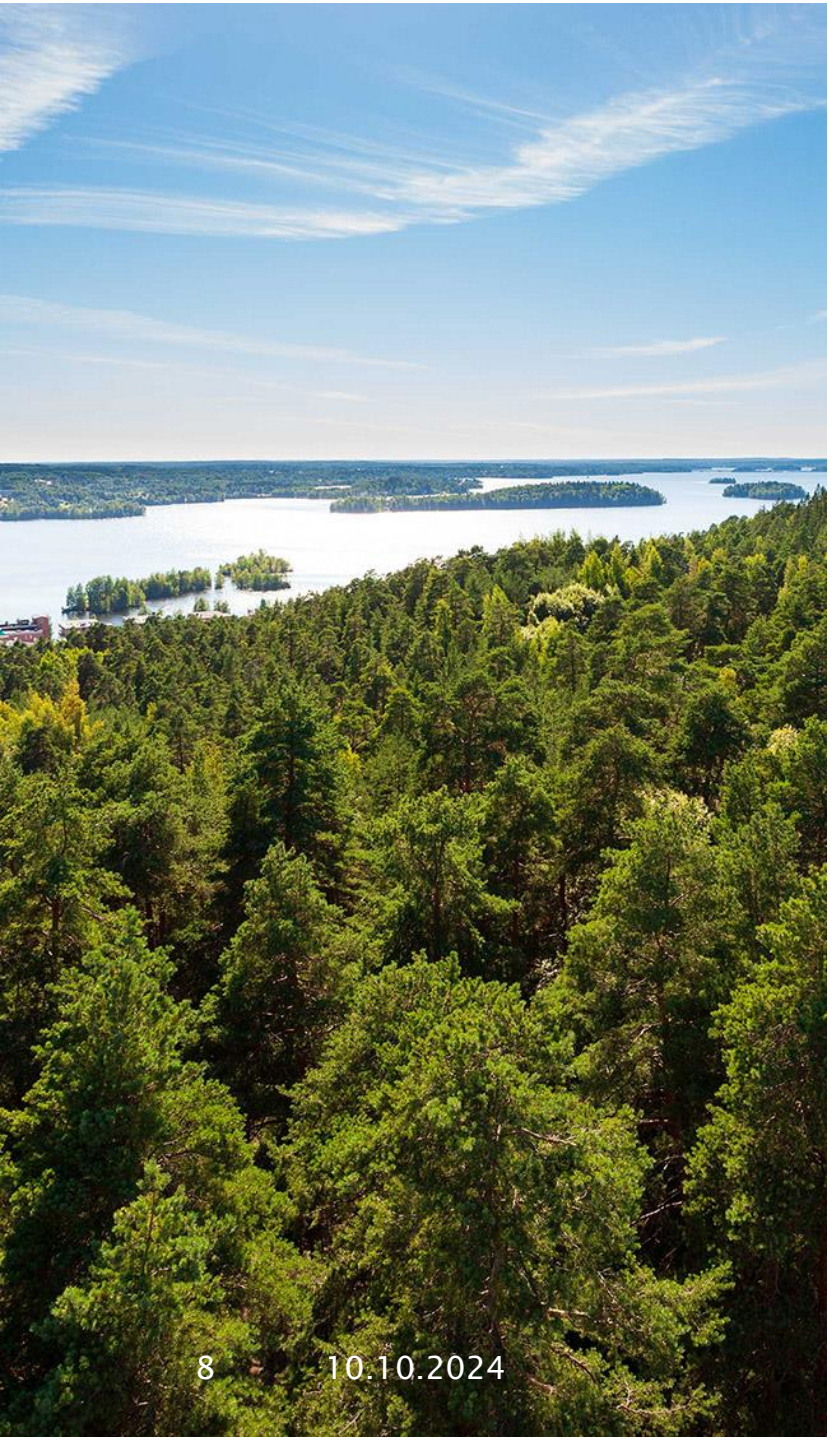

Case studies in industry and the commercial sector in Finland

Use of waste heat for district heat production (with or without heat pumps and from various sources) was 4.9 TWh in 2022, i.e., 13.2% of the total DH supply.

Industry is the largest source:

- A pre-study estimated the total technical waste heat potential in industry in Finland at 16 TWh in 2017.
- Economic potential varies along with, e.g., electricity tax decisions. Industries are often located far from habitation.

Commercial sector (2021 study):

- Total unharnessed waste heat potential in the grocery trade was estimated at 930 GWh/a (supermarkets and hypermarkets 797 GWh/a, malls 113 GWh/a and department stores 20 GWh/a)
- The largest waste heat potential is in mid-sized supermarkets.
- Only 10% of the total waste heat potential is used in small supermarkets about and 15-16% in mid-sized supermarkets and hypermarkets.

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Case studies on data centers in Finland

- A study in 2020 (by AFRY) estimated the utilized waste heat from data centers in Finland at 200 GWh/a, most of which is used in district heating networks.
- The total technical waste heat potential was estimated at 2 TWh/a, but the potential grows along with sectoral growth.

Examples:

- The Helsinki Data Center of Telia (a telecom operator and ICT service company) provides heating to over 20 000 dwellings.
- LUMI, Europe's most efficient supercomputer, provides 20% of district heat needs in the city of Kajaani.
- A new Microsoft data center will cover 40% of the heat demand of the 250 000 district heat customers in Espoo, Kauniainen and Kirkkonummi (cities next to Helsinki).

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Ramboll's case studies on data center waste heat

- In Denmark, Meta data center in Odense has been coupled to Fjernvarme Fyn's district heating network and is supplying around 7000 households with their excess heat.
- In Norway Green Mountain data center operator and trout farm operator, Hima Seafood, entered an agreement in 2021 to recover heat and use it for Hima Seafood's trout farm.
- In the Netherlands, an active project is NorthC's Aalsmeer data center south of Amsterdam, which supplies heat to local off-takers, including a swimming pool and school.
- In Germany, Frankfurt is a hub for data centers, and in 2021 a pilot project started to recover waste heat to supply 1300 apartments.

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ODYSSEE-MURE

ODYSSEE-MURE Fit4-55
2nd regional meeting September 25th 2024

Round table on Monitoring the Use of Waste Heat, including for art 12 Data Centres in Germany

Wolfgang Eichhammer, Fraunhofer ISI

Fraunhofer ISI

Agenda

ODYSSEE-MURE

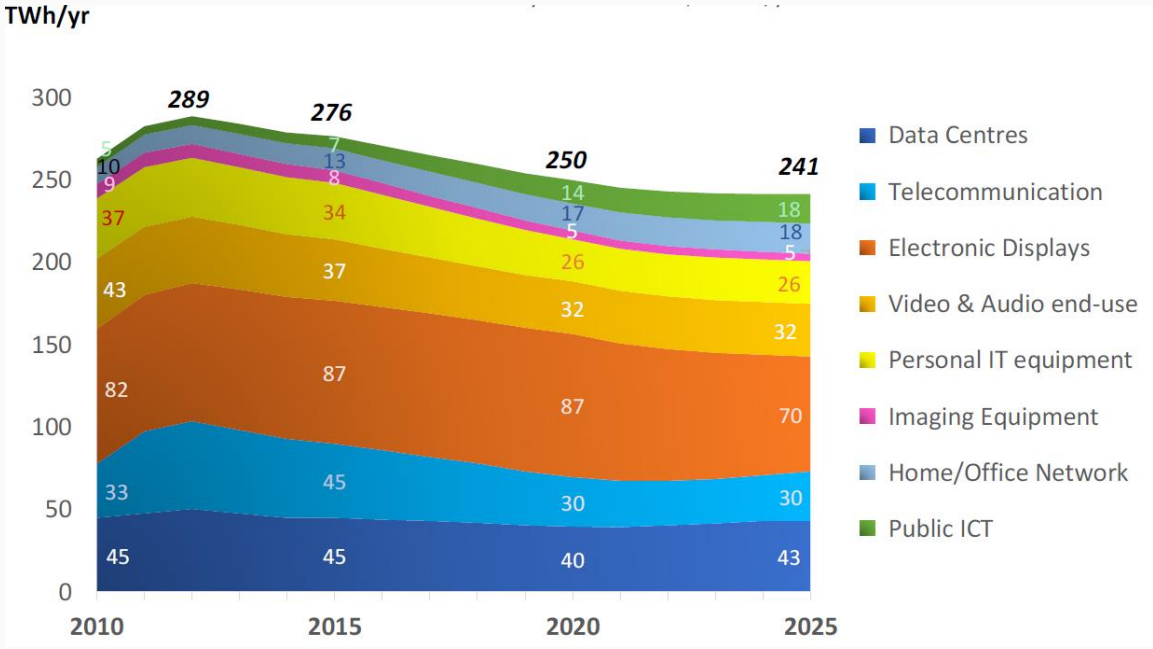
1. Art. 12 of the Energy Efficiency Directive in Germany
2. How this translates in Germany
3. Energy Efficiency Register for data centres
4. Some data on the energy demand for data centres

Minimum standards for ICT products under the EU Ecodesign Directive – We have already important policies for IT equipment

- Minimum standards already adopted since 2009:
  - PCs, monitors
  - Televisions, set-top boxes
  - Printer, copier
  - Standby and network standby, external power supplies,

- Since 2013: Computers and Small Server
- Since 2019: Enterprise Server and Data Storage Systems

- Voluntary agreements:
- Imaging Equipment
- Game consoles

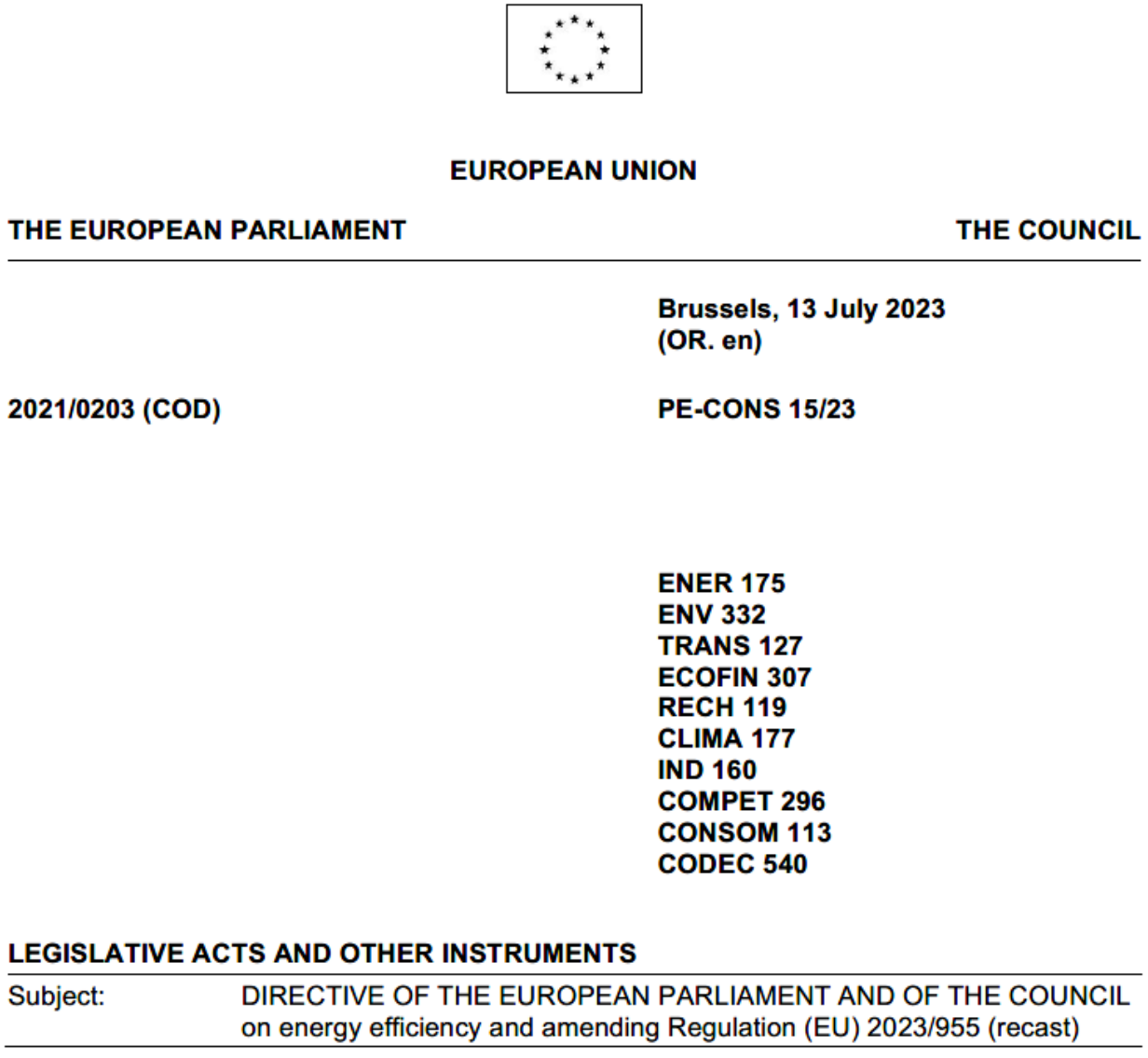


European Commission (2020) ICT Impact Study

The Energy Efficiency Directive

- Recast from 2023

- **Own article on Data Centres** (Article 12)
- Reporting and publication obligations for core data of data centres (performance, data traffic, area, energy consumption, temperature, waste heat utilisation, etc.) (for data centres with at least 500kW)
- Commission shall establish a European database on the above provided information
- Article 26: Heating and Cooling Supply
- Data centres have to utilise their waste heat (>1 MW); unless they can show it is not technically or economically feasibel



EUROPEAN UNION

THE EUROPEAN PARLIAMENT — THE COUNCIL

Brussels, 13 July 2023
(OR. en)

2021/0203 (COD)

PE-CONS 15/23

ENER 175
ENV 332
TRANS 127
ECOFIN 307
RECH 119
CLIMA 177
IND 160
COMPET 296
CONSOM 113
CODEC 540

LEGISLATIVE ACTS AND OTHER INSTRUMENTS

Subject: DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on energy efficiency and amending Regulation (EU) 2023/955 (recast)

Delegated Act - Data centres in Europe – reporting scheme

The act sets out a reporting scheme to rate the sustainability of data centres in the EU (Adopted in March 2024)

Minimum information to be monitored (among others):

- the floor area of the data centre,
- the installed power,
- the annual incoming and outgoing data traffic,
- the amount of data stored and processed within the data centre;
- the performance, during the last full calendar year, of the data centre in accordance with key performance indicators about, *inter alia*, energy consumption, power utilisation, temperature set points, waste heat utilisation, water usage and use of renewable energy

Energy Efficiency Act (Energieeffizienzgesetz EnEfG)

- With increasing digitalisation, data centres are becoming more and more important in terms of energy efficiency.
- The Energy Efficiency Act (EnEfG) therefore also explicitly addresses data centres. It contains important requirements for increasing the energy efficiency of data centres.
- These include
  - regulations in the area of waste heat utilisation,
  - the establishment of energy and environmental management systems and
  - the obligation to report in an energy efficiency register for data centres.

What are data centres?

- **Definition:** A data centre is a structure or group of structures (i.e. buildings) for the central accommodation, central connection and central operation of information technology and network telecommunications equipment (e.g. servers) for the provision of data storage, data processing and data transport services. A data centre also includes all systems and infrastructure for power distribution, environmental control and the necessary level of resilience and security required for operation.
- Reporting
  - The initial reporting deadline for operators of data centres with a non-redundant nominal connected load of **500 kilowatts** or more is 15 August 2024.
  - The initial reporting deadline for operators of data centres with a non-redundant nominal connected load of **300 kilowatts or more and less than 500 kilowatts** remains 1 July 2025 due to the longer lead time..

Requirements on data centres

- Both new data centres and those already in operation are obliged to comply with technical energy efficiency standards and to **use waste heat**.
- Large data centres must also introduce energy and environmental management systems and have these certified from a connected load of more than 1 megawatt.
- For publicly owned data centres, this already applies from a non-redundant nominal connected load of 300 kilowatts.
- Furthermore, information on the energy consumption of data centres is to be entered in a **public energy efficiency register**. Data centre operators will also be obliged to **inform customers about energy consumption**. This gives local authorities, companies and other users of data centres the opportunity to focus on higher energy efficiency standards when choosing IT services.

Requirements on data centres (Art. 11 - Climate-neutral data centres)

- 1) Data centres that commence or have commenced operation before 1 July 2026 must be set up and operated in such a way that they
  - 1.from 1 July 2027, they have an **Power Usage Effectiveness** of less than or equal to **1.5** and
  - 2.from 1 July 2030, achieve an annual average **Power Usage Effectiveness** of less than or equal to 1.3 on a permanent basis.
- (2) Data centres that commence operation from 1 July 2026 shall be constructed and operated in such a way that they
  - 1.achieve a **Power Usage Effectiveness** of less than or equal to **1.2** and
  - 2.have a proportion of reused energy in accordance with DIN EN 50600-4-6, November 2020 edition of at least **10 percent**; data centres that commence operation from 1 July 2027 must have a planned proportion of reused energy of at least **15 percent**; data centres that commence operation from 1 July 2028 must have a planned proportion of reused energy of at least **20 percent**.
    The requirements pursuant to sentence 1 must be achieved on a permanent basis no later than two years after commissioning on an annual average.

Requirements on data centres – Energy Consumption Effectiveness

- **Power Usage Effectiveness:** a key figure for the energy efficiency of a data centre's infrastructure, which describes the **ratio of the annual energy requirement of the entire data centre to the energy requirement of the information technology**.

Requirements on data centres (Art. 11 and Art. 13/14)

- 5) Data centre operators have to cover the electricity consumption in their data centres with:
  - 1.from 1 January 2024, 50 percent of electricity from renewable energy sources and
  - 2.from 1 January 2027, 100 percent of electricity from renewable energy sources.
- Art. 13 - Information obligation for data centre operators and IT operators /
  - (1) Operators of data centres are obliged to publish information about their data centre in accordance with Annex 3 for the previous calendar year by the end of 31 March of each year and to transmit this information to the Federal Government.
- Art. 14 Energy efficiency register for data centres
  - The Federal Government shall establish an energy efficiency register for data centres in which the information transmitted by the data centres in accordance with Section 13(1) in conjunction with Annex 3 shall be stored and transferred to a European database on data centres.

Requirements on data centres (Annex 3)

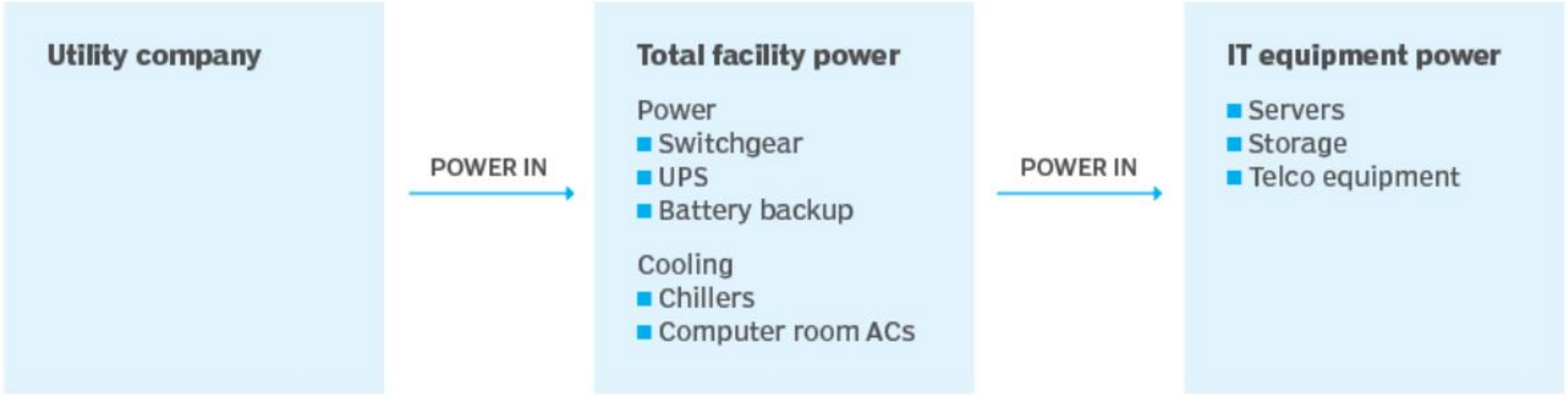
1) General information on the data centre:

- a) Name of the data centre,
- b) Name of the owner and operator of the data centre,
- c) Size class according to information technology connected load (< 500 kW, < 1 MW, < 5 MW, < 10 MW, < 50 MW, < 100 MW, > = 100 MW),
- d) Postcode in which the data centre is located,
- e) Total size of the building area,
- f) nominal connected load of the information technology and the non-redundant nominal connected load of the data centre.

2) General data on the operation of the data centre in the last full calendar year:

- a) Total electricity consumption including own generation, total electricity consumption and electricity fed back into the supply grid,
- b) Share of renewable energies in total electricity consumption according to DIN EN 50600-4-3, November 2020 edition ,
- c) Quantity and average temperature of measurable or estimable waste heat released into the air, water or ground
- d) Amount of waste heat supplied by the data centre to heat consumers in kilowatt hours per year and its average temperature in degrees Celsius
- e) the amount of data stored and processed in the data centre,
- f) **Power Usage Effectiveness** according to DIN EN 50600-4-2, August 2019 edition, of the entire data centre,
- g) Proportion of reused energy in accordance with DIN EN 50600-4-6, November 2020 edition
- h) Efficiency of the cooling system according to DIN EN 50600-4-7, edition August 2020 ,
- i) Efficiency index of water utilisation in accordance with DIN EN 50600-9, May 2020 edition

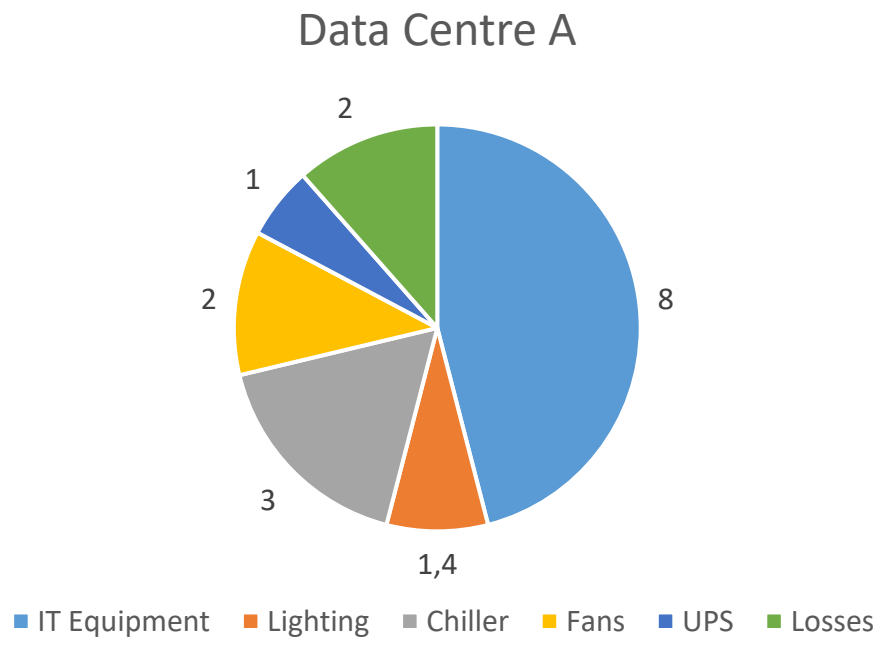
Part 1) Data Centres: Power Usage Effectiveness - Calculations & Challenges



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

Part 1) Data Centres: Power Usage Effectiveness - Calculations & Challenges

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



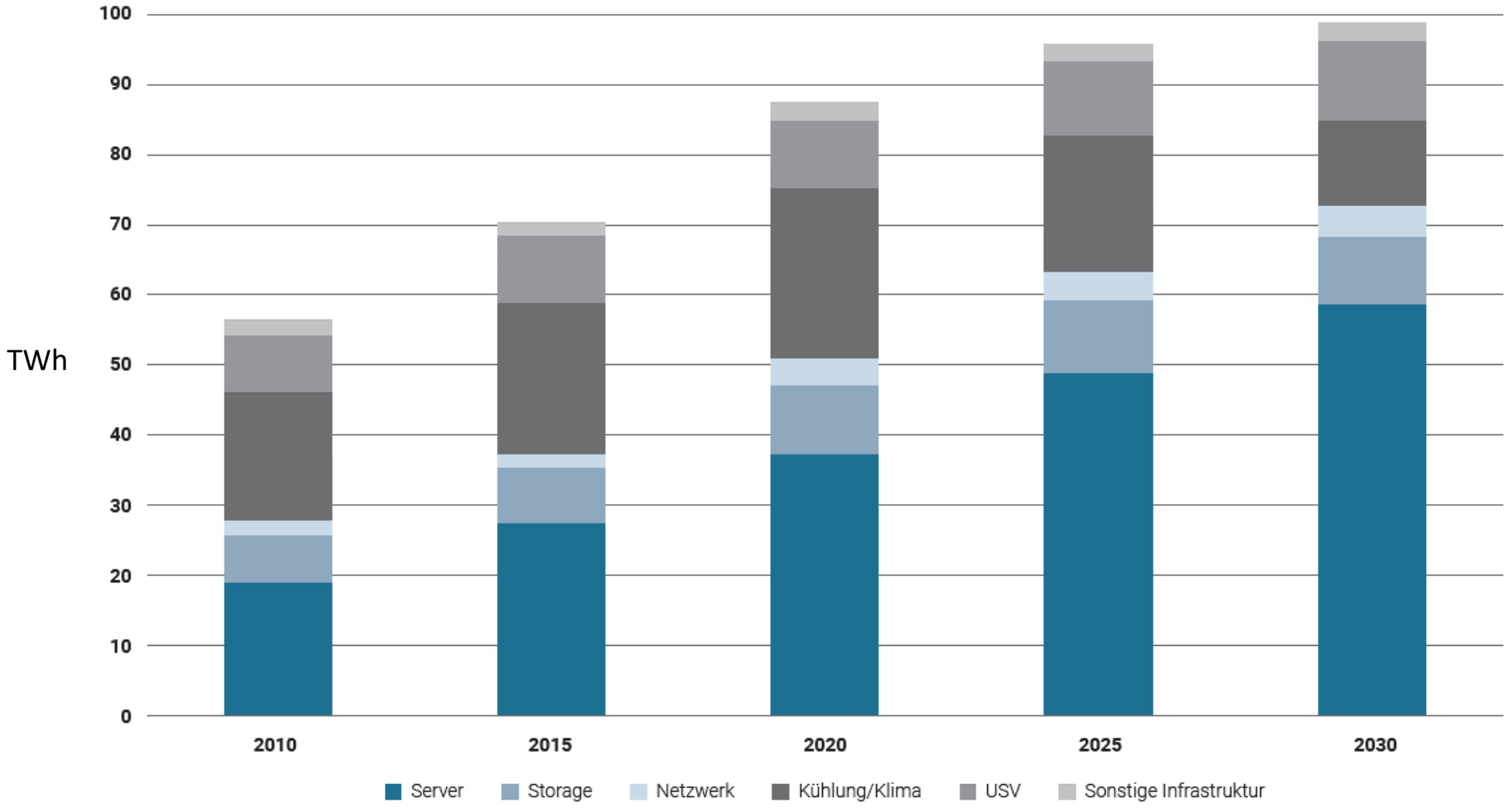
Data Centre B

Device	Consumption Unit	Quantity
Firewall	180 W	2
Switch	870W	2
Switch	264 W	1
Storage	432 W	2
Router	360 W	1
Servers	1200 W	3
Air Conditioner	3400 W	1
UPS	3320 W	1

1. **Calculate the PUE of the two example data centres**

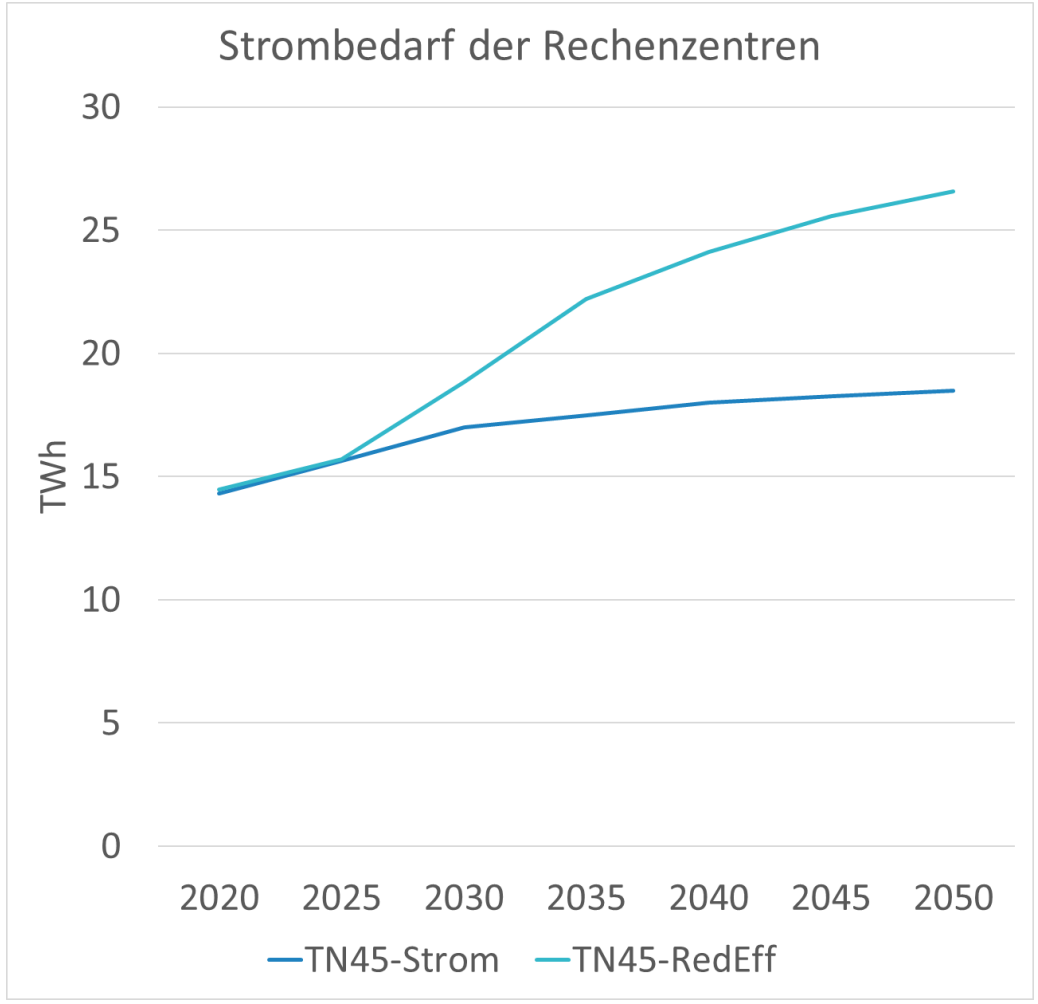
Most important rising trend: increase in data traffic

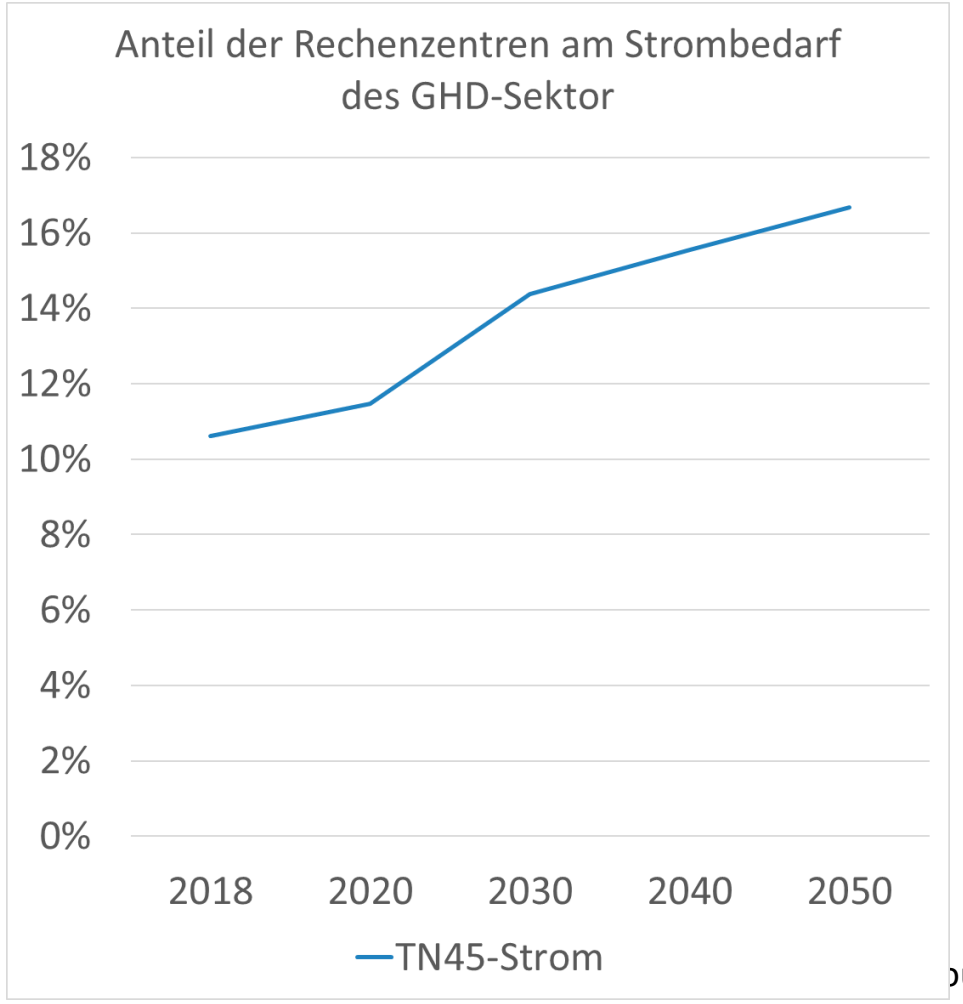
and the resulting increase in energy demand in data centres (in Europe).



Source: Borderstep
Hintemann, Hierholzer (May 2020)

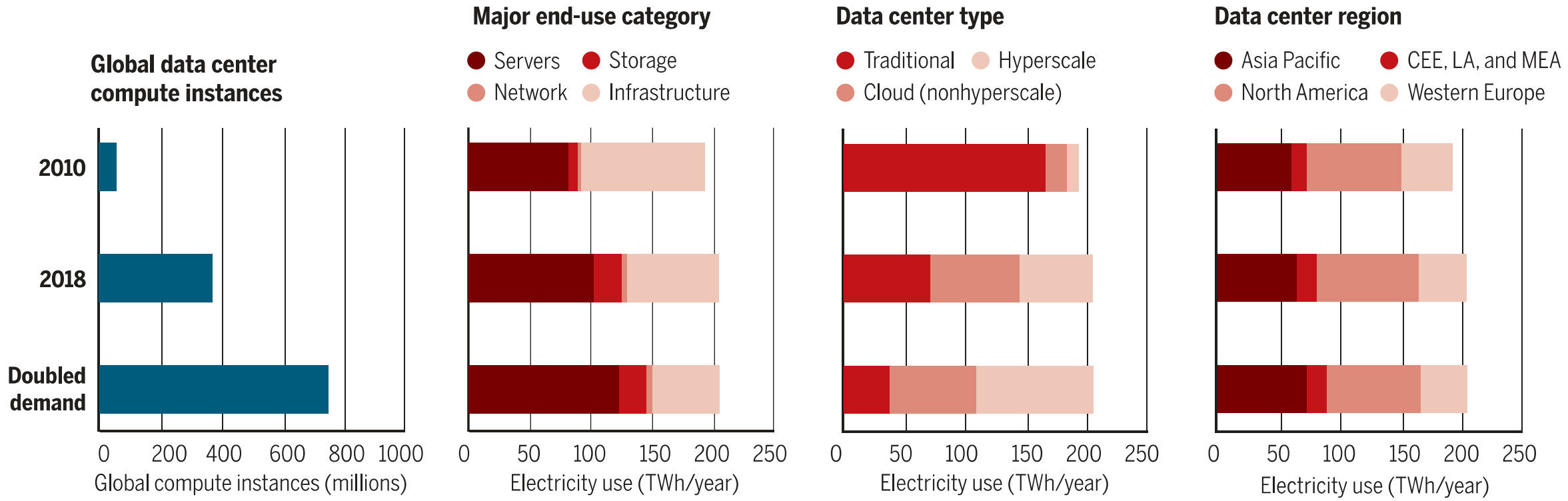
Energy demand of data centres in Germany increases both in relative and absolute terms





ource: Long-term scenarios 3

Increasing energy efficiency in data centres currently still offsets globally rising computing instances



CEE, LA, and MEA, Central and Eastern Europe, Latin America, and Middle East and Africa; TWh, terrawatt-hour.

Source: Masanet et al (2020)

Thank you for your attention!

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Fraunhofer ISI