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Green Computing

24 October 2024, Kyiv National University of Trade and Economics

Robin Teurlings

Managing Partner Zero Emissions Fund

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Привіт! Я Робін Терлінгс

- Executive Education Fellow School of Computing NUS
- Managing Partner Zero Emissions Fund
- Founder & CEO of The Startup Buddy
- Entrepreneur in Residence at INSEAD
- Mentor German Accelerator, Founders Institute
- Investor, mentor, swimmer, runner, DIY home improver

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Past:

- Program Manager at ING Bank
- Strategy consultant at DCE Consultants (now Altran)
- Consultant at Accenture
- MSc Public Policy and Public Administration (Netherlands)

NUS National University of Singapore

Zero Emissions Fund

Family fund that backs entrepreneurs with a focus on scalable decarbonization solutions.

Zero Emissions Accelerator

Free, online, live cohort in 2025

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TO JOIN

Register a STARTUP account on

www.thestartupbuddy.co

Use the program code: **ZeroEmissionsAccelerator**

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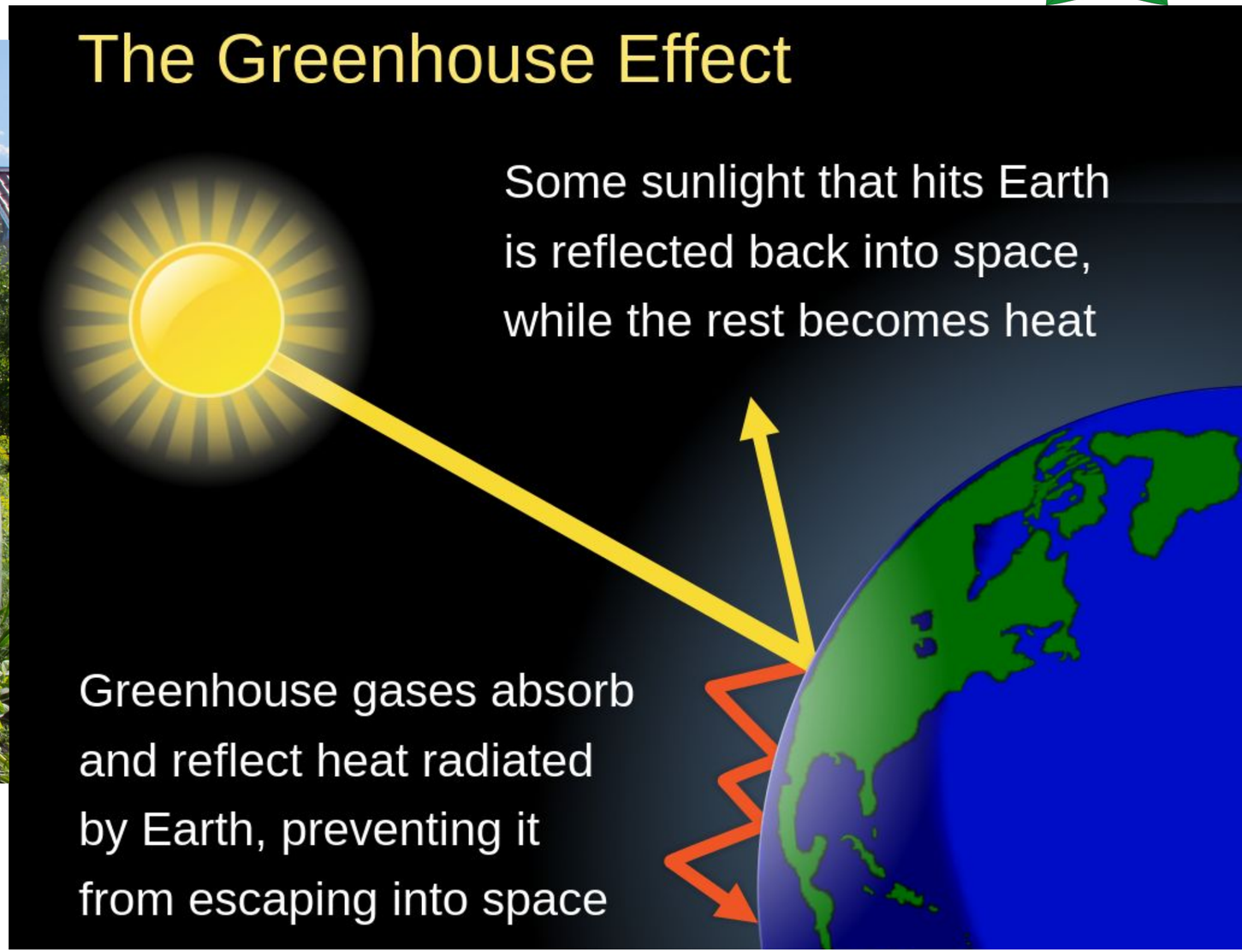

Source: https://en.wikipedia.org/wiki/Greenhouse_effect

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Green computing, green IT, or ICT sustainability, is the study and practice of environmentally sustainable computing or IT.

Many corporate IT departments have green IT initiatives to reduce the environmental effect of their IT operations.

Wikipedia, Green computing

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Estimates of ICT sectors impact:

1.8%-2.8% of GHG Emissions

Policies are mostly based on these estimates excluding scope 3

Based on research and scope 1, 2 AND 3:

2.1%-3.9% of GHG Emissions

The climate impact of ICT: A review of estimates, trends and regulations Lancaster University December 2020

Green Digital Transformation: How to Sustainably Close the Digital Divide and Harness Digital Tools for Climate Action, World Bank, 28 November 2023

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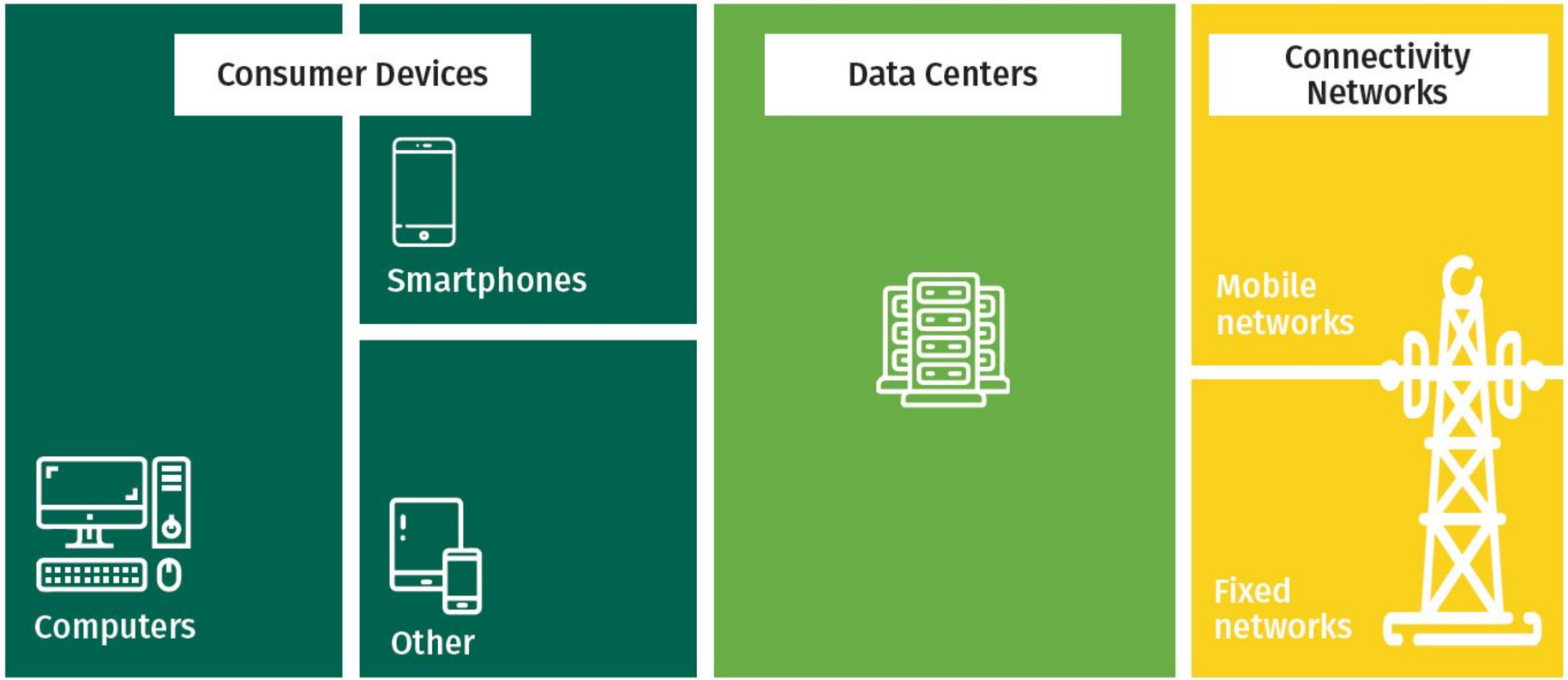
Figure ES.1: Sources of ICT sector emissions



Measuring the Emissions & Energy Footprint of the ICT Sector, ITU &World Bank, October 2024

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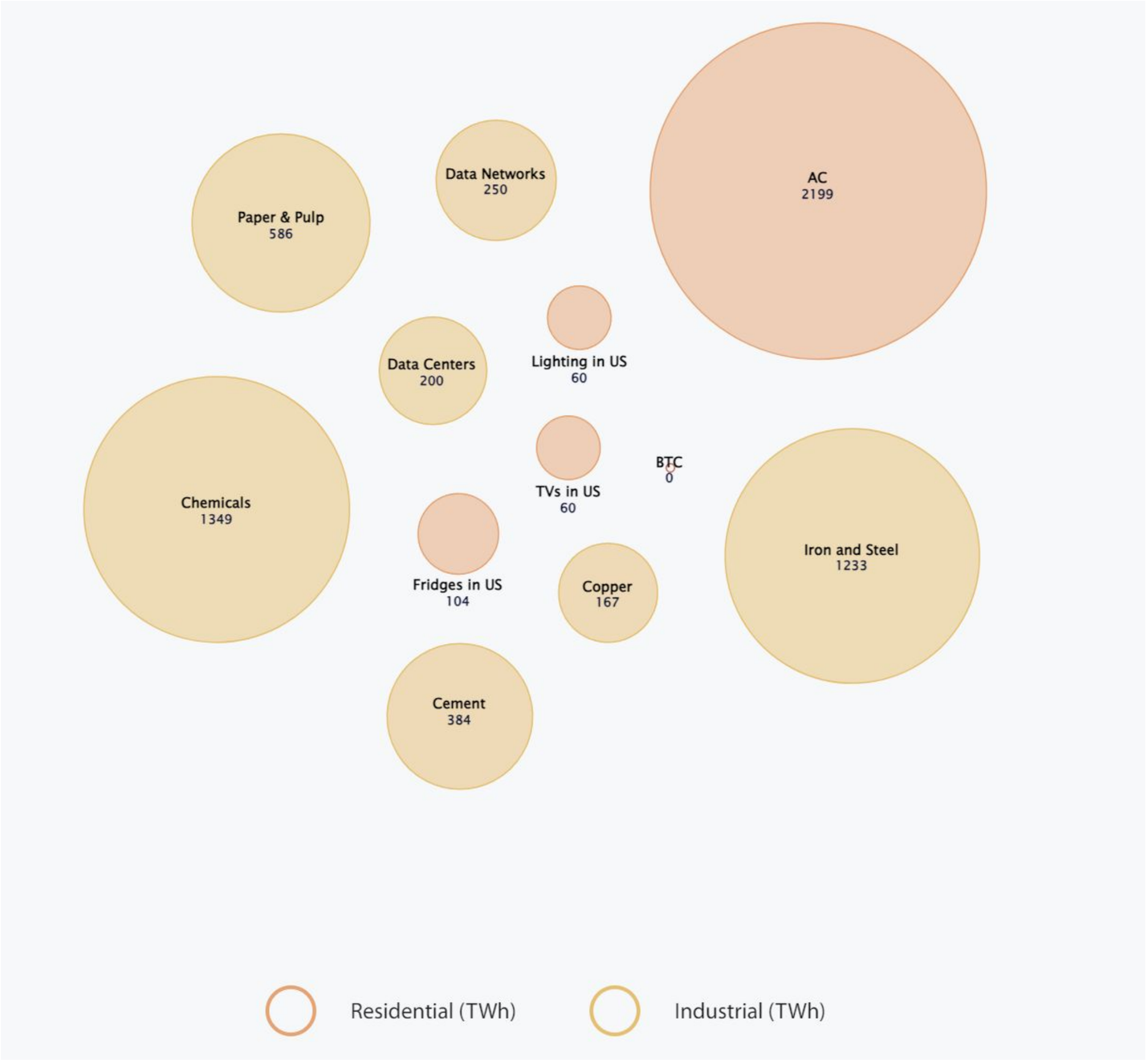

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*"Electricity consumption from data centres, artificial intelligence (AI) and the cryptocurrency sector could **double by 2026**. Data centres are significant drivers of growth in electricity demand in many regions. After globally consuming an estimated 460 terawatt-hours (TWh) in 2022, data centres' total electricity consumption could reach more than 1 000 TWh in 2026. This demand is roughly equivalent to the electricity consumption of Japan. Updated regulations and technological improvements, including on efficiency, will be crucial to moderate the surge in energy consumption from data centres."*

Quarterly growth of AI Compute Capacity, Semi Analysis, March 13th 2024

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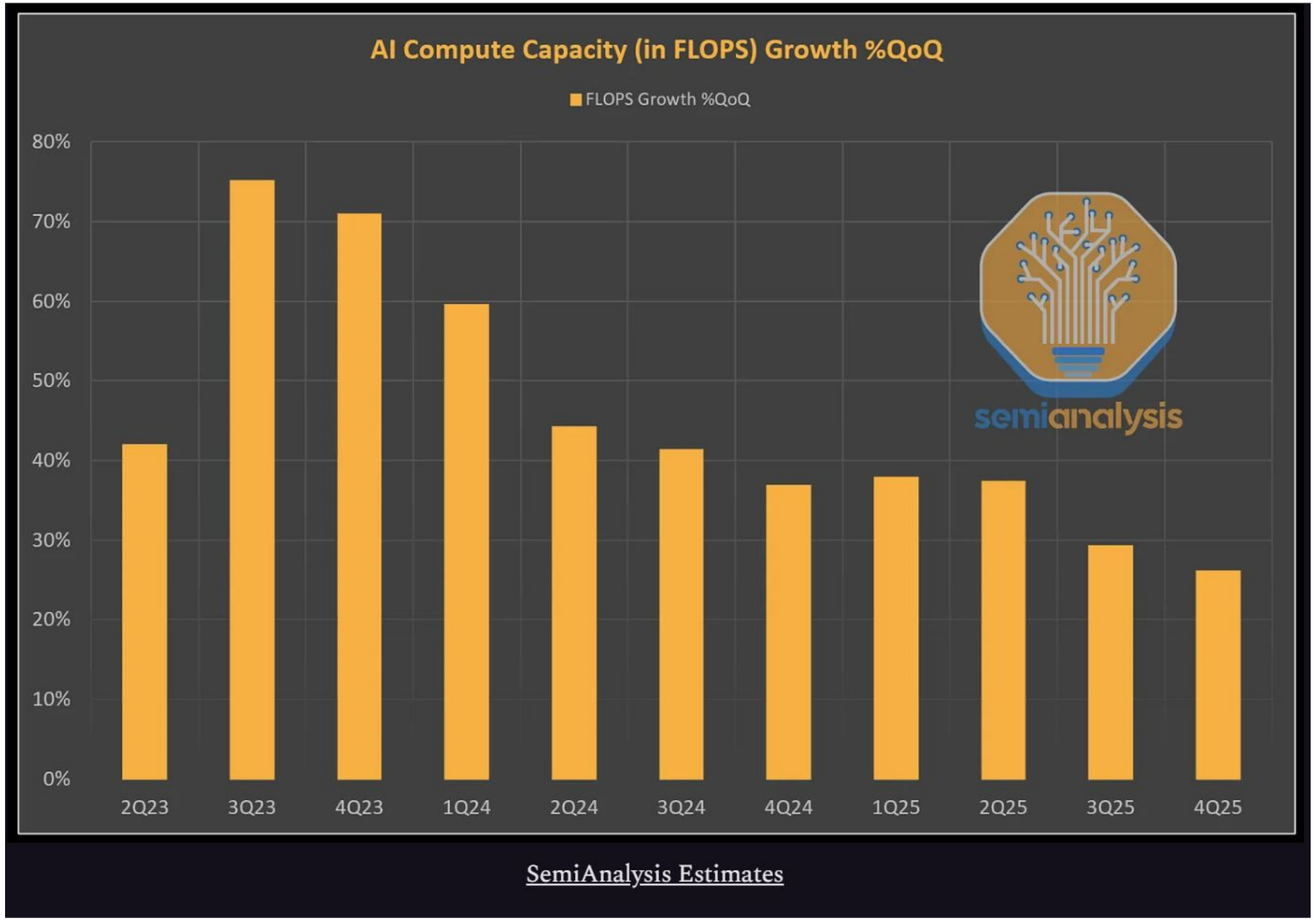

Quarterly growth of AI Compute Capacity, Semi Analysis, March 13th 2024

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The Guardian, Google’s emissions climb nearly 50% in five years due to AI energy demand, July 2nd 2024

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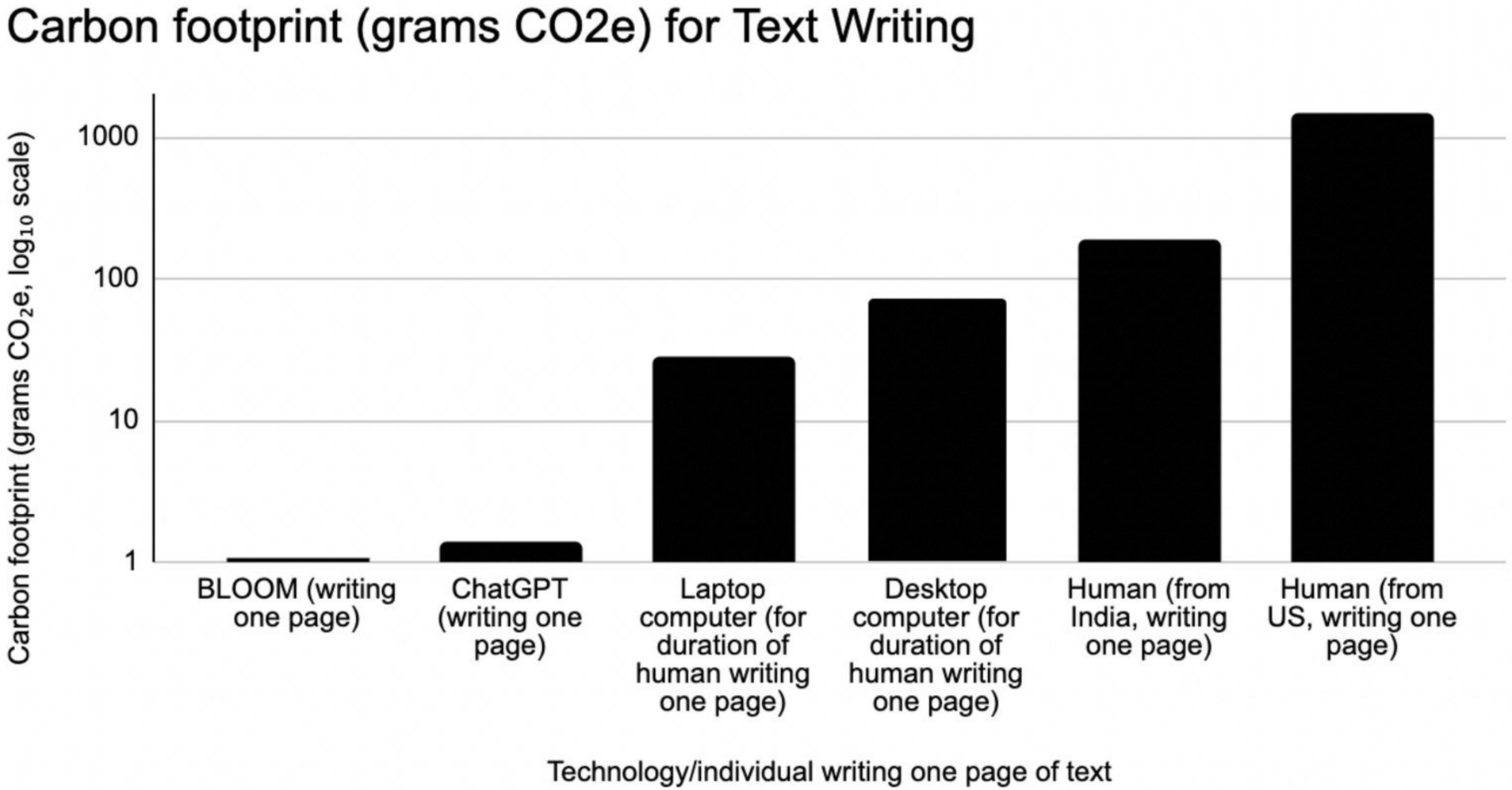

The carbon emissions of writing and illustrating are lower for AI than for humans, Nature, February 2024, Bill Tomlinson, Rebecca W. Black, Donald J. Patterson & Andrew W. Torrance

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Green Computing approaches

- Product longevity
- Data center design
- Software and deployment optimization
- Power management
- Materials recycling
- Cloud computing
- Remote work
- Telecommunication and network devices

Wikipedia, Green Computing

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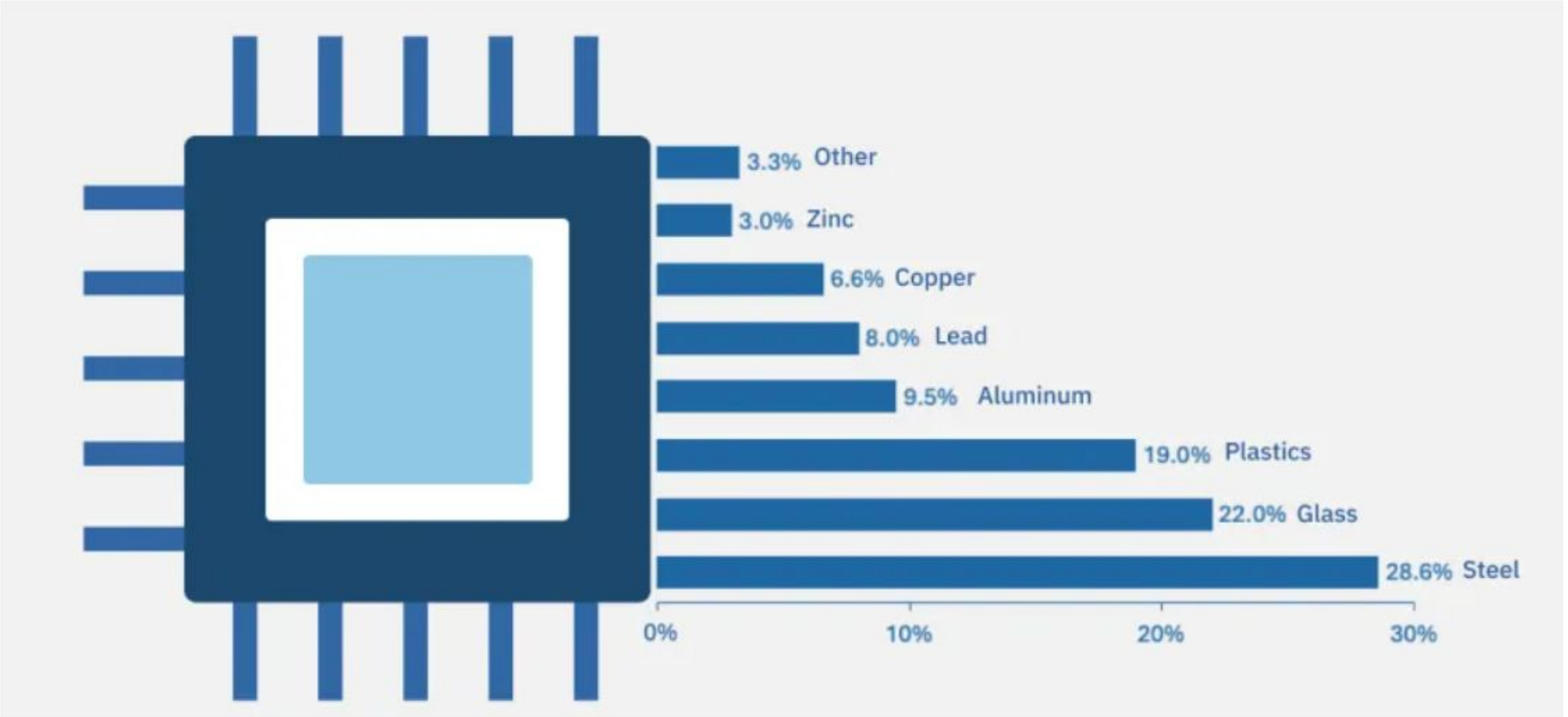
Material Composition of a Desktop Computer[27]



Center for Sustainable Systems, University of Michigan. 2024. "Information Technology Factsheet." Pub. No. CSS09-07.

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ENERGY CONSUMPTION BY SOFTWARE

World Economic Forum

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Total Cost of Ownership over 5 Years

Gamer and system type			5-year energy cost at given electricity price							Annual carbon dioxide emissions (lbs)		
			Electricity price ($/kWh)									
Light Gamer	kWh/y	Purchase cost	$0.10	$0.15	$0.20	$0.25	$0.30	$0.35	$0.40	Cleanest US region	US average	Dirtiest US region
Entry-level PC	236	$550	$118	$177	$236	$295	$354	$413	$472	106	291	448
Mid-range PC	285	$1,500	$143	$214	$285	$356	$428	$499	$570	128	351	541
High-end PC	373	$2,500	$187	$280	$373	$466	$560	$653	$746	167	460	708
PS4 Pro	99	$400	$50	$74	$99	$124	$149	$173	$198	44	122	188
Xbox One	101	$500	$51	$76	$101	$126	$152	$177	$202	45	124	192
Switch	5	$300	$3	$4	$5	$6	$8	$9	$10	2	6	9
Extreme Gamer												
Entry-level PC	521	$550	$261	$391	$521	$651	$782	$912	$1,042	233	642	988
Mid-range PC	897	$1,500	$449	$673	$897	$1,121	$1,346	$1,570	$1,794	402	1105	1702
High-end PC	1101	$2,500	$551	$826	$1,101	$1,376	$1,652	$1,927	$2,202	493	1356	2089
PS4 Pro	398	$400	$199	$299	$398	$498	$597	$697	$796	178	490	755
Xbox One	318	$500	$159	$239	$318	$398	$477	$557	$636	142	392	603
Switch	37	$300	$19	$28	$37	$46	$56	$65	$74	17	46	70
										Emissions factor (lbs CO2/kWh)		
										0.448	1.232	1.897

Sustainable Software by assistant professor B. van Gastel, Radboud University Nijmegen, The Netherlands, research done across 2016 - 2021

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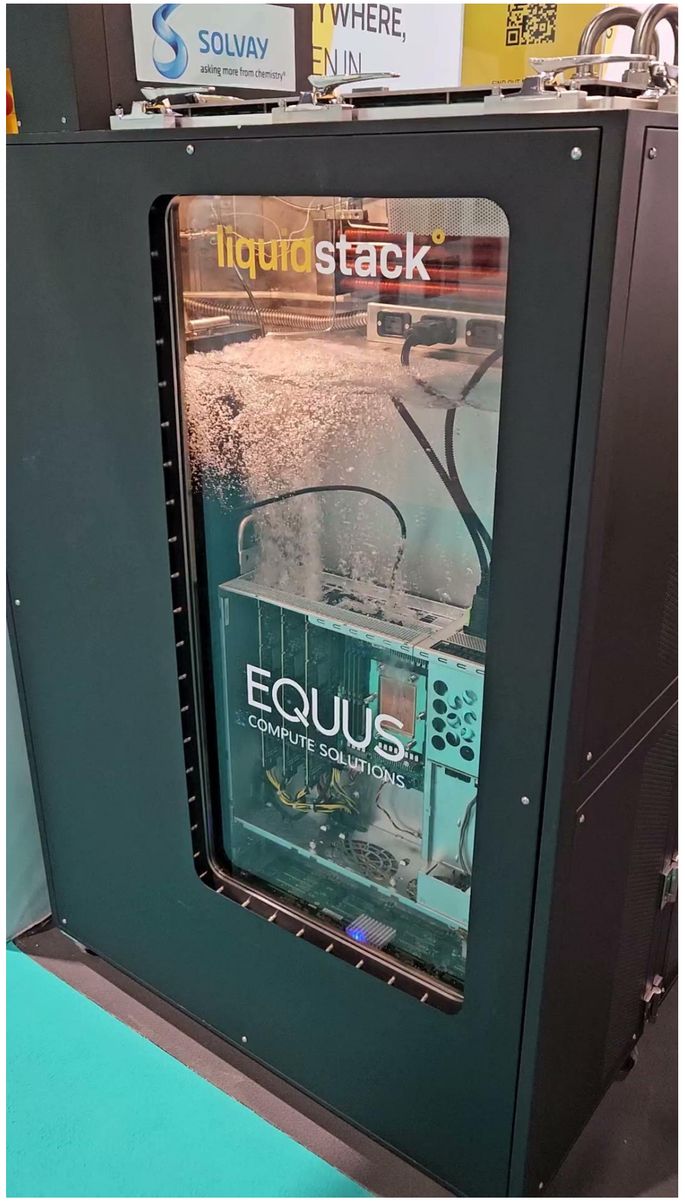

Liquid Stack, Liquid cool for data centers

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Photonic integrated circuits (PICs)A technology that harnesses the power of light to create energy-efficient, faster, and more accurate microchips, Photon Delta, The Netherlands, August 2024

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SOLID

SRP	The Single Responsibility Principle"	A class should have one, and only one, reason to change."
OCP	The Open Closed Principle	You should be able to extend a classes behavior, without modifying it.
LSP	The Liskov Substitution Principle	Derived classes must be substitutable for their base classes.
ISP	The Interface Segregation Principle	Make fine grained interfaces that are client specific.
DIP	The Dependency Inversion Principle	Depend on abstractions, not on concretions.

[Robert Cecil Martin, Software Engineer, SOLID + Agile Manifesto]

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- Write programs for people, not computers
- Define things once and only once
- Use a version control system
- Optimize software only after it works correctly
- Be a good code citizen
- **Keep it short (under 100 characters per line of code)**
- Language-specific style guides

THIS DEFINES GOOD SOFTWARE DEVELOPERS

SHOULD BE APPLIED TO NEW SOFTWARE AND UPDATES EQUALLY

Principles of Good Coding, Tilburg Science Hub

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Дякуємо за увагу!