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BEREC Summary Report on External Workshop on digital services ecodesign for greener networks and ICTs

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Foreword

As part of its annual work program, on 30 April 2025, BEREC organised an external workshop to deepen its understanding of the means to implement ecodesign principles to digital services for greener networks and ICTs. The aim was to identify the existing tools, frameworks, and best practices that enable the development of digital services that are sustainable by design. This workshop gathered a number of representatives from stakeholders: regulatory public authorities, agencies, end-user associations, academics, market players and environmental specialists to build a comprehensive overview of existing initiatives and stakeholder perspectives on digital services' ecodesign.

The workshop included a presentation from the European Commission (EC) delivered by Thomas Ebert, Seconded National Expert at DG Connect, presentations by the leading academic researchers Prof. Lynn Kaack (Hertie School) and Vlad C. Coroamă (Roegen Centre for Sustainability), presentations by the ICT experts Anna Zagorski (German Environmental Agency), Susanna Kallio (Nokia), Leonardo Veneziani (CCIA), Asim Hussain (Green Software Foundation) and Ana Maria Galindo (Ericsson). The workshop concluded with a panel discussion moderated by Bianca Sofian (Cullen International). A video recording of the workshop has been published on BEREC's public YouTube channel for a wider outreach.[1]

The following summary report provides an overview of the workshop's presentations and main content.

1. Welcome by the BEREC Chair 2025

The BEREC Chair 2025, Mr Robert Mourik, Commissioner of the Irish Commission for Communications Regulation (ComReg) opened the workshop, welcomed the participants and briefly presented the importance of the topic for BEREC.

Mr Mourik noted that in these turbulent times, environmental crisis is not receiving enough attention, therefore, it is important for BEREC to keep the focus on environmental sustainability alive and understand how Europe could lead the way in pursuing a greener future.

According to research, the ICT sector is responsible for approximately 2% to 4% of global greenhouse gas (GHG) emissions which, without a substantial change, could reach 14% by 2040,[2] especially considering the growing deployment of innovations, such as AI, and the energy-intensive extraction and processing of raw materials used in digital infrastructure.

Mr Mourik stressed the importance for the regulators and sector players to continue addressing environmental sustainability questions and keep raising awareness within society.

[1] https://youtu.be/vJz6hFIrd1w?si=jyWcXq5p691_gtzm
[2] BEREC Report on Sustainability: Assessing BEREC's contribution to limiting the impact of the digital sector on the environment

For the ICT sector, this means promoting greener networks and services and positively contributing to the European climate objectives[3].

The workshop on digital services' ecodesign for greener networks and ICTs builds on previous work done by BEREC over the last years, focusing on themes such as: end-user empowerment, sustainability indicators and infrastructure sharing.

Mr Mourik noted that even though sustainability is not currently mentioned among the core objectives of BEREC's work, this may change in the near future. He added that from a regulatory perspective, there are several new EU initiatives in the area, namely the forthcoming EU Code of Conduct for sustainable telecommunication networks which cites the ecodesign initiative and the new energy labelling and ecodesign requirements[4,5] for the ICT sector. Similarly, the White Paper "How to master Europe's digital infrastructure needs?"[6] published by the EC, extensively mentions environmental concerns which are part of the ongoing discussions in view of the new framework for telecom sector for which EC is preparing a new proposal to be published by the end of 2025[7]. One of the questions addressed in the White Paper is whether environmental objectives could be part of the target objectives for the sector. According to Mr Mourik, another equally important discussion is BEREC's role in empowering end-users so that they can make well-informed choices and choose the most environmentally sustainable products and services with confidence.

Mr Mourik reiterated that collaboration between member NRAs and dialogue with all relevant stakeholders across the digital ecosystem are of utmost importance for BEREC as it ensures a more comprehensive understanding of the issues and encourages a collective effort to increase environmental sustainability.

Finally, Mr Mourik noted that insights shared during the workshop will feed into BEREC's work towards sustainable digital regulation and the outcomes of the workshop will strengthen BEREC's common understanding of the underlying problems and help to identify possible solutions.

[3] https://climate.ec.europa.eu/eu-action/climate-strategies-targets_en
[4] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast, http://data.europa.eu/eli/dir/2023/1791/oj
[5] Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC
[6] https://digital-strategy.ec.europa.eu/en/library/white-paper-how-master-europes-digital-infrastructure-needs
[7] https://joint-research-centre.ec.europa.eu/projects-and-activities/green-and-sustainable-telecom-networks_en

2. Introduction by the Co-Chairs of the BEREC Sustainability working group

Maria Sarantopoulou (EETT) and Tom Nico (Arcep), Co-Chairs of the Sustainability working group (SUS WG), presented some facts related to the digital services ecodesign of greener networks and ICTs.

Ms Sarantopoulou highlighted that, according to the UNCTAD Digital Economy Report[8] published in 2024, digital technologies were responsible for up to 3.2% of GHG emissions in 2020 and accounted for 6% to 12% of global electricity use. Moreover, manufacturing, using and disposing of a single smartphone may require up to 70kg of raw earth materials. To address potential increase in these figures, BEREC is currently working on several initiatives which contribute to adopting a more holistic and harmonised understanding among stakeholders while raising end-user awareness of environmental sustainability importance in the ICT sector.

Ms Sarantopoulou noted that, in order to align with broader policy efforts and contribute to ICT-related goals of the EU Green Deal and the UN Agenda 2030, BEREC has included environmental sustainability in its strategy for 2021 – 2025 and its annual Work Programmes. Through the Sustainability working group, established in 2020, BEREC published its first report "Assessing BEREC's potential contribution to limiting the impact of the digital sector on the environment"[9] in 2022.

In this context, the report identified four key areas where BEREC could make a meaningful contribution to environmental sustainability. The first identified priority was the lack of environmental data availability and definition of common sustainability indicators for the sector. Other priorities include exploring how existing regulatory tools can be adapted or expanded to support sustainability goals, promoting sustainable practices among digital players, and fostering a stronger commitment to empower end-users.

In 2023, BEREC responded to the first priority with its report "Sustainability Indicators for Electronic Communications Networks and Services"[10]. In the report, BEREC emphasized the importance of robust common sustainability indicators to encourage the collection and publication of comparable and standardized data. It also underlined the lack of available data on the environmental impact of ICTs, especially with respect to telecom components.

The second priority area concerns the existing regulatory tools outlined in the European Electronic Communications Code (EECC). To build knowledge and enhance common understanding, BEREC produced the report "Infrastructure Sharing as a lever for ECN/ECS Environmental Sustainability" published in June 2025. Additionally, BEREC provided input to

[8] https://unctad.org/publication/digital-economy-report-2024
[9] https://www.berec.europa.eu/system/files/2022-07/10282-berec-report-on-sustainability-assessing_0_3.pdf
[10] https://www.berec.europa.eu/system/files/2023-10/BoR%20%2823%29%20166%20Final%20Report%20on%20sustainability%20indicators%20for%20ECN%20ECS.pdf

the European Commission's public consultation on the needs of digital infrastructure and its ongoing work on infrastructure sharing.

In response to the third priority, related to promoting of eco-conscious practices of digital players, BEREC published in 2024 a high-level position on the sustainability implications of AI and virtual worlds calling for resource efficiency and life cycle awareness for design and deployment of such technologies.

Finally, to address the fourth priority related to end-users' empowerment, BEREC has launched a communication campaign and, in 2024 published a report on "ICT sustainability for end-users: Empowering end-users through environmental transparency on digital products"[11].

Ms Sarantopoulou emphasised that, in order to properly assess the environmental footprint of digital technologies, it is essential to consider the entire value chain as a whole, given the interdependence between devices, data centres and networks, which are all interrelated since they support the use of digital services.

Mr Tom Nico presented an iconography depicting a framework for assessing life cycle environmental impacts of digital services including examples of the main ICT footprint drivers for different ICT services. According to the International Energy Agency (IEA), electricity demand from data centres worldwide will double by 2030 reaching around 945 TWh[12].

Mr Nico noted that AI is considered to be the primary driver for the increased energy consumption in the future and AI-optimised data centres will more than quadruple by 2030. In 2024, the global electricity consumption by data centres is estimated at 415 TWh or 1.5% of all sectors combined and over the last 5 years, there was an average increase of 12% per year.

BEREC acknowledges that both device manufacturing and energy consumption from digital infrastructures continue to rise due to increase in digital usage. As such, sustainability is essential for future technological acceptability and availability of ICT. Therefore, collective efforts and actions are needed to promote 'sustainable-by-design' ICTs and especially through the ecodesign of digital services.

[11] https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-ict-sustainability-for-end-users-empowering-end-users-through-environmental-transparency-on-digital-products
[12] https://iea.blob.core.windows.net/assets/40a4db21-2225-42f0-8a07-addcc2ea86b3/EnergyandAI.pdf

3. Presentation from the European Commission, Ecodesign for Sustainable Products Regulation (ESPR) and Digital Product Passport (DPP), Thomas Ebert (DG Connect)

Mr Nico opened the session of external presentations and welcomed the first speaker, Mr Thomas Ebert, Policy Analyst Seconded National Expert at the DG Connect.

Mr Ebert presented some findings from the Global Resources Outlook 2024[13] which show that the triple planetary crisis (biodiversity loss, pollution and climate change) are strongly linked to extraction and processing of raw materials. He pointed out that according to the World Economic Forum, half of the top 10 global risks for the 10-year period (2025-2035) are related to the environment[14].

One way to reduce the resource consumption is circular economy, meaning that practices such as repair, reuse and recycling can increase value and lifetime of a product and reduce the necessity to extract more earth materials. Circularity requires cooperation among different actors: manufacturers, retailers, repairers and recyclers. Circular economy is also one of the top priorities listed in the DG Environment's (ENV) strategic plan for the period 2020-2024.[15]

Mr Ebert presented the framework legislation: Regulation on ecodesign for sustainable products (2024/1781)[16] which consists of product specific Delegated Acts which state requirements for a specific product group. Adoption of such Delegated Acts requires multiannual working plans setting out priorities based on dedicated impact assessment, which are then discussed among different stakeholders in an Ecodesign Forum.

In April 2025, the EC published the new Ecodesign for Sustainable Products and Energy Labelling Working Plan 2025-2030[17] which builds on the previous working plan 2022-2024 and includes final products, intermediate products and horizontal requirements.

Mr Ebert noted that the new requirements for Ecodesign and energy label which will apply to mobile phones and tablets[18] available on the EU market from 20 June 2025, will target the issue of device obsolescence. According to estimates based on a 2019 report by the European Environmental Bureau (EEB)[19], extending the lifetime of all smartphones in the EU by one year would save 2.1 million tonnes of CO_2 per year by 2030, equivalent to taking 1 million cars off the road.

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[13] https://www.resourcepanel.org/reports/global-resources-outlook-2024
[14] https://www.weforum.org/publications/global-risks-report-2025/digest/
[15] https://commission.europa.eu/system/files/2020-10/env_sp_2020_2024_en.pdf
[16] https://eur-lex.europa.eu/eli/reg/2024/1781/oj
[17] https://environment.ec.europa.eu/document/5f7ff5e2-ebe9-4bd4-a139-db881bd6398f_en
[18] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2023_214_R_0002&qid=1693469508416
[19] EEB (2019), Coolproducts Don't Cost the Earth, full report: https://eeb.org/wp-content/uploads/2019/09/Coolproducts-report.pdf

Mr Ebert highlighted that many Directorates-General (Connect, DIGIT, ENER, ENV, GROW, JRC, TAXUD) are actively contributing to the design and deployment of the Digital Product Passport (DPP). Mr Ebert stated that expected benefits of the Digital Product Passport are:

- The possibility to track raw material extraction/production and support due diligence efforts, enable manufacturers to link information to products (e.g. products' digital twins, embedding all the information required),
- Tracking the life cycle of a product, enabling services related to its remanufacturing, reparability, re-use/re-sale/second-life, recyclability and new business model,
- Benefits to public authorities, policy makers, market surveillance authorities and customs authorities by making reliable information available,
- Allowing citizens to have access to relevant and verified information related to the characteristics of the products they own or are considering to buy/rent (e.g. using apps able to read the identifier).

Data to be included in the DPP will be product group-specific and identified in the Delegated Act. It may include information/data on: technical performance, environmental sustainability performance, circularity aspects (durability, reparability), legal compliance, product-related information (e.g. manuals, other labels).

4. Presentation from academics: focus on the environmental footprint of AI, an example of growing digital services, Prof. Lynn Kaack (Hertie School)

Ms Sarantopoulou welcomed the second speaker, Prof. Lynn Kaack, Assistant Professor at Hertie School of Governance and Chair of Climate Change AI.

Prof. Kaack presented findings from the recent Intergovernmental Panel on Climate Change. (IPCC) Sixth Assessment Report [20] showing that the currently implemented policies result in projected emissions that lead to warming of 3.2°C with a range of 2.2°C to 3.5°C. In order to limit warming to the target goals of 1.5°C to 2°C, rapid and significant GHG emission reduction is needed.

Prof. Kaack noted that given the disruptive nature of AI, there are various opinions and theories of how it may impact the environment. In order to understand how AI affects GHG emissions, researchers, including Prof. Kaack, have developed a framework[21]. At the core of this framework are computing-related impacts (i.e. direct impacts) such as energy consumed for AI use and training, production of hardware and operation of data centres. The second

[20] https://www.ipcc.ch/report/ar6/syr/summary-for-policymakers/
[21] https://www.nature.com/articles/s41558-022-01377-7

level of impacts are application-related impacts (indirect impacts) classified by the project scope in different sectors where they can increase or decrease emissions through different applications. The third level of impacts are system-level impacts focusing on higher and larger effects, e.g. rebound effects, changing consumer behaviour or political opinion.

Prof. Kaack noted that computing-related impacts consist of operational emissions, which result from the energy consumed during computation (depending on the data centre efficiency and type of energy used) and embodied emissions resulting from production and end-of-life of hardware (depending on mining, production, transportation, disposal and recycling of hardware). She remarked that emissions discussions around AI often focus only on single model or use-phase. In reality, most energy is consumed during the model development phase – however, this development phase is carried out at the very beginning of a foundation model's journey, and not often repeated. Subsequently, the model training phase can be done frequently or infrequently. The model inference phase (use phase) is done very frequently and its energy consumption actually outweighs energy consumption related to the training phase over time.

She highlighted that important findings show generative tasks (e.g., generation of text, picture or video) are more energy intensive than discriminative tasks (i.e., identifying patterns in order to classify new inputs). Using general-purpose AI (GPAI) for discriminative tasks is more energy intensive compared to task-specific models and tasks including images are more energy intensive compared to tasks including text.

Prof. Kaack noted that AI is currently mostly used in service development and operations in tech sector, marketing and financial service operations rather than in the energy sector. Extensive AI use may increase productivity and demand that could lead to increased GHG emissions as a rebound effect.

Prof. Kaack observed that many applications of AI currently remain in conceptual phase and are not yet marketed. Moreover, environmental benefits and costs need to be understood better and therefore, more pilot projects are needed. In order for AI to be helpful in addressing climate change, technologies need to be deployed at scale across different sectors and integrated with other existing technologies and processes.

Prof. Kaack concluded that the forecasts of AI impact on GHG emissions are rather uncertain. In the future, a sizeable computing-related share will be generated by data centres which are needed to support large language models (LLMs). However, AI's overall environmental effect (whether positive or negative), will depend on how it has been deployed.

5. General Policy Framework on the Ecodesign of Digital Services (RGESN), Sandrine Elmi-Hersi (Arcep)

Mr Nico welcomed the third speaker, Ms Sandrine Elmi-Hersi, Head of Open Internet Unit at Arcep, the French NRA.

Ms Elmi-Hersi noted the shift in the paradigm about the relationship between ICT products and services and the environment. In the past, digital services and technologies were seen as solutions to stop or slow down the climate change. Since 2010, thanks to the work of civil society organisations, industry and public authorities, there has been a growing awareness that what used be considered as non-material (intangible) digital services, actually depend on physical infrastructures and devices (made of raw/critical materials) which have a significant environmental impact. As a result, importance of environmental sustainability is being reflected in policy-making and digital regulation at both national and European levels. Arcep has been investigating environmental issues related to digital technologies since 2019. At European level, new focus on reducing environmental footprint of ICT has been introduced by the European Green Deal.

To complement the EC's efforts targeting sustainability of material products (e.g. the ESPR), French legislators tasked Arcep and Arcom (the French audiovisual and digital communications regulator), in connection with ADEME (the French environmental agency), to develop a General Policy Framework for the Ecodesign of Digital Services to address the non-material part of ICTs.[22] The Inter-ministerial Directorate in charge of the State's digital transformation (DINUM), the Internet freedoms and innovation watchdog National Commission on Informatics and Liberty (CNIL), and the National Institute for Research in Digital Science and Technology (Inria), also made a significant contribution to this policy framework.

After several publications on measuring the environmental footprint of ICTs, the General Policy Framework for the Ecodesign of Digital Services constitutes a new area of work: supporting effective and actionable tools to mitigate adverse impact on the environment from digital technologies.

The three main goals are:

- Improving capacity to measure and monitor the digital environmental footprint;
- Integrating environmental issues into Arcep's regulatory actions;
- Supporting stakeholders' efforts for sustainable digital technologies with actionable tools.

Ms Elmi-Hersi introduced the main findings of the Arcep–ADEME study on the impact of digital technologies: evaluation methodology, measurement and prospective[23]. According to the study, ICT-related GHG emissions amounted to 2.5% of the total GHG emissions in France in 2020, which thanks to France's low-carbon electricity mix, is lower than the global average (estimated at 4%). The study also shows that ICT impacts depletion of abiotic resources, e-

[22] https://www.arcep.fr/uploads/tx_gspublication/general_policy_framework_for_the_ecodesign_of_digital_services_version_2024.pdf

[23] https://en.arcep.fr/fileadmin/user_upload/04-22-english-version.pdf

waste and high energy consumption. Without proper actions and policy measures the GHG footprint will almost triple by 2050.

Even though, until recently, devices were responsible for the largest share of carbon footprint, growing use of digital services and AI use could change this trend.

Ms Elmi-Hersi noted that the environmental impact of AI has not been considered in full, due to its rapid growth after the publication of the study. However, LLMs require significant computing power and contribute to a rapid increase in data centres' energy consumption which, according to the study, might double between 2022 and 2026. In order to address these trends, a holistic approach addressing the total environmental impact of digital services is needed.

The General Policy Framework for the Ecodesign of Digital Services established a common base of best practices for digital professionals to implement ecodesign principles in their digital services. It contains a set of 78 best practices aimed at:

- extending devices' lifespan,
- limiting adverse consequences of attention-grabbing techniques used by digital platforms,
- reducing the resources needed over the digital service's lifecycle, and
- increasing transparency of the digital services carbon footprint.

It also contains 78 factsheets specifying methods for implementing each practice, an ecodesign declaration template to certify the efforts put in place, and a methodology to calculate the progress score.

Ms Elmi-Hersi reiterated that ICT sector must reduce its own carbon footprint to support the green transition, however it is currently one of the sectors with the fastest growing impact. While national and regional initiatives are crucial first steps, only European and global actions including participation from a broad range of stakeholders could be effective to invert the current trajectory.

6. Analysis of software-based influence on a shortened service life of products, Anna Zagorski (German Environmental Agency)

Mr Nico welcomed the fourth speaker, Ms Anna Zagorski, Research Associate for Green IT at the German Environmental Agency.

Ms Zagorski presented the research study “Analysis of software-based influence on a shortened service life of products”[24], published in 2023. The study analysed risks which can lead to a shortened service life of products, mainly connected devices. A smart home should be understood more as a product “system” which provides functionality, as opposed to a number of individual devices.

By definition, connected devices are devices controlled by software which operate with interfaces and communication protocols. These connected devices can generate additional energy consumption that takes place in other devices or other infrastructures. The number of connected devices within households is increasing, which leads to increased data volumes in data centres. Connected devices also bring additional risks (e.g. cloud dependencies, manufacturer-dependent standards and interfaces).

Ms Zagorski presented the study and its conclusions in more detail. The study differentiated between direct software obsolescence (e.g. kill switches, missing updates) and indirect software obsolescence (e.g. missing end-user support, licences).

The study shows that connected devices have an increased risk of obsolescence compared to normal devices (manufacturer-dependent protocols, standards, etc.) which shall be addressed through promotion of open standards and interface and manufacturer-independent protocols for communication between devices. Moreover, large tech firms must be involved more strongly because they are crucial in defining the longevity of connected devices with their interfaces, communication protocols and updates. The current ESPR is insufficient as only the manufacturer's products are regulated, while large tech firms are not addressed. Ms Zagorski noted that this issue could be targeted by legislative regulation, perhaps via the extension of the Digital Services Act (DSA).

Ms Zagorski also confirmed that the German Environmental Agency strongly supports horizontal regulation of connected devices. In their view, the minimum requirements for market access should include:

- The core function of the device must also be usable offline;
- It should be possible to operate the devices without external dependencies;
- Provision of security-relevant software updates for a minimum period of 10 years;
- A guarantee of a minimum service life of 10 years;
- Compatibility and interoperability of product systems (interfaces, transmission protocols, open standards).

The minimum requirements for market access should include transparency about the requirements and dependencies for the functioning of the device (e.g. OS version, user

[24]https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/texte_13-2023_analyse_der_softwarebasierten_einflussnahme_auf_eine_verkuerzte_nutzungsdauer_von_produkten.pdf

accounts) and an obligation to specify the type and scope of processed data as well as the purpose of external processing of data.

7. Environmental impact assessment of AI systems in standards, Susanna Kallio (Nokia)

Mr Nico welcomed the fifth speaker Ms Susanna Kallio, Head of Sustainability Standardization at Nokia.

Ms Kallio endorsed points raised by the previous speakers and noted that exponential AI growth brings associated environmental impact as renewable energy supplies are not growing as fast as energy demands of AI systems. The overall AI environmental impact is difficult to quantify as there are no standardised methodologies in place. Standardisation bodies and forums (i.e. ITU, ETSI, CEN CENELEC, IEEE and ISO) have recognised this issue and are currently working to address it.

Ms Kallio pointed out that AI systems come in different forms and sizes. Generative AI and single-purpose AI are completely different, and their environmental impact also differs. The standardised methodology should be broad enough to cover all different AI use cases, both current and future.

Comparative analysis is useful for comparing several AI solutions providing the same functionality and for identifying the ones with lowest environmental impact. Also, it can be used to compare an AI system with a traditional non-AI system. However, in such case, the functionality should be assessed during the full lifecycle of the systems and not only during its use phase. Such considerations were used as the basis in developing the standard methodologies.

In 2024, Ms Kallio, together with colleagues, published a white paper “A transparent and standards-based way to assess the environmental impact of AI systems”[25] discussing mapping of existing standard approaches to build a methodology for assessing the AI’s environmental impact. The existing standards used were ‘Life Cycle Assessment’ (ISO 14040), ‘AI system life cycle’ (ISO 5338) and recommendation ITU-T L.1410. The Life Cycle Assessment standard systematically evaluates the environmental aspects and potential impacts of a product or service throughout its entire life cycle (from raw material extraction to final disposal), while the AI system life cycle describes processes and stages of the life cycle of AI systems. Mapping the two approaches together allows for an overview of the full life cycle impact. Ms Kallio stressed the importance to assess different aspects of the AI systems i.e. the hardware impact (from raw materials extraction to production), the training phase of the computational part of the AI system and the data management phase.

[25] https://onestore.nokia.com/asset/214115

The standards are a part of Open Standardisation, meaning that they are developed (or approved) and maintained via a collaborative and consensus-driven process. Ms Kallio invited stakeholders to contribute to the development of the open standards through their expertise. She noted that there are different issues to be addressed in the proposed methodology model, namely:

- Allocation of environmental impact of various phases/activities, e.g. defining which part of the foundation model environmental impact belongs to a specific AI system; data handling and preparation (how to use shared data and assess its environmental impact); embodied emissions of shared hardware.
- The environmental impact of "inference" phases is difficult to estimate as it happens in the future and depends on the number of inferences needed; it is also important to establish system boundaries, to allow for comparability when assessing the AI systems.
- Other non-direct impacts include the second order effects. The AI could have higher order effects, e.g., rebound effect[26] which should be evaluated properly. For instance, the chat bots that are very easy to use, can result in excessive use, thus negatively impacting the environment. Ms Kallio stressed that the ultimate goal of creating the standardised methodology is to identify and implement the necessary mitigation actions for reducing the negative AI systems' impact on the environment. In 2024, ITU-T supported this direction by publishing the report "AI and the Environment - International Standards for AI and the Environment"[27].

8. Roundtable discussion: "Ecodesign of digital services, one of the paths to sustainable digital development, greener networks and ICTs"

Moderator Bianca Sofian (Cullen International) noted that the discussion is very timely and builds on the momentum which ecodesign for environmental sustainability of ICT is gaining within the EU policy. On 16 April 2025, the EC adopted and published the first ESPR and Energy Labelling Working Plan. There have also been national policies, e.g. the General Policy Framework on the Ecodesign of Digital Services (RGESN) drafted by the French national authorities. Ms Sofian opened the roundtable discussion and invited panellists to take the floor and share their views on strategies, best practices and possible challenges in ensuring that digital services positively contribute to environmental sustainability through ecodesign measures.

[26] A phenomenon where improvements in efficiency lead to an increase of demand that offsets the positive effects of efficiency improvements (see BoR (24) 82)
[27] https://www.itu.int/dms%20_pub/itu-t/%20opb/env/T-ENV-ENV-2024-1-PDF-E.pdf

Panellists included: Leonardo Veneziani (CCIA), Asim Hussain (Green Software Foundation), Ana Maria Galindo (Ericsson) and Vlad C. Coroamă (Roegen Centre for Sustainability).

Ecodesign of digital services: CCIA Europe approach, Leonardo Veneziani (CCIA)

Mr Veneziani started his presentation by stating that the current climate legislation is sufficient to achieve the EU's climate goals. He noted that during the ninth legislative term (2019 – 2024), European Parliament has delivered on many legislative files and priorities focussed on the green and digital transitions. In its end-of-term assessment paper the European Parliamentary Research Service (EPRS)[28] analysed how the EC has delivered on the policy agenda set by its President, Ursula von der Leyen, and her College of Commissioners. EPRS found that out of a total of 526 submitted initiatives, 167 focused on the European Green Deal, positioning it as the highest policy priority in terms of the number of initiatives planned.

CCIA is supporting the EC's regulatory simplification initiatives and advocates for full enforcement of existing measures before introducing new ones. CCIA believes that there is a wide range of existing legislative and non-legislative measures addressing ecodesign of digital services and that any additional measures could potentially result in overlap and duplication. Moreover, industry actors have already developed self-regulatory initiatives to support compliance while minimising complexity (e.g. Climate Neutral Data Centre Pact[29]).

In 2024, the EC created the Ecodesign Forum to gather stakeholders' input. The forum currently has 132 members (industry players, public authorities, etc.) including CCIA Europe since January 2025. The stakeholder participation process started once the first meeting was held in February 2025.

CCIA Europe submitted three feedback documents to the EC:

- Feedback on the first ESPR work plan,
- Feedback on the disclosure of information on unsold consumer goods, and
- A joint industry call for a transitional regime for the implementation of Article 24 of the ESPR. CCIA also supports pragmatic approach to classification by ensuring clarity, consistency and alignment in reporting requirements for the disclosure of information on unsold consumer products.

In its feedback on the EC's work plan, CCIA underlined the importance of allowing sufficient time for: an in-depth impact assessment and cost benefit analysis before establishing requirements; gathering stakeholder inputs; market adjustment before reconsidering the requirements. CCIA also advocated for tailoring requirements to products by establishing a

[28] https://www.europarl.europa.eu/RegData/etudes/IDAN/2024/762283/EPRS_IDA(2024)762283_EN.pdf
[29] https://www.climateneutraldatacentre.net/

clear hierarchy where product-specific requirements prevail over horizontal ones. Finally, it supported harmonisation of fragmented national approaches.

Mr Veneziani closed his presentation by providing timelines for the ESPR requirements for ICTs and Energy Efficiency Directive (EED) requirements for data centres.

Philosophy of measurement, Asim Hussain (Green Software Foundation)

The Green Software Foundation (GSF) is a not-for-profit trade association with the mission to create a trusted ecosystem of people, standards, tooling, and best practices for building green software. GSF is engaged in changing the culture of building software across the tech industry, making sustainability a core priority for software teams, and equally important as performance, security, cost and accessibility. To that end, GSF emphasises emission abatement—avoiding or preventing emissions in the first place—over carbon offsetting, which compensates for emissions after they occur.

GSF develops standards through consensus of its members and is actively engaged in standards adoption projects. The main or primary category of ‘standards’ here are standards used for measuring environmental impact (i.e. how to measure software using key performance indicators (KPIs) to drive change). The most mature standard is Software Carbon Intensity (SCI) Specification. The purpose of the SCI is to encourage actions that reduce carbon emissions of software in a way that creates reductions at a system-wide level, rather than just at a local level. This specification defines a methodology for calculating the rate of carbon emissions for a software system. The purpose is to help users and developers make informed choices about which tools, approaches, architectures, and services they can use in the future. It is a score rather than a total; lower numbers are better than higher numbers, and reaching 0 is impossible. SCI also significantly differs from other methodologies, such as LCA and GHG.

Mr Hussain explained that “totals”—referring to total carbon emissions across an entire organisation or system, often serve as poor KPIs because they don’t drive effective action. Totals typically aggregate emissions from many teams or functions into a single number. While this may offer a big-picture view, it makes it difficult to assign responsibility, as no single team can see their direct impact. As he put it, “when everyone is responsible, no one is.”

To make KPIs actionable, Mr Hussain proposed aligning them with the agency boundary—that is, the specific scope of control and responsibility of a team or actor. Metrics should be designed by first identifying who the intended actor is, what action is expected from them, and only then defining the boundary of what is measured. For example, if a metric includes emissions from sales, engineering, and operations all at once, it becomes unclear who should take action—even if some teams perform well, the total might still go in the “wrong” direction.

He also highlighted that in the context of software, the more elements included in a measurement boundary (e.g. infrastructure, services, user devices), the harder it becomes to use that metric to guide specific action. Effective KPIs, therefore, focus not only on what is being measured, but also on who can act on it, ensuring metrics lead to accountability, not confusion.

Mr Hussain explained that the metrics developed by the SCI are first focusing on the target actor(s), then on actions to be taken by the actor(s), which decide the agency boundary and only then the actual metrics boundary is defined and aligned with the agency boundary to drive action.

Ericsson environmental sustainability journey, Ana Maria Galindo (Ericsson)

ICT has a unique potential to enable other industrial sectors to move towards the low-carbon economy that will be central to achieve the SDGs and the Paris Agreement.

Ms Galindo noted that for such an ambitious strategy to be effective, it has to be integrated in all processes and decisions within the company. Given the complexity of the digital sector, the correlation with the supply chain strongly influences the emission volumes. Approximately 90% of emissions come from the use of sold products (Scope 3, Category 11) which cannot be controlled by the company. However, Ericsson is striving to have the best possible products on the market and to achieve this, it is integrating ecodesign principles in their products and implementing solutions to minimize environmental impact through the product life cycle (production, use and end-of-life phases). A number of specific requirements covering many aspects are mandatory for all Ericsson products. Moreover, Ericsson products contain efficient silicon which reduces cooling needs, materials, and emissions, leading to smaller products.

In April 2025, Ericsson published a white paper “ICT energy evolution: Telecom, data centres, and AI” [30]. Data from 2007 to 2024 shows exponential growth in data traffic on mobile networks and slow growth in energy consumption. Only 5% of the electricity in mobile networks is used for transmission while the main reasons for energy increase in networks are deployment of equipment for new generations (e.g. 4G, 5G), densification and increased service needs. Such findings and data prove that, for mobile networks, there is no relation between energy consumption and data transmission, therefore, future data transmission estimates cannot be used to forecast electricity use.

Ericsson believes in the importance of building reliable models for future estimates. A possible solution is to use bottom-up approach (Power Model) which allows to:

- Assess all equipment in a network or data centre to measure the energy consumption;
- Estimate average power consumption and utilization;
- Integrate future technological progress resulting in energy efficiencies.

[30] https://www.ericsson.com/en/reports-and-papers/white-papers/ict-energy-evolution-telecom-data-centers-and-ai

Ms Galindo shared that verifying models against reality is essential to ensure reliability and accuracy of the results. Therefore, to be reliable and accurate, bottom-up approach shall be adjusted with a top-down approach (reality check): what has been happening in previous years and how the energy consumption is changing. To understand this, she explained, it is useful to check what is being reported by the network and data centre operators and what is reported in public electricity production and consumption statistics.

AI impact and possible consequences for service design, Vlad C. Coroamă (Roegen Centre for Sustainability)

Mr Coroamă presented research results analysing the overall impact of computing, which is composed of direct effects (footprint) and indirect effects, which can be either beneficial (saved/avoided impacts) or detrimental (induced impacts). The impact of indirect effects is more significant than that of direct effects.

Mr Coroamă also presented results from his study published together with G. Kamiya in March 2025, "Data Centre Energy Use: Critical Review of Models and Results"[31], which analysed global data centre energy estimates since 2010 and projections to 2030.

The conclusions of existing regional, global studies and company reports on data centre energy use diverged up to 6-fold for the current period and up to 40-fold for 2030 projections. According to Mr Coroamă, such differences can be explained by methodology, data sources and overall study quality (e.g. high-end estimates were observed in low quality studies).

An alternative assessment aggregating regional studies and data from the 60 largest data centre operators show plausible range between 300 – 380 TWh/year in 2023. As a result, the estimated overall energy consumption for data centres in 2030 will be approximately 700 – 900 TWh/year, of which approximately 300 TWh/year will be consumed by AI.

Mr Coroamă pointed out that environmentally beneficial and detrimental effects of AI are interconnected, which makes their assessment extremely challenging. Regarding the direct AI impacts, he noted that, while the overall AI energy consumption will likely not be that significant, AI components production and power density might become a problem. As for the indirect impacts, Mr Coroamă stressed that they are more significant than direct impacts, therefore, it is important to consider usage consequences during the design phase.

Finally, regarding regulation, Mr Coroamă suggested that it is important to focus on the essential items with the appropriate methods which are wide, yet simple enough to apply (i.e. top-down approach).

[31] https://www.iea-4e.org/wp-content/uploads/2025/05/Data-Centre-Energy-Use-Critical-Review-of-Models-and-Results.pdf

9. Q&A session

The workshop ended with a Q&A session moderated by Ms Sofian (Cullen International).

The panellists were asked if there is a specific digital services area where the negative environmental impact could be avoided or addressed.

In their answers, Mr Veneziani pointed out the longevity of the hardware (smartphones, computers etc.) and the use of more energy efficient circular products.

Ms Galindo noted that correctly implemented ecodesign approach leads to benefits in multiple areas across the entire product life cycle.

Mr Hussain added, when talking about energy efficiency of hardware in data centres, most of the servers were idle until recently. Producing a chip that is twice as energy-efficient would result in purchasing twice as many chips, leading to the consumption of exactly the same amount of electricity. He also pointed out that AI surge is likely to change this phenomenon, since AI requires a higher electricity supply.

Ms Sofian asked Mr Veneziani about the review of the Commission Regulation (EU) 2019/424 laying down ecodesign requirements for servers and data storage products.

Mr Veneziani noted that the new draft regulation includes more circular economy considerations related to the design for repair and reuse, the availability of spare parts and access to repair and maintenance information. The upcoming Cloud and AI Development Act, that the EC is to propose towards the end of this year, should include some considerations about the sustainability of data centres and energy efficiency.

Mr Veneziani pointed out that it is important to decide a hierarchy between product-specific and horizontal requirements. CCIA's preference would be that the product-specific requirements shall take precedence over horizontal requirements because each product category has their own repairability scores. Moreover, CCIA advocates that these product-specific requirements would help a rapidly evolving ICT sector.

Ms Sofian asked Ms Galindo about the e-waste management at Ericsson and how the concept of circular economy can be applied to design and deployment of digital services which can minimise e-waste and promote resource efficiencies for greener networks.

Ms Galindo noted that circularity shall not be understood as a set of rules that apply to everything. It should be a collection of principles that needs to be adapted to each industry in a considered way in order to reduce environmental impact. Network performance, customer experience and energy consumption are among the factors which Ericsson considers crucial when evaluating modernization of networks. At Ericsson, operators are supported in their network deployments and they highly influence their environmental transition.

Ms Sofian asked Mr Hussain what role cloud computing plays in advancing sustainability goals within the ICT sector and what potential environmental reduction can be achieved through cloud services.

Mr Hussain said that quantifying positive beneficial impacts of cloud is challenging because those impacts are very hard to measure. There is a research underway to explore that and more information will be available in the future. He added that quantifying the energy savings can be very challenging and calculation of avoided emissions should be done in parallel with calculation of enabled emissions.

Ms Sofian asked Mr Coroamă how mature are the methodologies or standards to assess the indirect impacts of digital services and what are the limits of these methodologies.

Mr Coroamă believes that currently, the methodologies fail to adequately address this. According to Mr Coroamă, the recommendation ITU-T L.1480 and related bottom-up approach are insufficient. Therefore, it is necessary to come up with top-down, input-output analysis of quantitative system dynamics to be able to quantify the impacts.

Finally, the participants briefly discussed end-user understanding of the ICT environmental footprint, end-user awareness initiatives, market players behaviour and upcoming regulatory developments.

Conclusions and acknowledgements

BEREC thanks the distinguished speakers and participants at this workshop on digital services ecodesign for greener networks and ICTs. As part of its commitment, BEREC will continue to build its expertise on digital services to help understand drivers and identify solutions to lower the environmental footprint of electronic communications, including through ecodesign initiatives. BEREC continues to pursue its work to support the green transition of digital players and ICT and enable them to reach international and European environmental targets.