OCP Sustainability Whitepaper

Call for Climate Action & Circularity for Information and Communications Technology (ICT) Industry

Nov 2021

Audience: Value chain actors across Cloud Based Network, Data and Storage Service Centers in ICT & Data Center Industry

1. Introduction

The recent Intergovernmental Panel of Climate Change (IPCC) report, addressing the most up-to-date physical understanding of the climate system and climate change, makes it clear that human activity is changing the climate in unprecedented and sometimes irreversible ways, warning of increasingly extreme heatwaves, droughts and flooding as key temperature limits are broken.[1]

Technology, while holding the key to how we might solve many of these challenges, also contributes significantly to global warming via greenhouse gas (GHG) emissions through its physical goods and infrastructure. The Information Communication Technology (ICT) industry is on track to grow its share of global carbon emissions from today's ~4% to 8% by 2025, as the global internet traffic is expected to double to 4.2 trillion gigabytes.[2]

Rapid improvements in energy efficiency have helped to limit energy demand growth from data centers and data transmission networks, totalling about 2% of global electricity use in 2019.[3] Additionally, many technology leaders and hyper-scale operators have been at the forefront of setting ambitious renewable energy targets, helping to reduce the Scope 1 and Scope 2 impacts of their operations, and opening up clean and renewable energy markets for others. But the greenhouse emissions from the operational life of ICT equipment and data centers (e.g. Scope 1 & 2 emissions) is just one part of the larger picture. Data shows that depending on the device and the operator, emissions from the value chain (e.g. Scope 3) drive the majority of greenhouse gas emissions for hyperscalers and ICT manufacturers.[4]

The ICT industry must address the full lifecycle greenhouse gas impacts of its infrastructure, including that of its upstream and downstream supply chain (e.g. Scope 3), by embedding circularity and low-carbon design into both the ICT equipment and facilities that run them.

As an important part of the ICT industry, the OCP community has a responsibility to contribute towards reducing the environmental impact of the industry, and drive conversations within their influence to impact technologies deployed in the data centers. OCP's mission to design, use, and enable mainstream delivery of the most efficient designs for scalable computing in an open source way uniquely positions OCP to drive the adoption, experimentation, and innovation towards aggressive climate action and circularity.

[1] The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report: https://www.ipcc.ch/report/ar6/wg1/
[2] The Shift Project 2019 "The Climate Crisis: The Unsustainable Use of Online Video". https://theshiftproject.org/wp-content/uploads/2019/07/2019-02.pdf
[3] International Energy Agency. "Data Centres and Data Transmission Networks – Analysis." IEA, June 1, 2020. https://www.iea.org/reports/data-centres-and-data-transmission-networks.
[4] Gupta, U., Kim, Y.G., Lee, S., Tse, J., Lee, H.H.S., Wei, G.Y., Brooks, D. and Wu, C.J., 2020. Chasing Carbon: The Elusive Environmental Footprint of Computing. arXiv preprint arXiv:2011.02839.

2. Circularity is Key to Climate Action

Historically, supply chains have been optimized for linear consumption ("take → make → use → waste") in a single use model, with fragmented value chain actors focused on their particular stage of the life cycle. In the past decade, circular business practices have offered a radical alternative that gets to sustainability goals in a more holistic fashion, relying on three principles: Design waste out, keep products in circulation and in use for as long as possible, and regenerate natural systems in the process. The shift towards a circular economy will impact how we make decisions, treat existing assets, evolve business models, and adapt to increasingly complex regulatory landscapes. However, the shift to circularity is necessary, as it offers a mechanism that aligns businesses with the United Nations Sustainable Development Goals, including decent work and economic growth (SDG8), industry, innovation and infrastructure (SDG9), responsible consumption and production (SDG12), and Climate Action (SDG13).[5]

3. Barriers to Value Chain Circularity in the ICT Industry

The ICT industry faces significant challenges towards achieving value chain circularity and decarbonization. The barriers can be broadly defined under constraints in hardware and software design, lack of transparency and data availability, inefficiencies in materials recovery, and prohibitive security policies.

Hardware and software design not optimized for circularity: The linear model has focused primarily on optimizing for performance and cost, while less attention has been paid to other parts of the life cycle, such as end of life or reuse. This has presented a number of challenges to circularity, including:

- **Interoperability & Standardization.** There is a lack of interoperability and standardization across vendors. As a result, vendor support is not optimized to support circular business models. For example, products that rely on regular software updates and support to operate may still be in good operational condition after software support has ended, resulting in under utilization and unnecessary waste generation.
- **Serviceability vs. Extended Use and Reuse.** Products and data center facilities are designed and optimized for serviceability and repairability in the field; however, concepts of serviceability and repairability can sometimes contradict those of designing for life extension and sustainability. Designing components to be easily serviceable may lead to favoring the swapping out of entire sub-assemblies or components over identifying the true root cause, if typical diagnosing tools are not able to identify the issue(s).

[5] United Nations. "The 17 goals | sustainable development". https://sdgs.un.org/goals

Lack of transparency and data availability: There is lack of transparency of critical information to enable circularity across the value chain in a number of different areas, including:

- **Environmental impact metrics.** Understanding the environmental impacts across the full value chain is critical to making informed business decisions to reduce climate impact. For many companies, the information needed to understand a product's environmental impact is not readily available in a standardized format. Environmental impact areas include greenhouse gas emissions, water consumption and resource depletion.
- **Product information.** Product information is not easily nor consistently transferred between value chain actors to help enable circular business decisions. Examples include information to allow for recertifications, extension of warranties, or accurate determinations of resale value being shared between manufacturers, first users and consequent re-users.
- **Compliance.** With an evolving landscape of regulatory requirements on hazardous substances, there is no standard platform for exchanging compliance documentation and material information from end of first use to second use.

Inefficient component and material recovery processes: Lack of consideration towards design for circularity in its entirety (i.e. beyond serviceability and repairability) can prevent ease of component extraction without the use of manual steps. One level down, materials can often be fused, mixed, and combined together to make mechanical separation extremely challenging. This becomes a financial disincentive for extending product life, refurbishment, or separation into single materials streams for recycling. Altogether, these challenges make salvaging components and materials from electronic waste inefficient economically and with respect to material recovery.

Data Security: Organizations go to great lengths to secure sensitive data, and fundamental to any cloud service providers' business is the customer promise that their data is secure in the cloud. It is therefore common to physically destroy data bearing devices (DBDs), despite advanced encryption and security features on devices, and near zero risk to data leaks. Physical destruction, commonly including punching and shredding DBDs, eliminates the ability to reuse the devices or recover sub-components, such as rare earth magnets.

4. Industry Opportunity and OCP Focus Areas

The ICT sector is taking steps towards meeting the commitments under the Paris Agreement by limiting warming to 1.5 degrees C above pre-industrial levels. Many OCP technology leaders have already made science-based commitments for 2030 and 2045. To decouple the industry's predicted growth from its environmental impact, the hyperscale and colocation data center industry will need to accelerate existing and future sustainability strategies and solutions to reduce overall environmental impact. For Scope 1 (direct) and Scope 2 (indirect from purchased electricity, heat, steam and cooling), strategies include:

- Continuing to focus on energy and water efficiency, specifically related to the facility-level cooling system
- Implementing local or district-level heat recovery and reuse solutions, taking into consideration implications around water consumption and water quality

- Waste reduction
- Electrifying transportation fleet
- Electrifying onsite fossil fuel processes such as steam
- Procuring of renewable energy
- Aligning of workloads to current and forecasted renewable energy capacity (e.g. run faster, defer, or pre-do an action when it is sunny or windy)
- Investing in carbon capture and storage technology

For Scope 3 (indirect value chain), strategies include:

- Engaging suppliers on on reducing environmental impact, such as resiliency or greenhouse gas emissions reduction, across value chain
- Enabling extended life and reuse of hardware and components to the fullest extent
- Leveraging lower carbon shipping and logistics
- Deploying responsible packaging solutions, including using recycled & renewable materials, reusable packaging, and minimizing packaging weight
- Using low carbon materials for both products and buildings; for example, utilizing low-carbon construction materials such as wood, instead of steel and concrete

Acknowledging the progress made in reducing organization operational impact (e.g. Scope 1 & Scope 2 emissions), OCP believes it can have the most effective and immediate impact on value chain impact by focusing on embedding circularity from the early life cycle/design stages across the range of ICT infrastructure, including building facilities and ICT equipment. The following are key interventions leveraging the strengths of OCP that we will focus on:

Education & awareness: OCP will develop a set of guidelines to help organizations along their journey towards greater sustainability and circularity. These guidelines will touch on all phases of the life cycle, including materials selection, design, manufacturing, use phase, and reuse.

Circular design standards: Design decisions affect the downstream circularity and environmental footprint of the device. The industry will need to design computing equipment and data center facilities with the end of product and building life in mind to maximize life extension, reuse, and recyclability, which will in turn reduce greenhouse gas emissions and waste.

Transfer of Ownership standards: To successfully establish a circular business model for Data Bearing Devices (DBDs), the ICT industry will require trust that storage vendors properly implement advanced security and device encryption capabilities by designing and certifying to government standards like Federal Information Processing Standards (FIPS). It will require commitments from OEMs, hyperscalers, and their customers to promote safe and secure reuse of IT equipment. OCP is developing standards around the transfer of ownership, going beyond the user data - to device firmware and hardware security features, to provide circularity and secure initializing, accepting, and relinquishing ownership.

Standardized metrics and promotion of data transparency across value chain: OCP will encourage the industry to leverage existing standards, tools, and best practices for understanding environmental impacts and to promote greater disclosure of these impact metrics for OCP contributions. Where gaps are identified, OCP will help spur the

development of metrics to improve efficiency and reduce greenhouse gas emissions associated with data center infrastructure. In the spirit of open source, OCP will continue to encourage information transparency in order to enable reuse of products and components.

Supporting the evolution of greenhouse gas accounting practices to align with circularity: OCP can leverage its membership and industry partnership voice to support development of carbon accounting practices appropriate for circular economy practices. Examples include measuring and reporting on the emissions reductions associated with optimizing board and chip designs, shifting to recyclable, bio-based or reusable packaging, business models such as repair and resale and end of life materials management, among other circular economy initiatives.

5. Conclusion and Call to Action

Tackling these industry challenges will be critical to achieving the climate action needed to minimize the impacts of climate change and keep warming below 1.5 degrees C.

OCP recognizes the economic value and innovation opportunity that designing and operating circular and sustainable systems provides for our industry. OCP is committed to driving the transition towards sustainable development, which requires an integrated approach considering environmental concerns along with economic development.

Accessing the power of open source and industry collaboration, the OCP Sustainability & Circularity workstreams welcomes your engagement to contribute towards increasing industry education and awareness, developing design standards for circularity, promoting standardized metrics, and utilizing our industry voice to advocate and influence global standards. Please join us on making sustainability and circularity a priority, a contact decision criteria and a success factor for your companies in the following specific ways:

- Join the sustainability workstreams to foster further development of sustainability ideas taking into account your company perspectives.
- Promote OCP Sustainability work within your organization to create awareness by sharing this paper with your company's sustainability teams or those working on sustainability, circuality and/or carbon neutrality targets and projects.
- Provide periodic input into the OCP sustainability direction via surveys which OCP Foundation plans to conduct from time to time.

6. Acknowledgments

The following members are part of the two sustainability work streams and have directly contributed to this whitepaper in writing and ideation. The names are listed in the alphabetical order of last names, and *denotes the 2021 sustainability workstream co-chairs if you want to contact the co chairs with specific ideas.

Frances **Amatruda**, Meta
Fahmida **Bangert**, ITRenew*
Mark **Dansie**, Open Compute Project
Jonmichael **Hands**, Chia Network
Dharmesh **Jani**, Meta*
Kari **Lio**, Microsoft
John **Miranda**, Intel*
Jordan **Tse**, Meta*
Kesava **Viswanathan**, Microsoft

7. License

8. References

The Circular Design Guide (IDEO): https://www.circulardesignguide.com

The Cradle to Cradle Products Innovation Institute (William McDonough and Dr. Michael Braungart, 1992): https://www.c2ccertified.org/about

Lyle Center for Regenerative Studies: https://env.cpp.edu/rs/rs

Cradle-to-Cradle: http://www.cradletocradle.com

Circular Design: Designing for Sustainability (European): http://circulardesigneurope.eu

Braungart, Michael, McDonough, William and Hoye, Stephen: "Cradle to Cradle: Remaking the Way we Make Things":
https://www.amazon.com/Cradle-Remaking-Way-Make-Things/dp/1400157617

Ernst & Young, "Modular Product Design":
https://www.ey.com/Publication/vwLUAssets/ey-modular-product-design-reducing-complexity-increasing-efficacy/$FILE/ey-modular-product-design-reducing-complexity-increasing-efficacy.pdf

9. About the Open Compute Project Foundation

The Open Compute Project Foundation is a 501(c)(6) organization which was founded in 2011 by Facebook, Intel, and Rackspace. Our mission is to apply the benefits of open source to hardware and rapidly increase the pace of innovation in, near and around the data center and beyond. The Open Compute Project (OCP) is a collaborative community focused on redesigning hardware technology to efficiently support the growing demands on compute infrastructure. For more information about OCP, please visit us at http://www.opencompute.org