Green Streaming

Sustainable value chain of digital media - Distribution

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Modeling of Energy Consumption

ENERGY INTENSITY MODEL (DATA BASED)

- Energy consumption/**data rate** [kWh/GB]
- **More data → more energy consumption?**
- Recognized KPI in ESG reporting

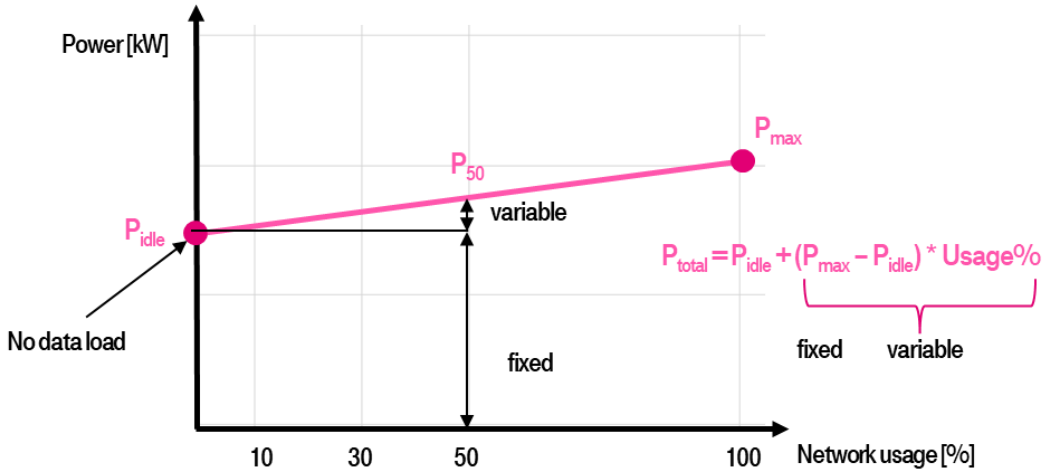
Network	EI [kWh/GB]
Core	0,02
Fixed	0,07
Mobile	0,2

Current models give a **common understanding** of energy consumption in networks

Need for more predictice models taking into account the complex parameter sets

GENERIC POWER MODEL (TIME BASED)

- Energy is a function of power **over time**
- **High energy consumption at *no load*** *("idle or service power")*
- Energy consumption is **proportional to data traffic for the small variable part only**



(1) Coroama Investigating the Inconsistencies among Energy and Energy Intensity Estimates of the Internet Metrics and harmonising values (2021)

(2) Malmodin: The porwer consumption of mobile and fixed network data services (2020)

EC in the Fixed & Mobile Telco Network

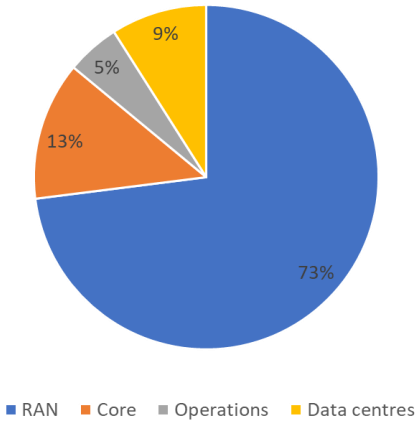
FIXED NETWORK

- Energy consumption **has remain stable** over the last years
- **Fiber** leads to a substancial reduction in energy consumption – **Greenest access technology**
- **Largest energy consumer: CPE** stands for appr. 50-70%

EI Model(1)	**Power Model** (2)
Core network 0,02 kWh/GB **Fixed Access Network** 0,07 kWh/GB	~0,5 W/line ~16,5 W/line (11,5 W router + ~5 W line

MOBILE NETWORK

- **RAN** consumes appr. 75% of the energy (25% by core, data center and operations)
- 5G is more energy efficient than 4G (higher spectral efficiency), but the **absolute power consumption per cell is higher**
- Appr. **70%** of total electricity consumption at **no load**



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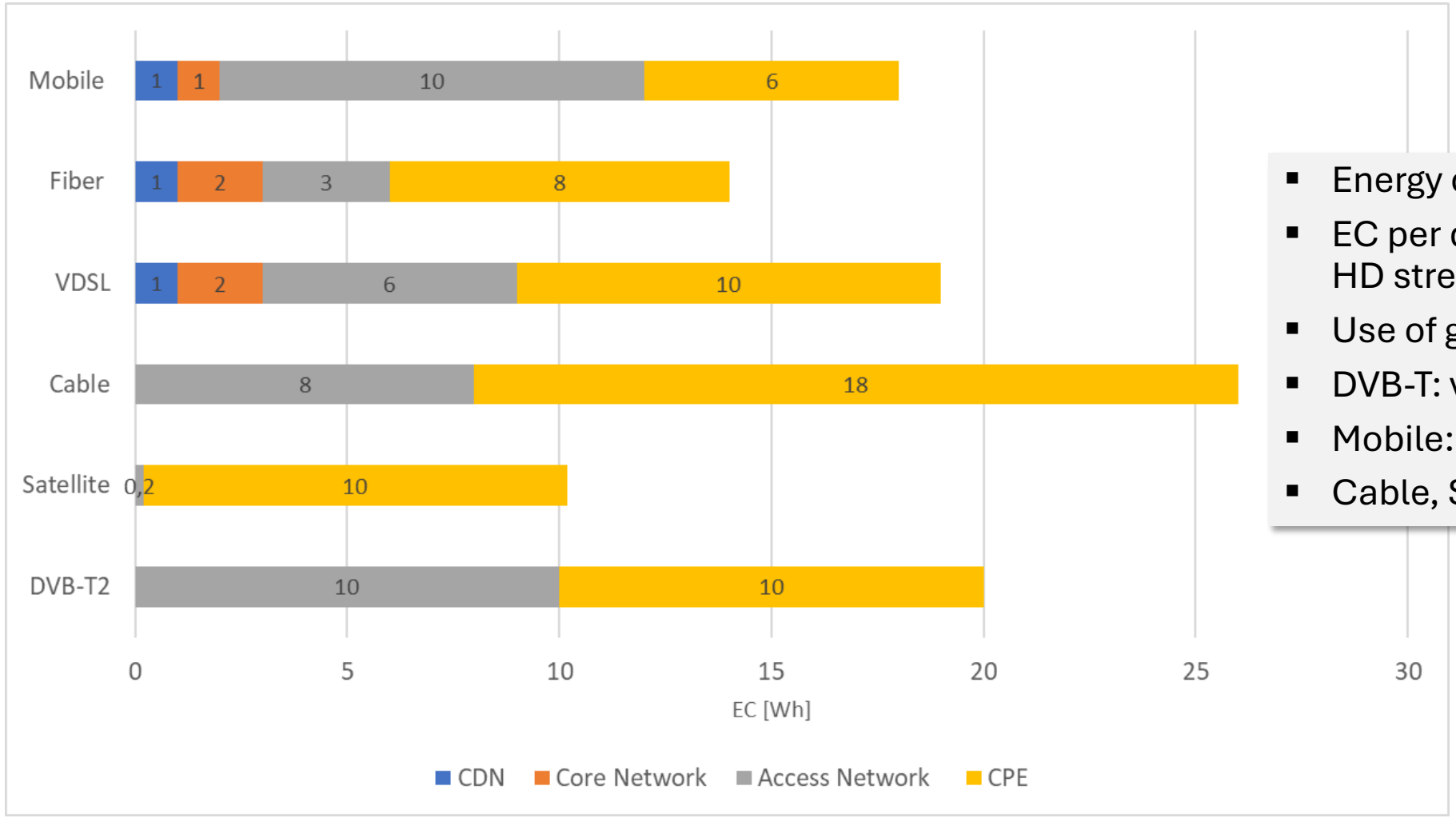
EC of different Distribution Technologies



- Energy consumption **per line**
- EC per device viewing hour per HD stream with 6 Mbit/s
- Use of generic power model
- DVB-T: valid for Germany only
- Mobile: CPE is a 5G/LTE Router
- Cable, Satellite, DVB-T: broadcast

Summary

- Energy consumption is **not driven bei data demand**
- High energy consumption **at no load**
- **Fiber is the greenest access technology** for streaming and Satellite for broadcast
- **Most effective measure** for energy saving: hibernation/shutdown of components