The Practical Business Case for Data Center Sustainability

Open Compute Project

Educational Webinar Series

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Practical Business Case for DC Sustainability

Today's Speakers

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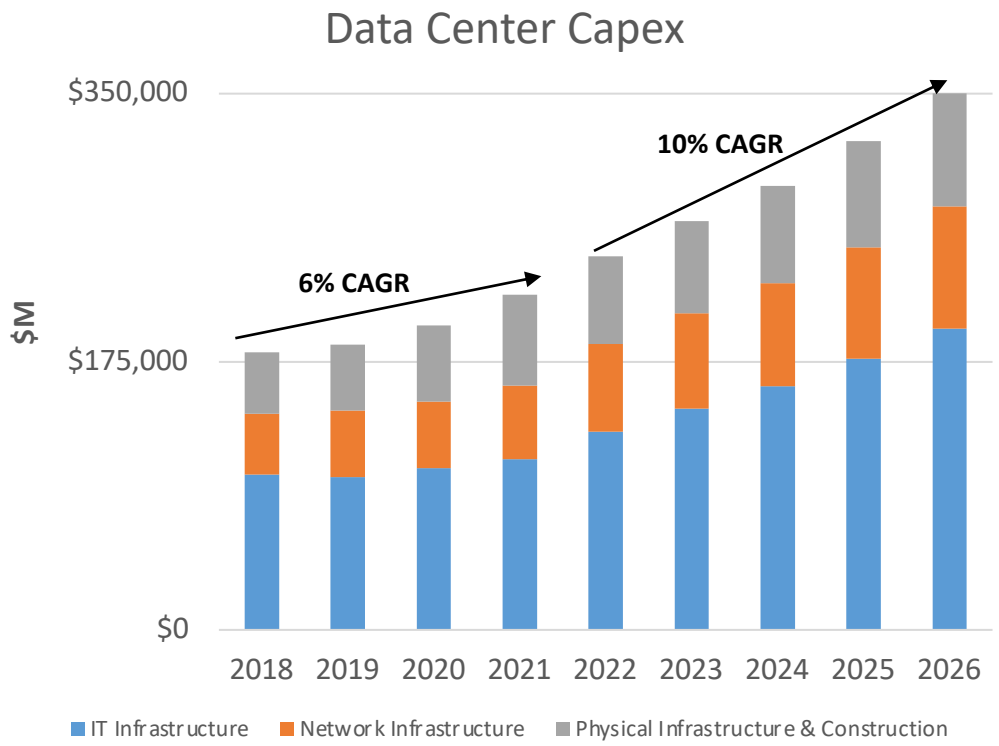
Agenda

- Embedding Sustainability in Data Center Growth
- Measuring Sustainability and the Circular Economy
- Data Center Thermal Management: From “Waste” Heat to Heat Re-use
- Use Cases: Heat re-use and Video Conferencing
- Sustainability is a Practical Business Choice
- Live Q&A

Digital Transformation is Accelerating



Source: Dell'Oro Group, DC Capex, 5-year Forecast, January 2022

Trends Driving Growth

- Pandemic behavioral shifts: Remote work and digital economy
- Accelerated computing: Artificial Intelligence (AI), Machine learning (ML), Augmented and Virtual Reality (AR/VR)
- Edge computing: Deployments to support latency-sensitive applications, such as cloud gaming, autonomous driving and industrial automation

Data Center Growth Must Be Sustainable

Why sustainability?

- Regulatory, investor, and customer pressure increasing sharply:
  - Data center moratoriums
  - Emerging regulatory actions
  - Investor community raising activism

What sustainability means?

- Sustainability is resulting in a Competitive Advantage:
  - Opportunity to reduce data center total cost of ownership (TCO)
  - Attract new customers, generate new revenue streams
  - ESG reporting drives investment

IT decision makers are central to supporting corporate social responsibility goals

Framing Data Center Sustainability

Data center sustainability is the intersection of:

A) **Efficient infrastructure to reducing carbon emissions**

B) **Lowering equipment embodied carbon footprint through lifecycle**

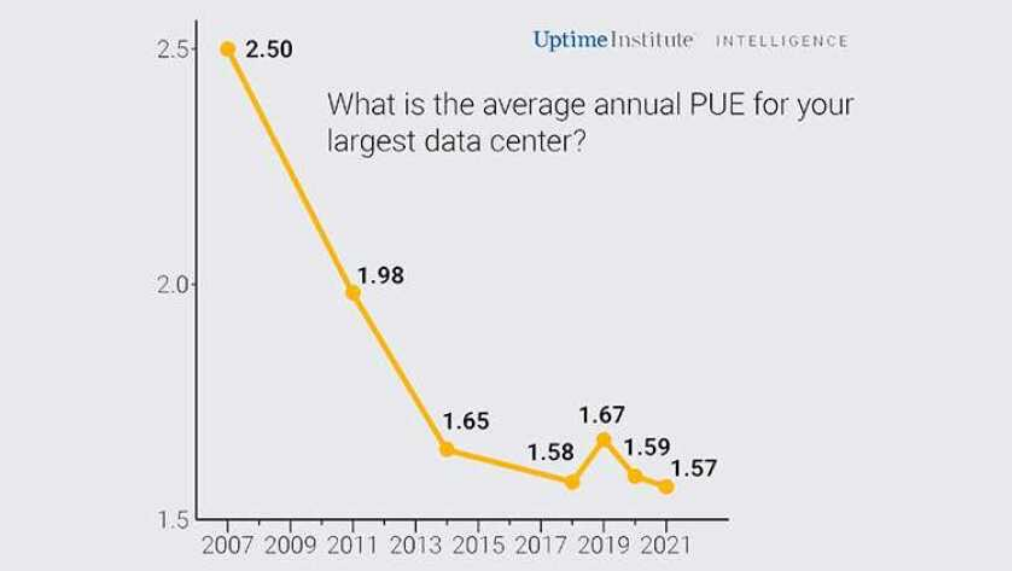
Evolving Focus on Scope 3 GHG Emissions

Past

- **Scope 1:** Direct – Day-to-day operations
- **Scope 2:** Indirect - Purchase of electricity
  - RECs, PPA for renewables
  - Increased efficiency to reduce electricity use (PUE), but progress is stalling

Future

- **Scope 3:** Indirect – Supply chain
  - Standardized sustainability reporting
  - Circular Economy
  - Heat re-use



Source: Uptime Institute

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Full End-End Accounting: What Role for Telemetry

Σ =

Cloud

Compute HW
- CPU, xPU
- Memory, Storage

Orchestration SW
- Provisioning
- uServices

Infrastructure
- Cooling (PUE)
- Heat Reuse (ERE)
- Regional Energy Profile

+

Connectivity

Data Volume

Distance

Speed

Regional Energy Profile

+

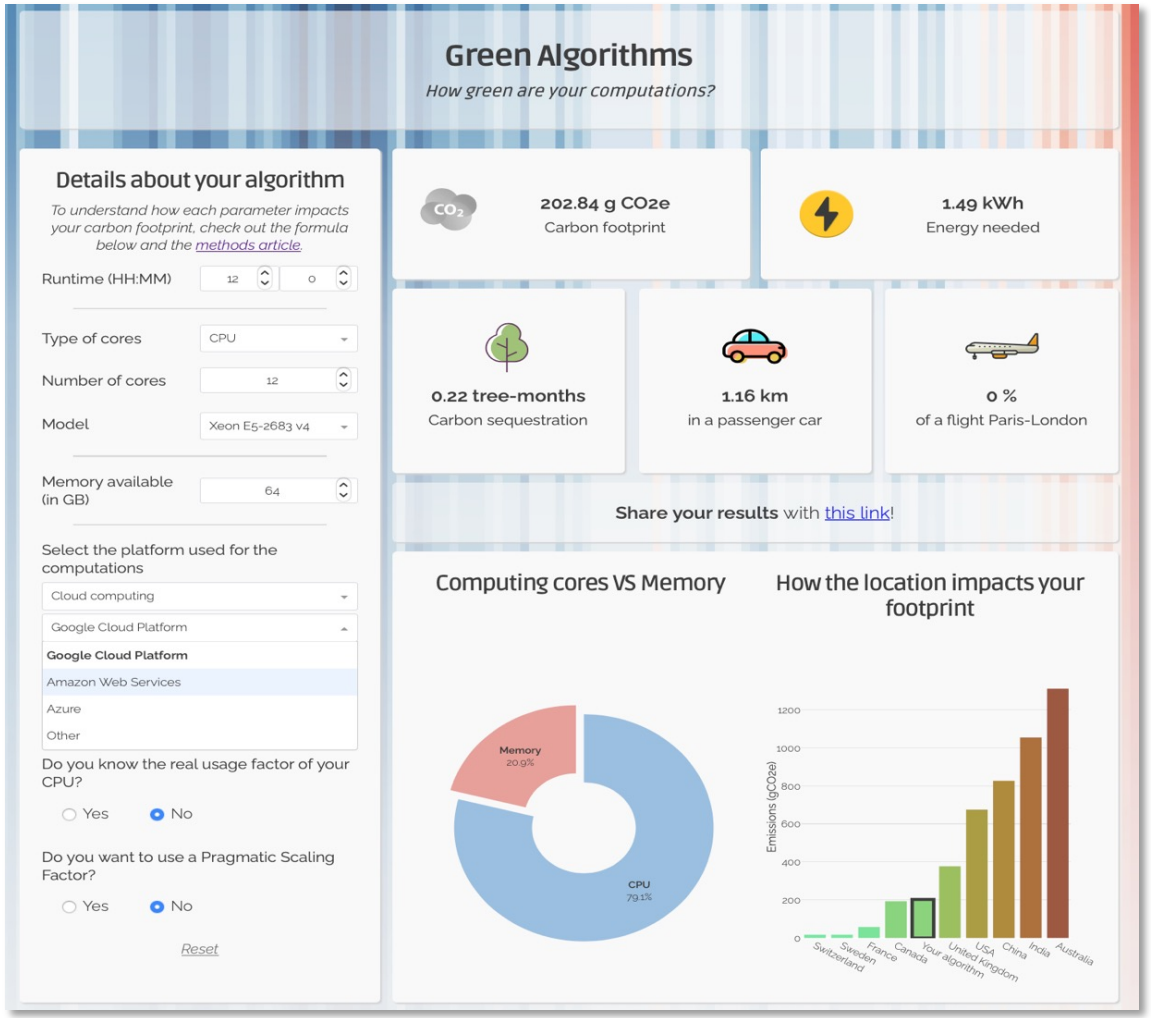
Devices, IoT, Cloud

Device Power Modes

Regional Energy Profile

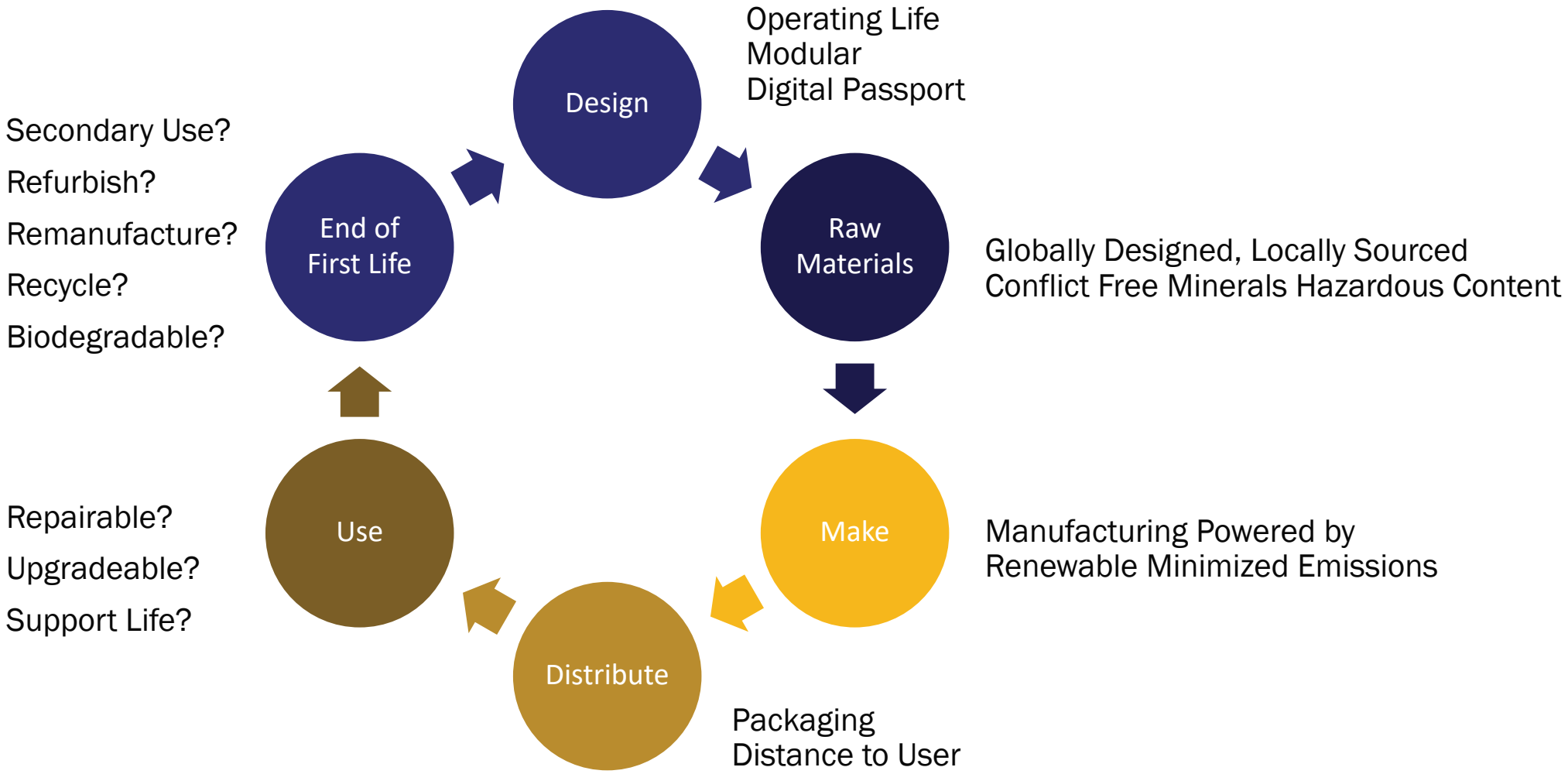
Awareness, Education, Standards, Reporting

Models Require Manual Input, Can Telemetry Reshape?



Source: http://www.green-algorithms.org

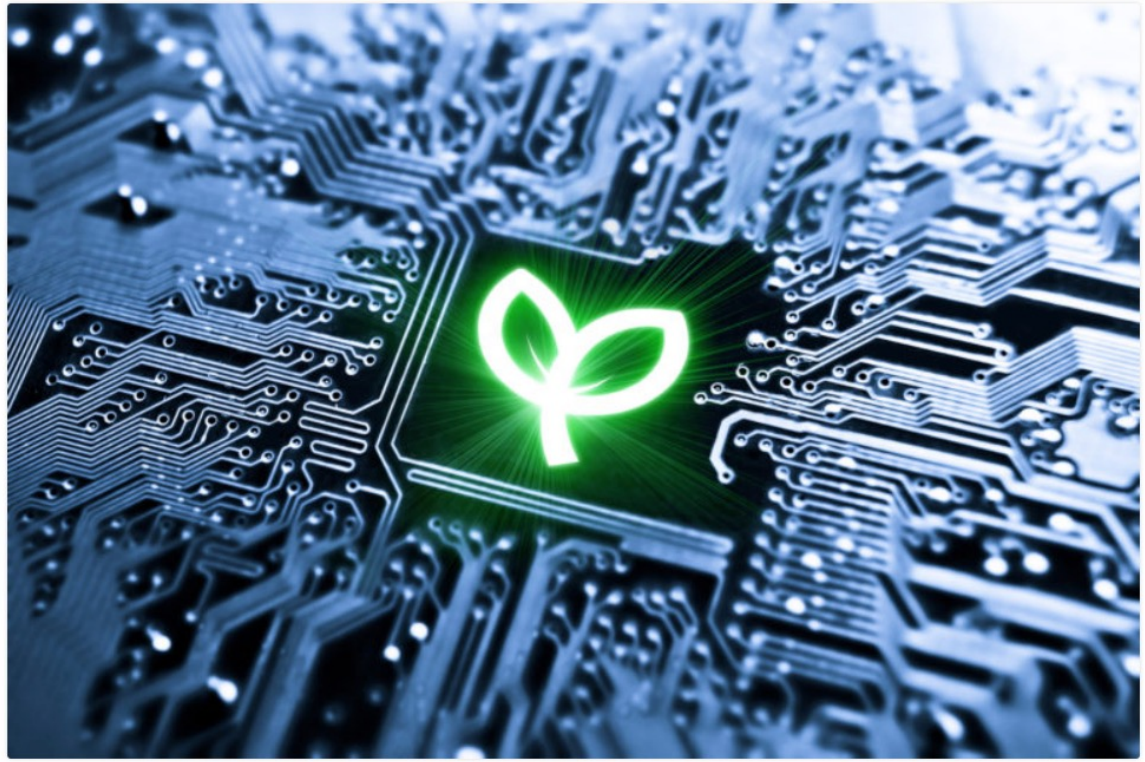
Adopting Circular Economy Principles Begins at Design



Modularity, Upgradeability, Repairability, Reusability….

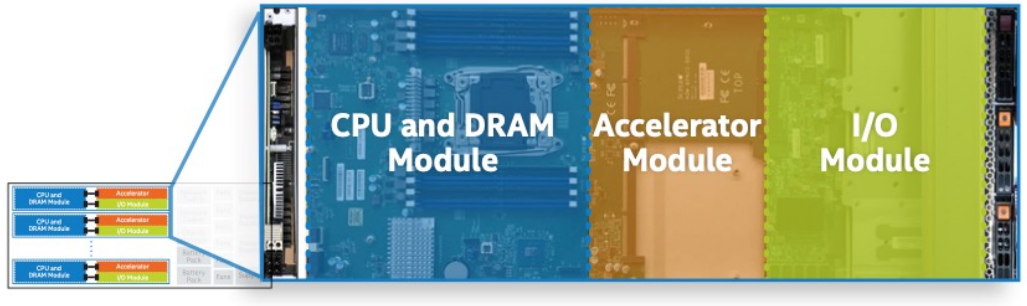
Intel Takes on E-Waste with Disaggregated Servers

Written by Shesha Krishnapura | September 1, 2021

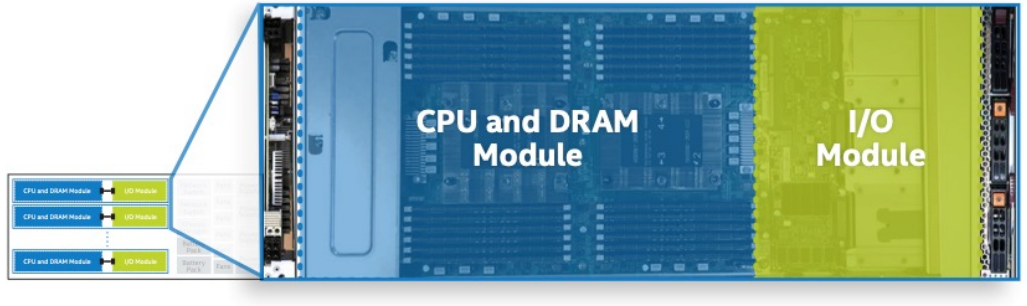


https://itpeernetwork.intel.com/ewaste-and-disaggregated-servers/

Example of a 1-Socket Disaggregated Server



Example of a 2-Socket Disaggregated Server



The disaggregated server architecture is characterized by CPU/DRAM module and a NIC/drives module that can be refreshed independently of each other and the rest of the server components.

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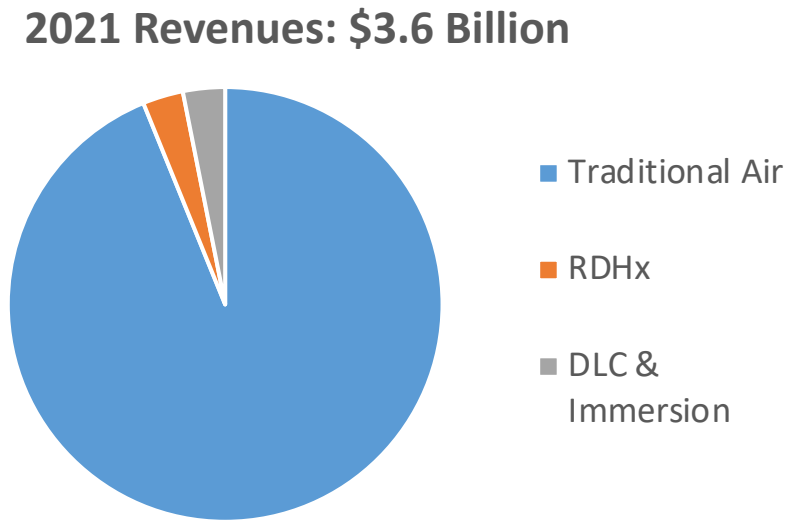
The Role of Thermal Management in Data Center Sustainability

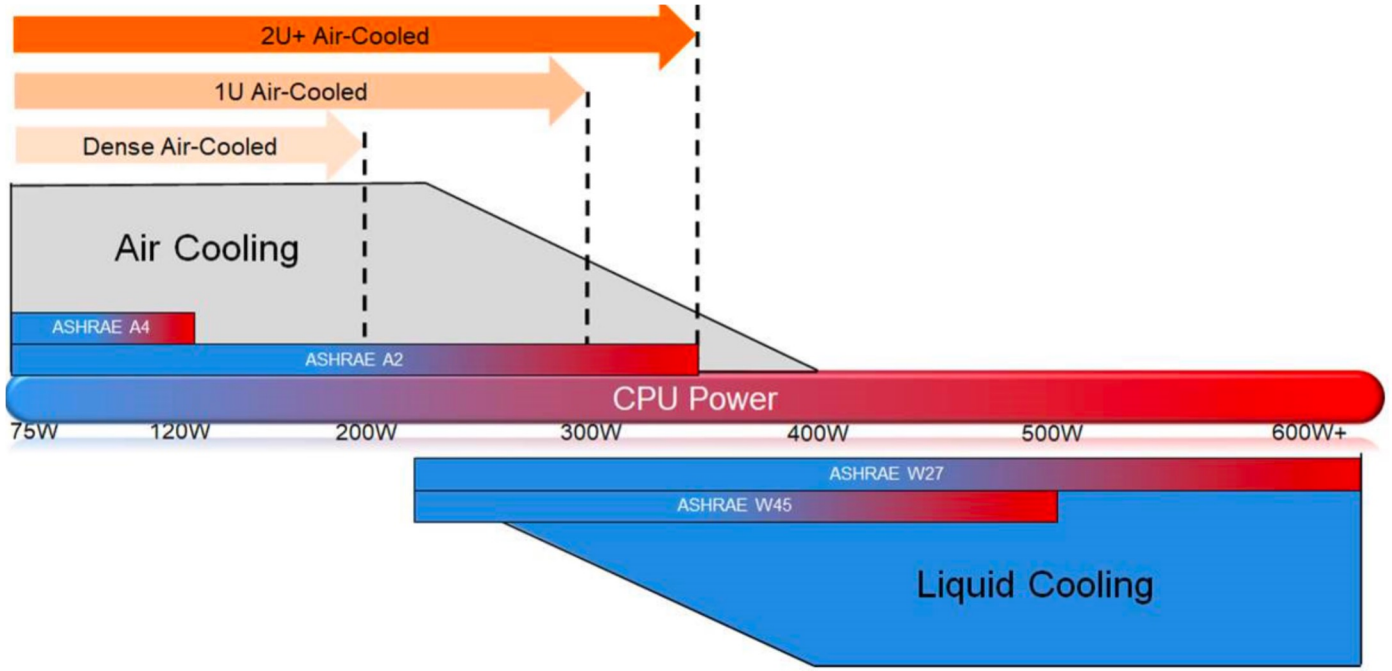
Data Center Thermal Management



Source: Dell'Oro Group, Data Center Physical Infrastructure, March 2022

- Data center thermal management accounts for 25 - 40% of a data centers operational energy consumption
- Air-based thermal management reaching its limits in efficiency and capability
- Liquids entering the white space in the form of RDHx, DLC (cold plates) and immersion

Chip Density is Causing A Thermal Management Evolution



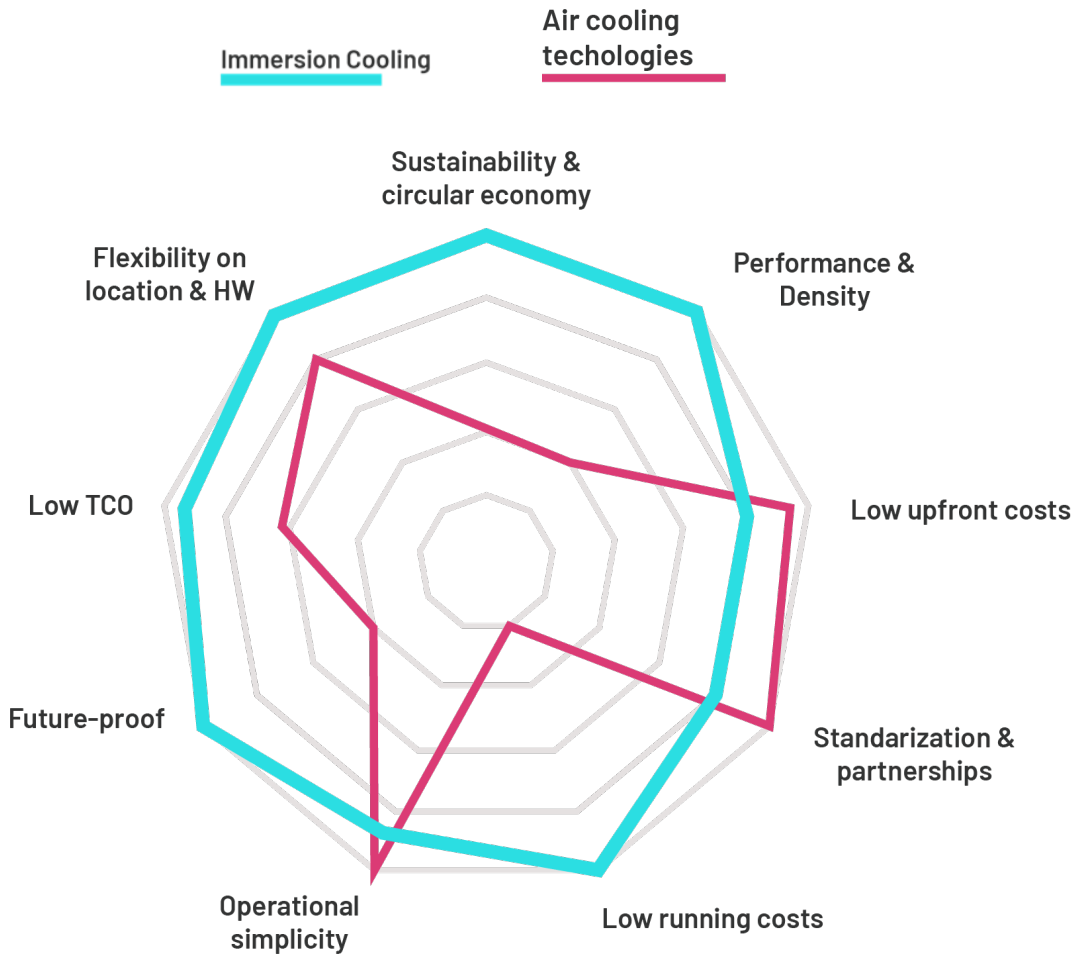
- Chip densities are rising
- 300 – 400 watts per chip becomes challenging to air cool
- Beyond 400 watts per chip air become inefficient and ineffective

Like the automobile almost a century ago; compute needs to move to liquid cooling!

source: ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) paper on the emergence and expansion of liquid cooling in mainstream data centers
https://www.ashrae.org/file%20library/technical%20resources/bookstore/emergence-and-expansion-of-liquid-cooling-in-mainstream-data-centers_wp.pdf

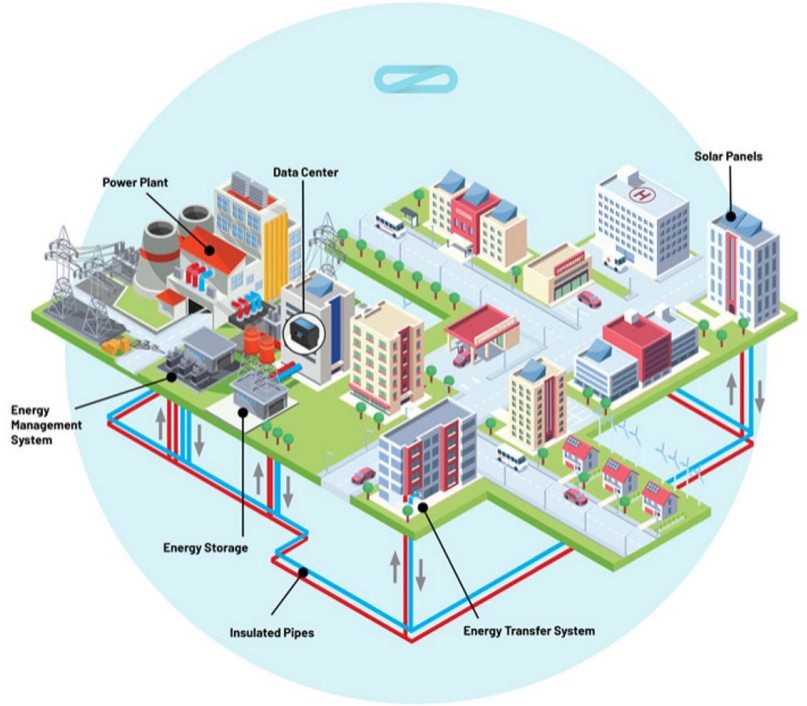
And Then on to Immersion Cooling

- Low upfront cost and TCO
- Future-proof technology
- Emerging standardization & partnerships help simplify deployments

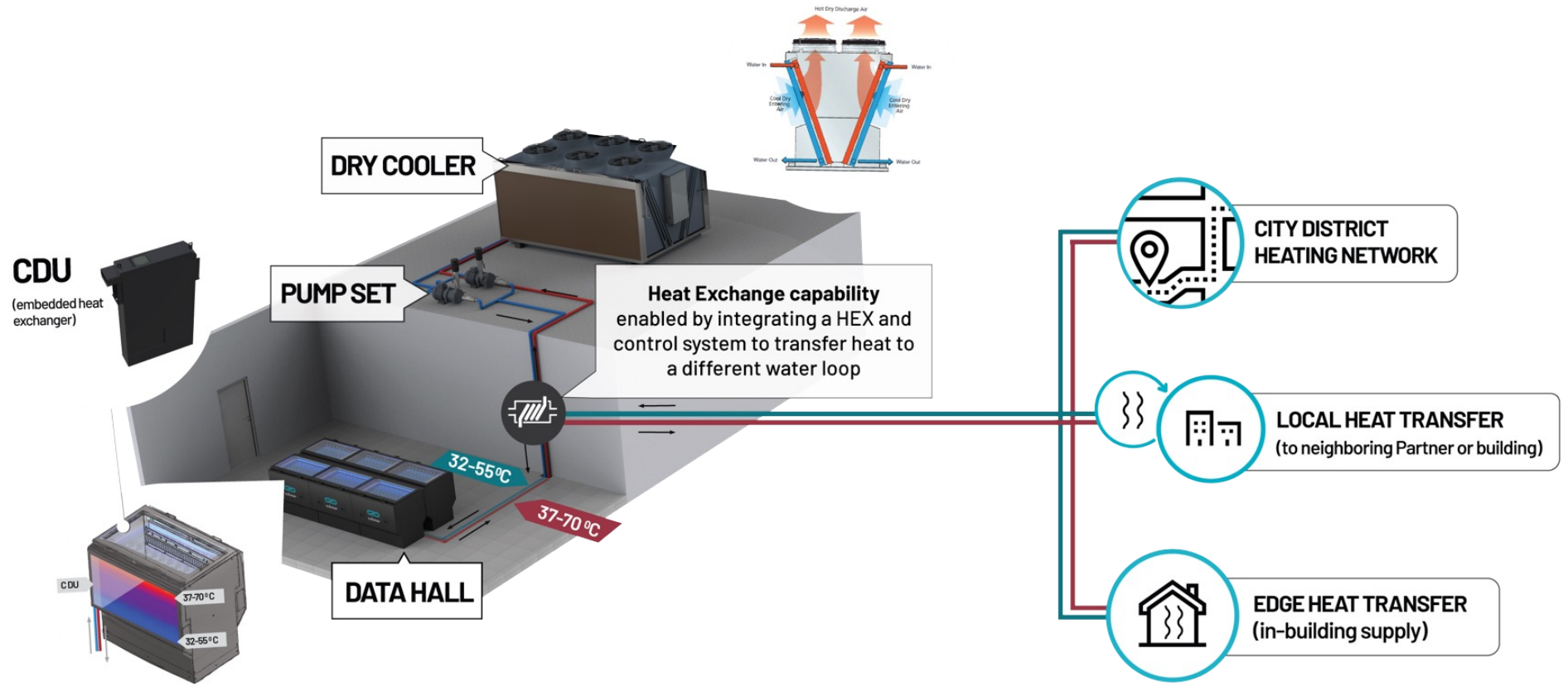


With Immersion Comes Heat Reuse

- **98% of the energy consumed by a datacenter is rejected in the form of heat into the atmosphere.**
- There's a massive opportunity-cost by **not re-using it.**
- Traditional air cooling technology **only allows to capture <5%** in the form of low-grade heat (max 25 ºC supply).



Immersion Cooling + Heat Reuse



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Heat Reuse Tech Demonstrator

Generalitat de Catalunya

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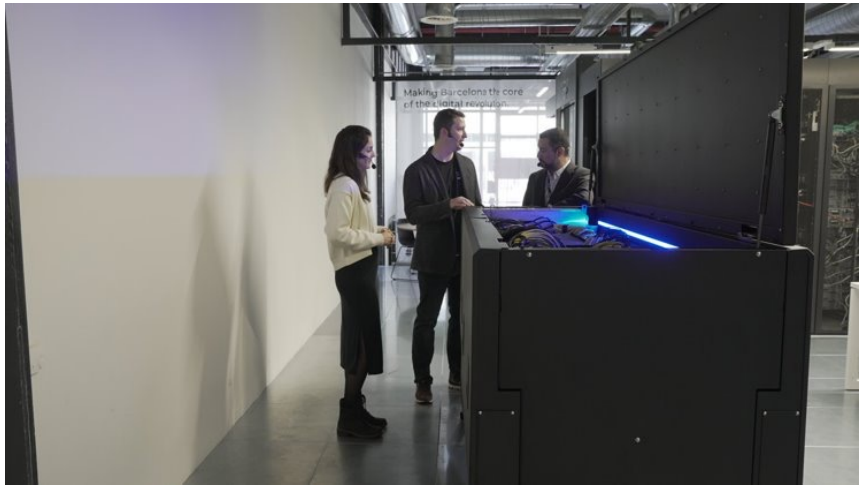
DFACTORY BARCELONA

Ecoenergies Barcelona

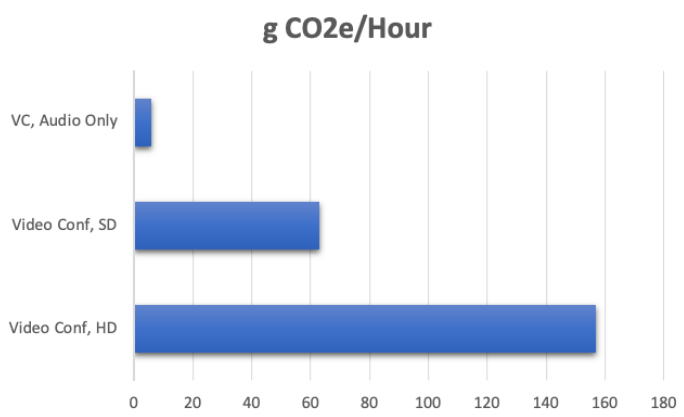
Heat Reuse Tech Demonstrator

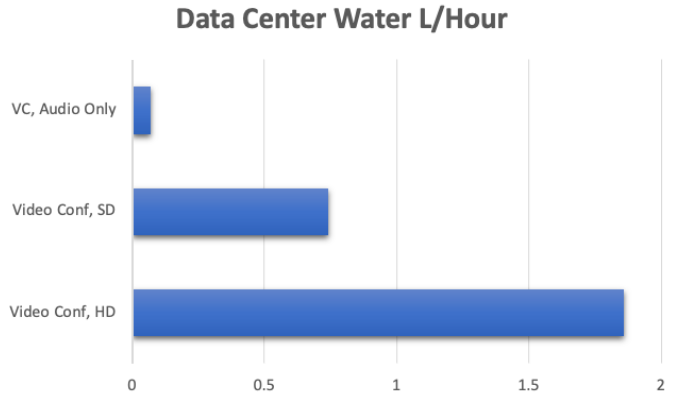


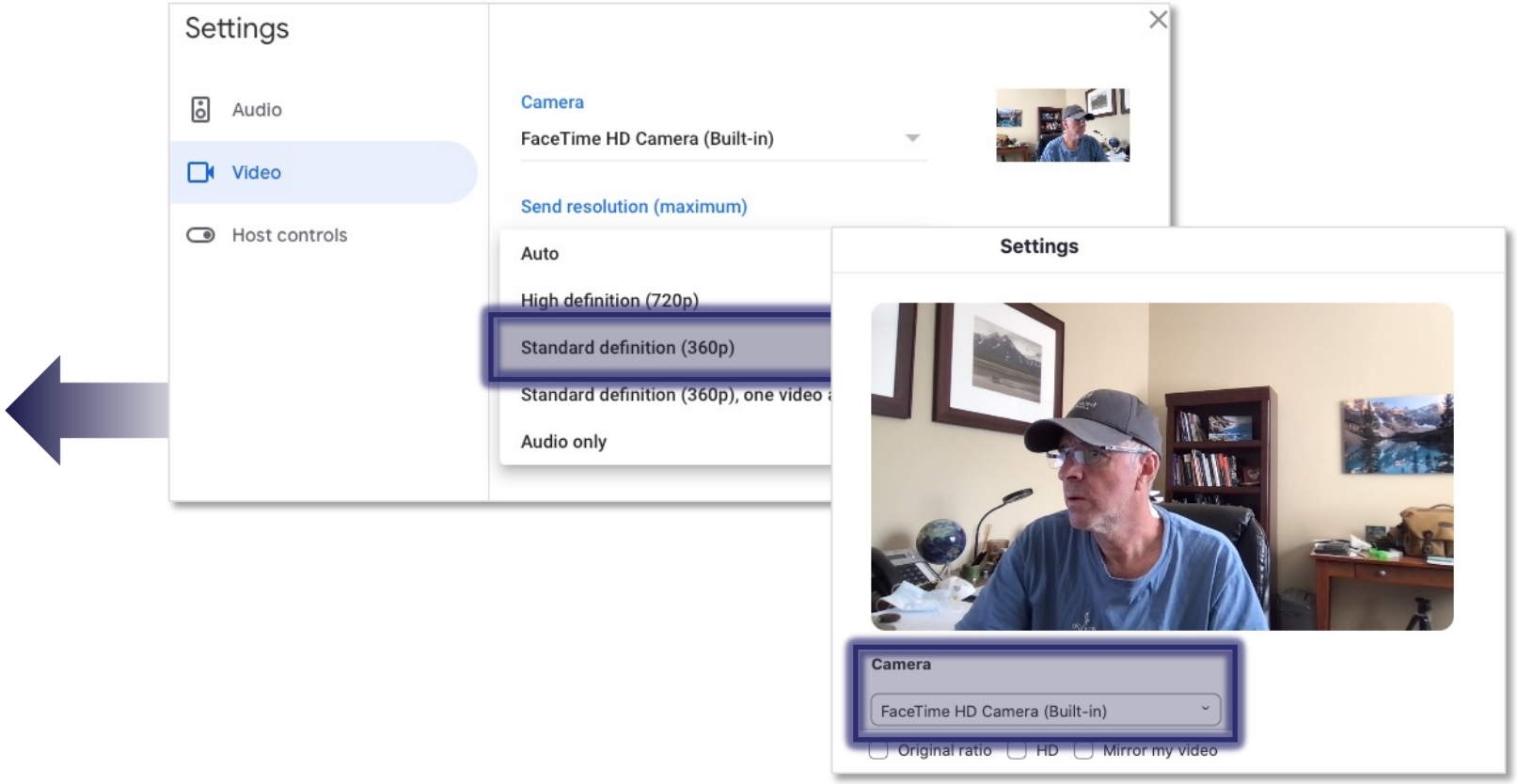
Modular DC with Heat Reuse

Videoconference Settings = Large differences in CO_2e

"If 1 million videoconference users were to make this change [turn off video], they would collectively reduce emissions by 9,023 t of CO_2e in one month, the equivalent emissions of powering a town of 36,000 people for one month via coal."







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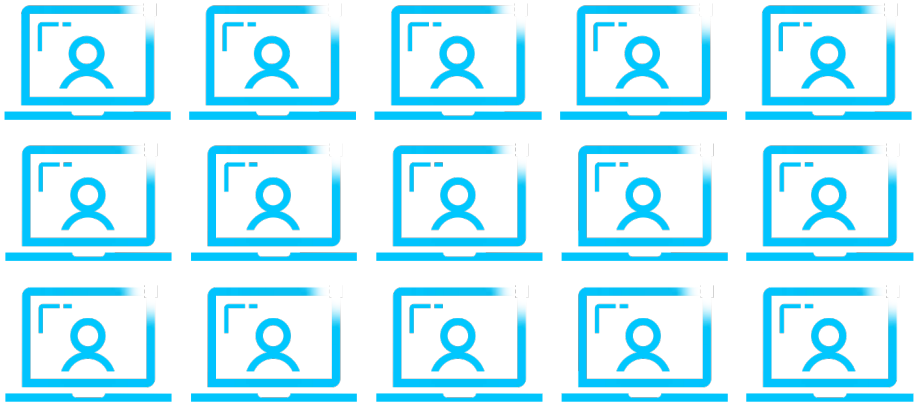
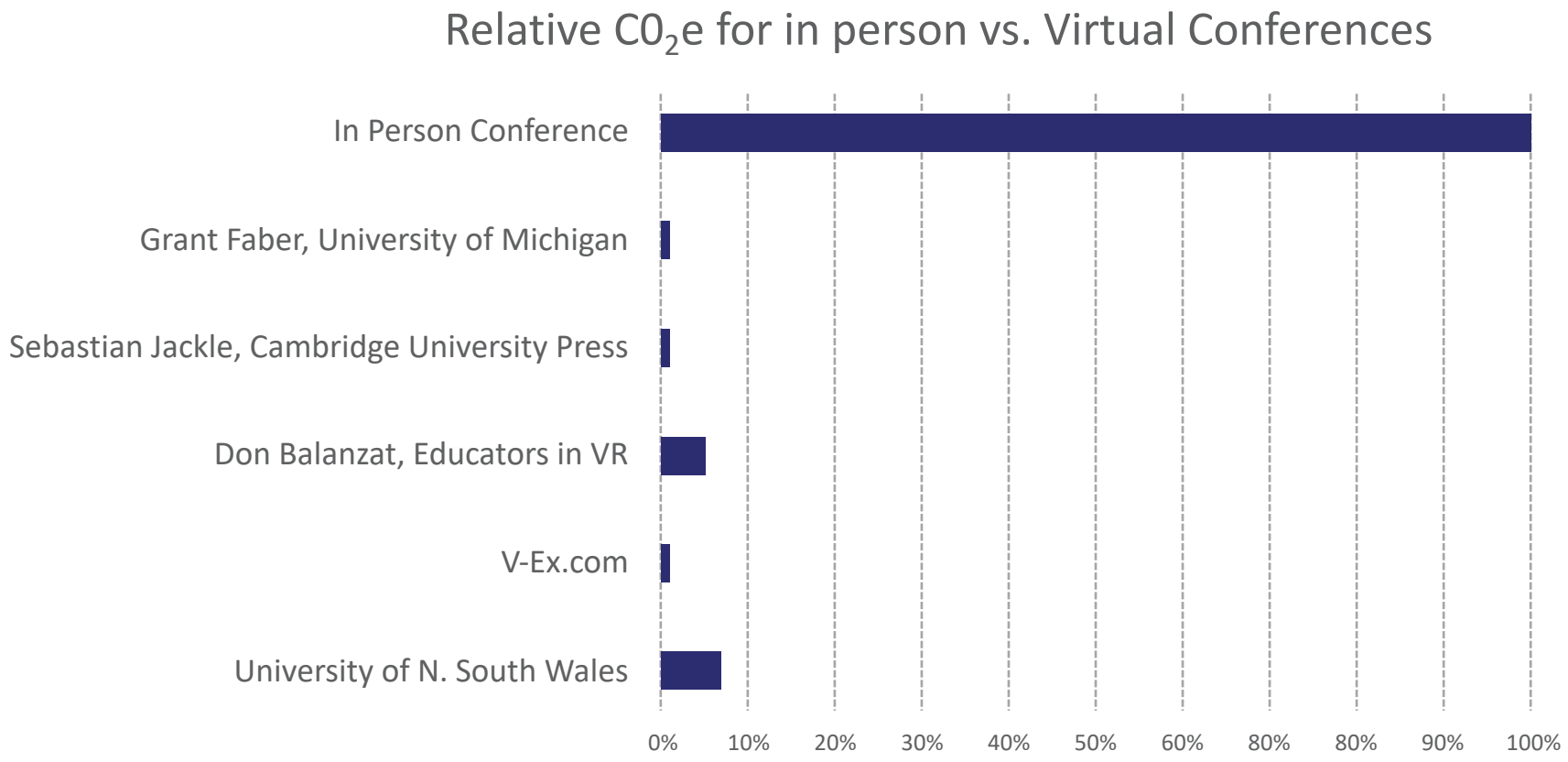


1 Million Videoconference Users With Video On

=

A Town of 36,000 People Powered by Coal

Yet Compute Can Offer a Positive Handprint Effect…



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The Practical Business Case for Data Center Sustainability

- Data center growth is booming
  - Capex CAGR forecast at 10% from 2022 – 2026
- Sustainability is a competitive advantage
  - Lower TCO of data center assets
  - New customers and revenue streams
  - ESG risk and growth opportunities
- Measuring sustainability, circularity & thermal management are a great places to start
  - Scope 3 GHG emission

Over the next 3 years, sustainability will impact your companies top and bottom line!

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Thank You

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