



Sustainable Digitization and Green IT

Wellbeing of digitalized societies and workplaces

Concluding Workshop Mannheim

Dr. Ulrike Kugler

January 9 2023



Baden-Württemberg

MINISTRY OF THE ENVIRONMENT, CLIMATE PROTECTION
AND THE ENERGY SECTOR

Baseline versus Carbon-aware Load

--- Baseline Load — Carbon-aware Load ● Carbon Intensity



Chaos Communication Congress

Hack fürs Klima gesucht



Runder Tisch „Nachhaltige Digitalisierung“



How to stop data centres from gobbling up the world's electricity

Bits & Bäume 2022

Die Konferenz für Digitalisierung und Nachhaltigkeit

30.9. – 2.10.22

Stromfresser Internet

Die Schattenseiten der Digitalisierung

001010001010000010101

Is Green IT Over?

A Plea for Lean Software

Umweltpolitische Digitalagenda



Quellen: Google (2020), Zeit (2019), Umweltministerium BW (2017), US EPA (2020), Nature (2018), EU COM (2020), BUND (2022), BMU (2020), ZDF (2018), Wirth (1995), Dell (2011)



Why Green IT?

Digitization leads to an increasing need for energy and resources.



~3% of electricity use in Germany

DC Infrastructure

Ø PUE* in 2021: 1,56

IT equipment

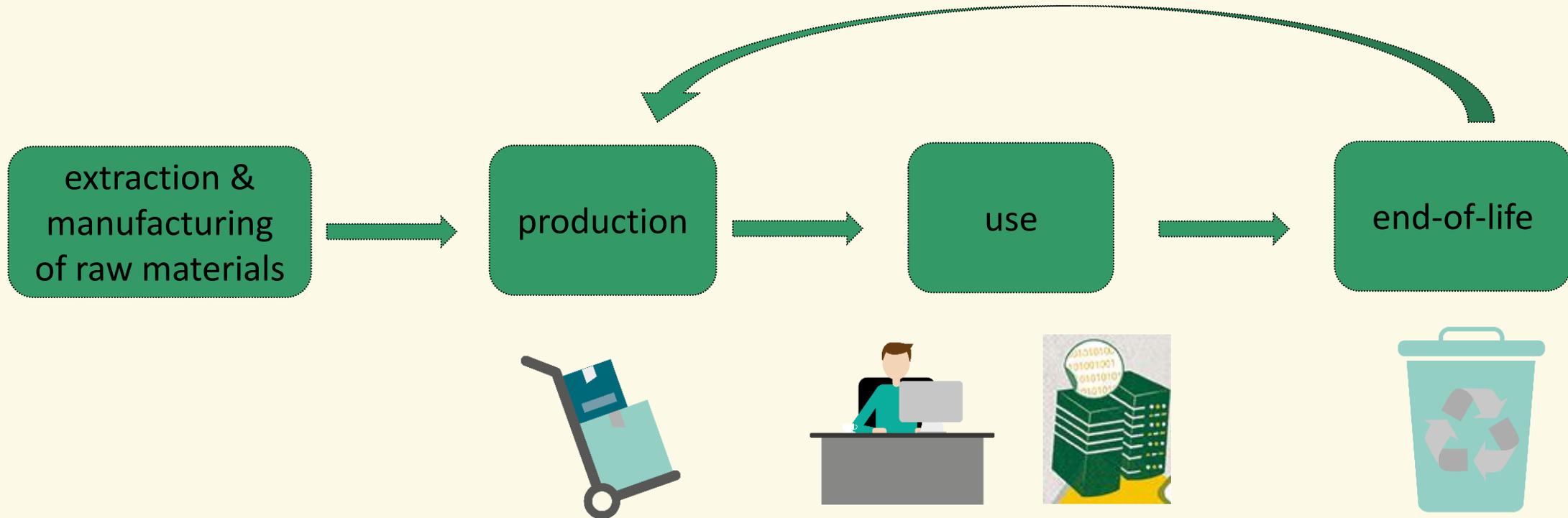
*Power Usage Effectiveness:

$$\frac{\text{total facility energy}}{\text{IT equipment energy}}$$



Green IT

From cradle to grave



Green IT means a sustainable use of information technology over its total lifecycle.

Sustainable Digitization/Green IT

Sustainable Digitization as a module of 



<https://um.baden-wuerttemberg.de/de/umwelt-natur/nachhaltigkeit/nachhaltige-digitalisierung/>



Baden-Württemberg

MINISTRY OF THE ENVIRONMENT, CLIMATE PROTECTION
AND THE ENERGY SECTOR

Sustainable Digitization/Green IT

Initiatives (Excerpt)

- EU declaration on digital rights and principles

<https://digital-strategy.ec.europa.eu/en>

- Climate Neutral Data Centre Pact (industry initiative)

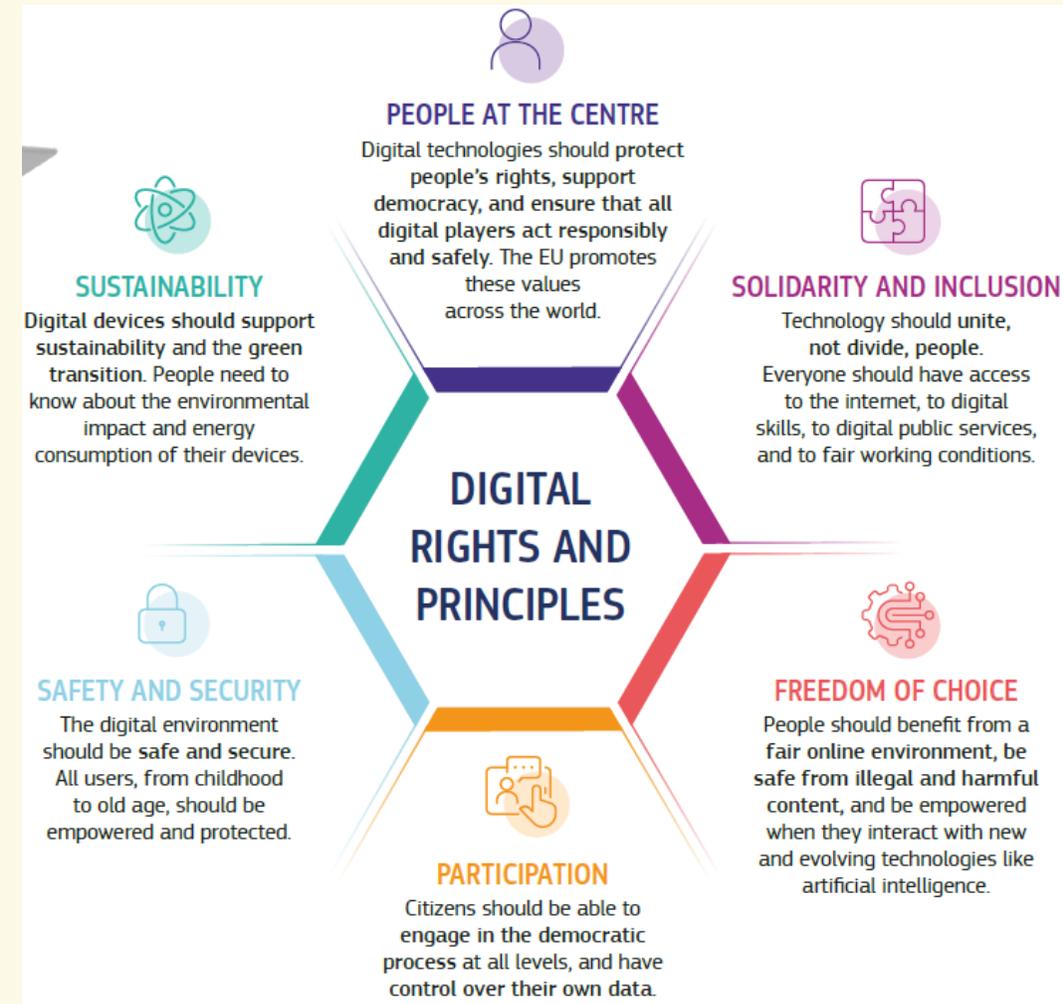
<https://www.climateutraldatacentre.net/>

- Revision of the EU energy efficiency directive (EED)

https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12552-EU-energy-efficiency-directive-EED-evaluation-and-review_en

- Green IT strategy for public administration in Germany

https://www.it-planungsrat.de/fileadmin/beschluesse/2022/Beschluss2022-18_Green_IT_Strategie.pdf (in German)



Green IT strategy for the federal administration of Baden-Württemberg

5 topics

Workplace

Procurement



GREEN IT
FÜR BADEN-WÜRTTEMBERG

Organisation, Energy
Management

Data Centres

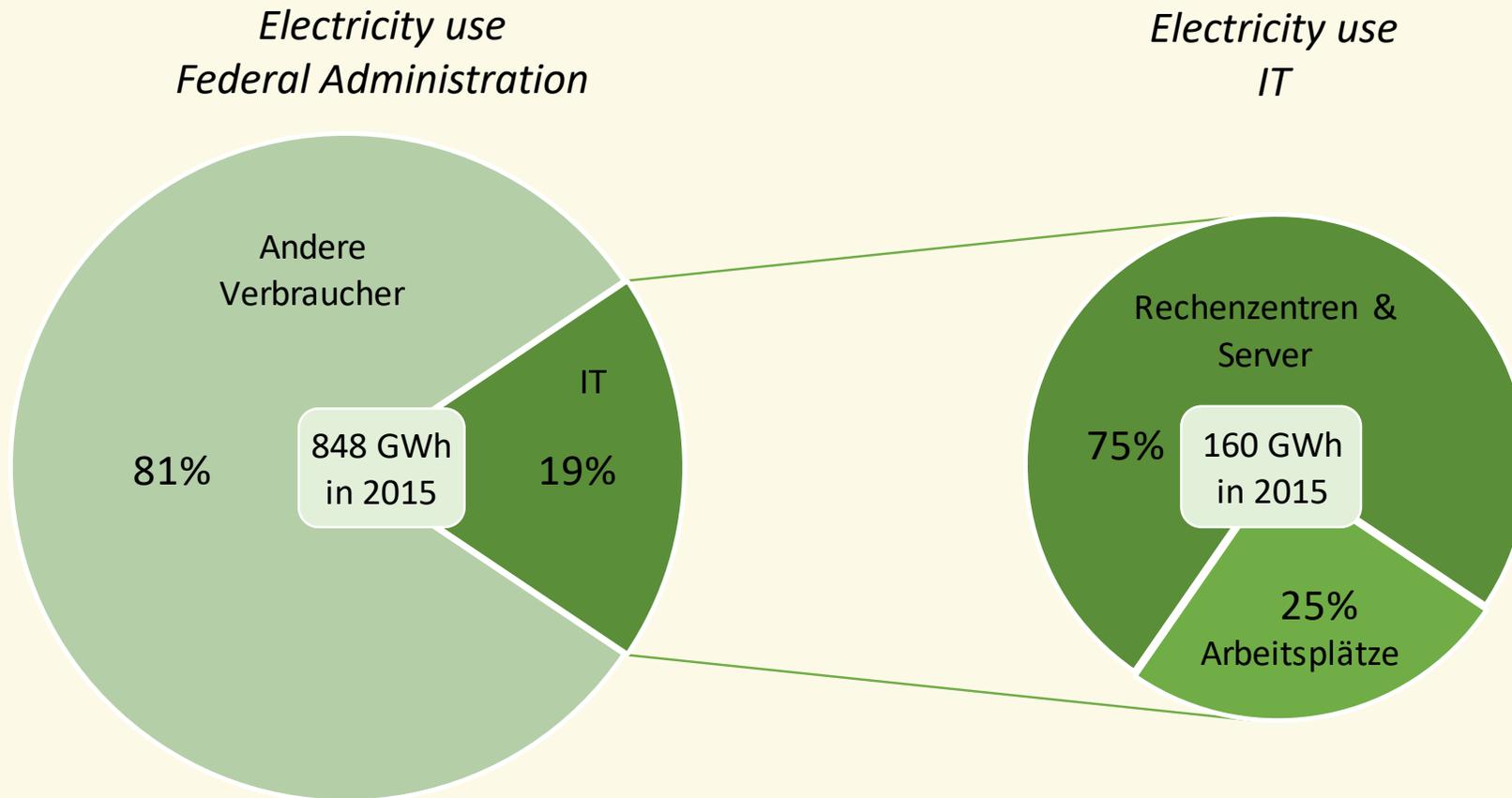
Science

...embedded in the Baden-
Württemberg Climate Protection Act
(KSG BW)

[https://um.baden-
wuerttemberg.de/en/topics/climate-
protection](https://um.baden-wuerttemberg.de/en/topics/climate-protection)

Green IT strategy for the federal administration of Baden-Württemberg

Monitoring



https://um.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/Dokumente/1_Ministerium/Aufgaben_und_Organisation/191122-Kurzbericht-Landesstrategie-Green-IT.pdf



Calculation example

Electricity use of a data centre

- IT electricity demand of a medium data centre: ~ 200 kW (≈30 Racks)
- Ø PUE: 1,56
- Total annual electricity consumption: **2,9 GWh**
(200 kW * 1,5 * 8.760 h = 2.855.760 kWh)

→ **Electricity consumption of about 1000 households**

- annual yield of a modern onshore wind turbine: ca. 6 GWh (3 MW power, 2000 full load hours)

Green IT strategy for the federal administration of Baden-Württemberg

Blue Angel for High-Performance Computing Centre Stuttgart

The High-Performance Computing Center of the University of Stuttgart (HLRS) is recognized for its sustainability and ecological responsibility.

The High-Performance Computing Center of the University of Stuttgart (HLRS) has received certification for Energy-Efficient Data Center Operation under the Blue Angel, the ecolabel of the federal government of Germany. This certification is the newest of several standards for sustainability and environmental responsibility that HLRS has achieved in the past year. Certification under the stringent requirements of the Blue Angel reflects the comprehensive policies that HLRS has put in place to maximize its energy efficiency and minimize its impact on the environment.

<https://www.hlrs.de/press/detail/hlrs-receives-blue-angel-certification>

Published

Oct 12, 2020

[← See all press releases](#)





Good working conditions
 Unknown supplier
 At least „conflict free“

Frame:
 Factory / mine visited
 Supplier contacted
 No direct contact to the supplier yet
 Trader

Symbols:
 „xxx“ Company name must not be published
 i.A. in negotiations for better production conditions
 P Process chemicals

Sugar cane Thailand
 Sugar mill
 Lactid → PLA Corbion
 Sugar beet Spain
 Sugar mill
 Lactid Corbion
 PDLA Synbra
 Min. auxiliaries xxx
 Crude oil
 Additives xxx
 Colouring Innosolids
 Pigments
 Medium

Assembly, Distribution
 Retex, Sheltered Workshop

PCB Assembly
 Retex Electronics

Bioplastic
 IfBB Uni. Hannover Devpt. and Prod.

Case
 IfBB/ Beoplast Moulding

Feet
 Qualitaner & Deck5

Soldering Wire
 Fairlötet/ Stannol

Soldering paste
 Solder

Die-cutting
 Frielingsdorf

PTFE sheet High Techton
 Adhesive film Neschen

Zinc, Steel
 recycled carton
 25% PET-Recycling-plastic
 Wheel:Beech
 Axis: Birch

Under construction
 June 2018
 Grey part incomplete especially raw materials

Plastics / Crude oil
 Paper
 Glue

SnGe(99/1)
 Sekundary-Tin XXX
 Reset-Soldering Stannol

Trader

Colophony Nat.Resin
 Activator
 Wax (Europ)

Germanium
 Tin
 Copper Intern.Quellen
 90%E-Waste 10% Scum
 99% Sn+Cu,Ni,Co

SMD Assembly
 Wabe, Sheltered Workshop

LED
 Nichia/ Japan

Capacitors
 WIMA

E-cap
 Frolyt

SMD Capacitor
 Vishay/ Israel

Resistors
 Microtech electronic

PCB
 Hofmann LP

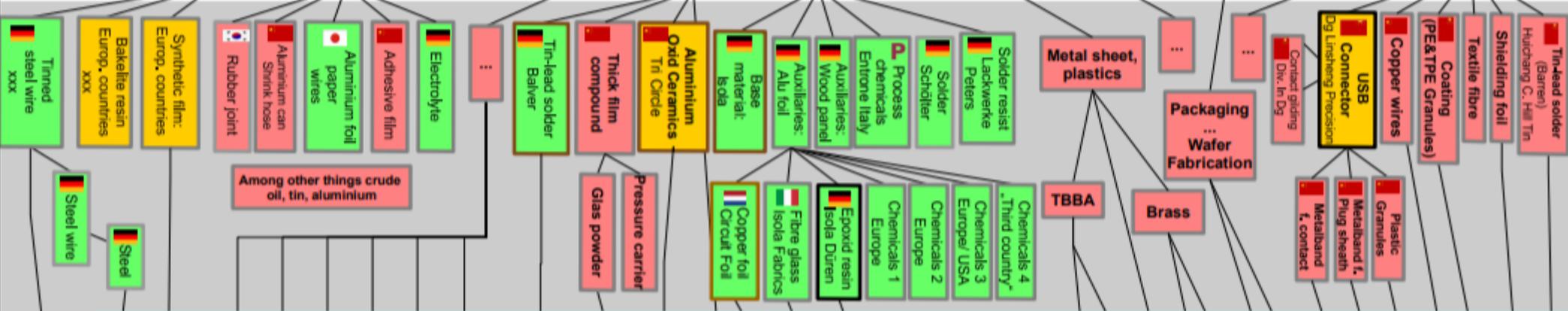
Switch
 Kailh

Encoder
 Kailh

Sensor
 Design: Pixart/ Tw Prod. Malaysia

Lense
 SZ Source Lung Opt. Techn

USB Cable
 Ningbo Broad



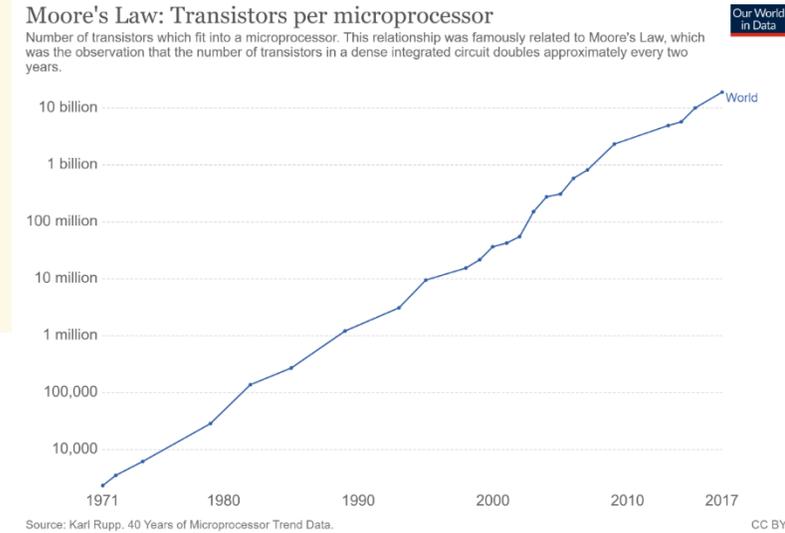
Trader for (metal, oil...), refining companies, processing companies, metal exchange, ...intransparent channels of trade

- Tin
- Iron
- Crude oil
- Silver
- Titan
- Nickel
- Tin
- Barium
- Palladium
- Tin
- Silicon
- Aluminium
- Ruthenium titan, silber nickel
- Copper
- Silicon
- Crude oil
- Crude oil
- Bromic
- Silver
- Zinc
- Copper
- Silicon
- Gold
- Tin, copper
- a.o. Iron
- Crude oil
- Copper
- Crude oil
- Aluminium
- Tin

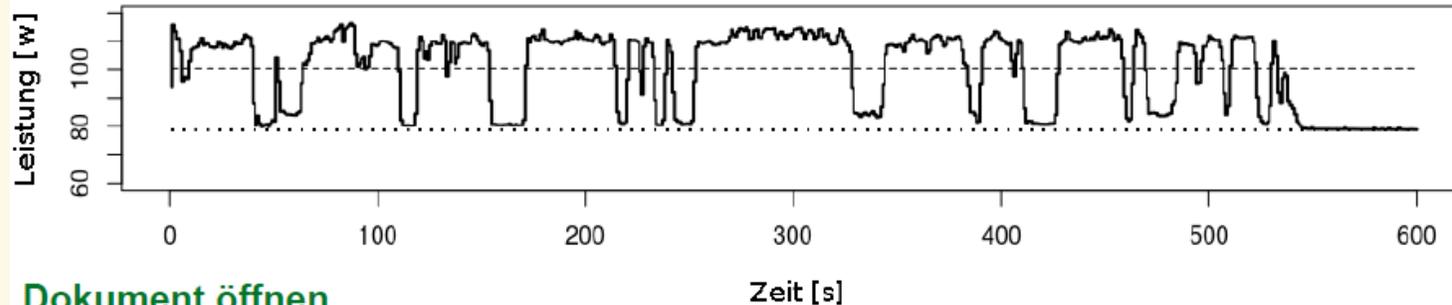
Green IT strategy for the federal administration of Baden-Württemberg

Ressource efficient software

„Software is getting slower more rapidly than hardware becomes faster.“ (Wirth, A plea for lean software, 1995)



Mittlere Leistungsmesswerte von Textverarbeitungssoftware 1

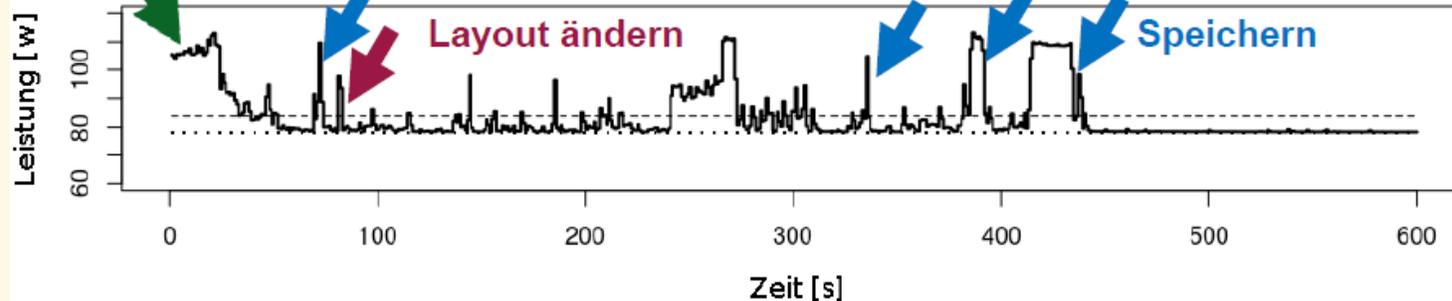


Nettoverbrauch
100,317 W ----

Grundverbrauch
78,48 W

**Dokument öffnen
und ändern**

Mittlere Leistungsmesswerte von Textverarbeitungssoftware 2



Nettoverbrauch
83,911 W ----

Grundverbrauch
78,48 W



Green IT – What can individuals do?

Use electronic devices longer

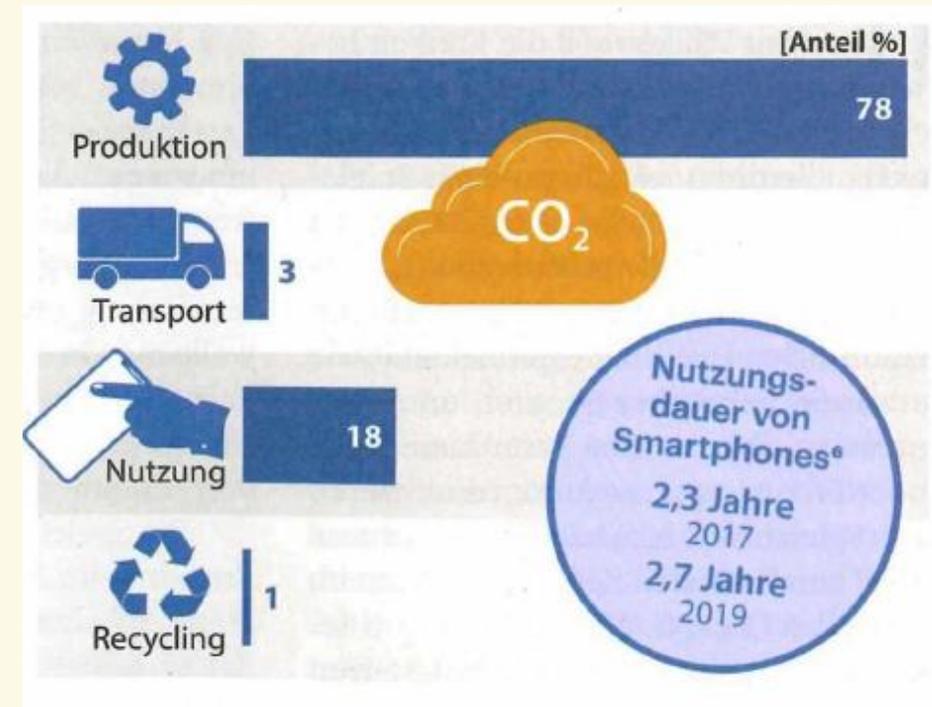
The „ecological backpack“ from producing electronic devices is heavy, so use them as long as possible.

POSITIVE KLIMAWIRKUNG UND KOSTEN-EINSPARUNG BEI LÄNGERER NUTZUNG

Vergleich von durchschnittlicher und verlängerter Lebens- und Nutzungsdauer über den Betrachtungszeitraum von 7 Jahren



durchschnittliche Nutzungsdauer: 2,5 Jahre, langlebig: 7 Jahre
 CO₂e = CO₂-Äquivalente, Maßeinheit zur Vereinheitlichung der Klimawirkung unterschiedlichen Treibhausgase
 Kosten = Lebenszykluskosten



Quelle: c't 2020 (Apple, FhG IZM)

Quelle: <https://www.vzbv.de/pressemitteilung/studie-zu-langlebigkeit-von-produkten-qualitaet-zahlt-sich-aus>

Green IT – What can individuals do?

Use your smartphone longer?

- hardware obsolescence by software: (security) updates are only provided for a while
- repairability: modules are rather glued than screwed; replacement parts are expensive or not available any longer

→ in 2022/2023: Revision of EU Ecodesign Directive and the EU Energy Labelling Regulation

https://www.izm.fraunhofer.de/en/news_events/tech_news/eu-regulations-set-to-make-smartphones-and-tablets-more-sustainable.html , https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12797-Designing-mobile-phones-and-tablets-to-be-sustainable-ecodesign_en , https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12798-Energy-labelling-of-mobile-phones-and-tablets-informing-consumers-about-environmental-impact_en

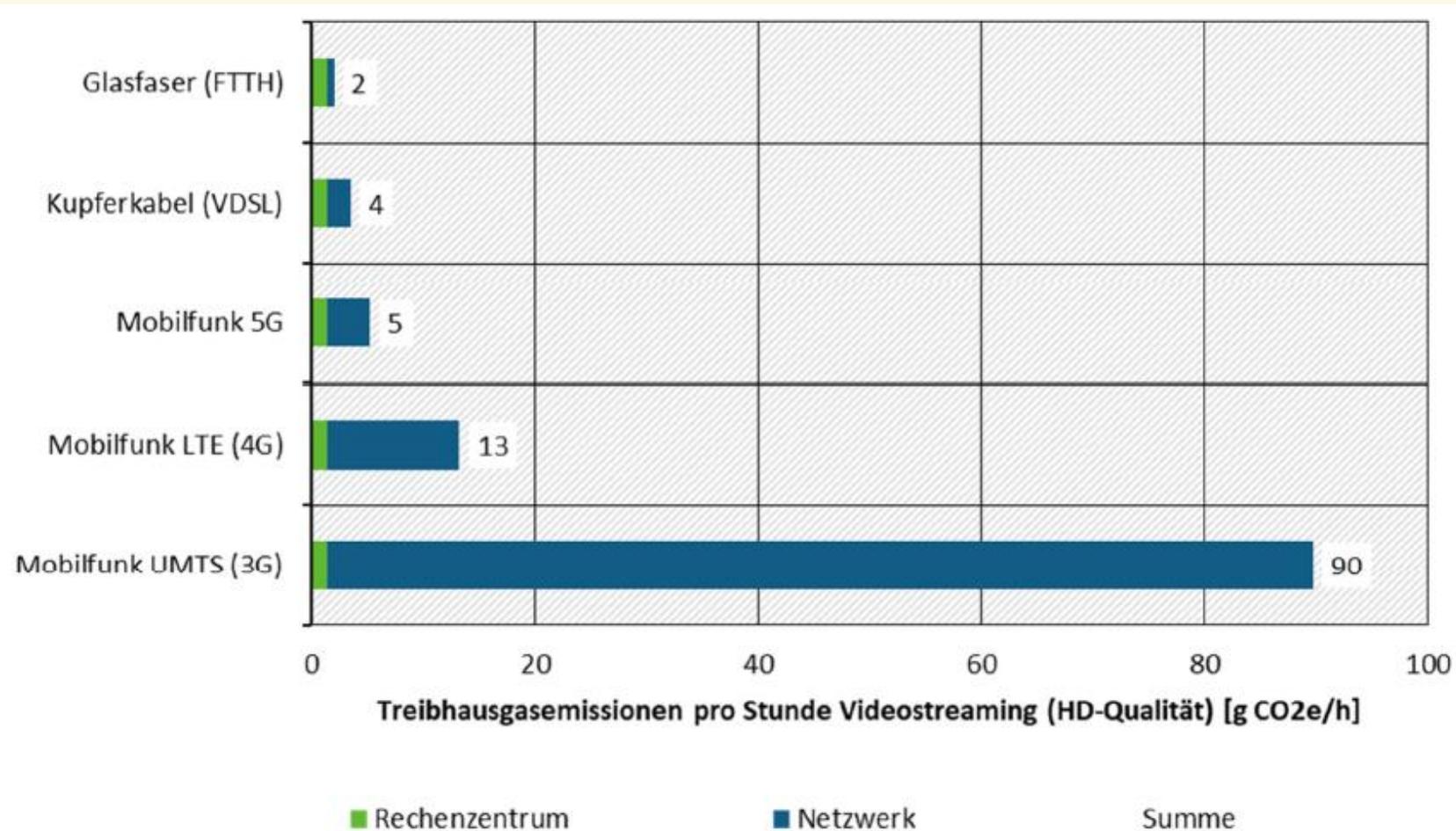
Repairability index in France for
electronic devices, amongst others
smartphones



<https://www.indicereparabilite.fr/>

Green IT – What can individuals do?

Use wireline for streaming (LAN/WiFi)



Quelle: Forschungsprojekt „Green Cloud-Computing“ (2020)

Green IT – What can individuals do?

Streaming with adapted resolution...

Tabelle 1: Datenmengen bei unterschiedlichen Bildschirmauflösungen und Videoqualitäten

YouTube nach Videoqualität	Bildschirmauflösung (Pixel)	Datenmenge pro Stunde
144p	192 x 144	30 MB/h
240p	320 x 240	150 MB/h
360p	480 x 360	300 MB/h
480p	640 x 480	450 MB/h
HD / 720p	1280 x 720	1,2 GB/h
Full HD / 1080p	1920 x 1080	1,7 GB/h
Netflix nach Videoqualität		Datenmenge pro Stunde
Niedrige Qualität		300 MB/h
Mittlere Qualität	1280 x 720	700 MB/h
Hohe Qualität	1920 x 1080	3 GB/h
Ultra-HD	3840 x 2160	7 GB/h

Quelle:
 Forschungsprojekt
 „Green Cloud
 Computing“ (2020)

heise online › News › 03/2020 › YouTube reduziert Videoauflösung in Europa

YouTube reduziert Videoauflösung in Europa

YouTube will die Auflösung seiner Videos reduzieren, um die Netze zu entlasten.



Green IT – What can individuals do?

...and sizes of devices

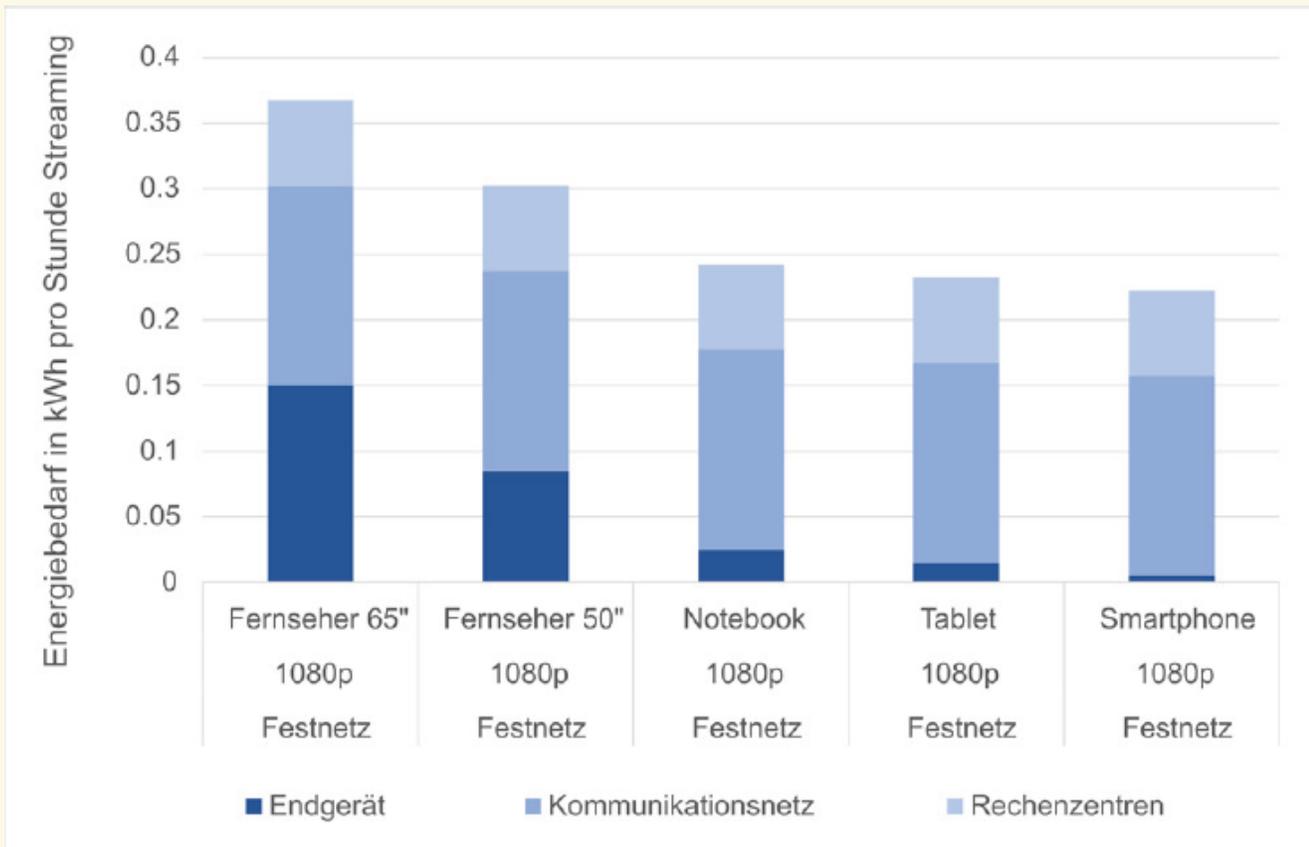


Abb. 3 Energiebedarf Videostreaming in Full-HD (1080p) in Abhängigkeit vom verwendeten Endgerät (Basisjahr 2018, ohne Herstellung der Geräte und Anlagen). (Quelle: Borderstep, 2020)



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<https://um.baden-wuerttemberg.de/de/umwelt-natur/nachhaltigkeit/nachhaltige-digitalisierung/>