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European Framework Initiative for Energy & Environmental Efficiency in the ICT Sector

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D3.4 – RECOMMENDATIONS TOWARDS POLICY ACTION PLAN ON GREEN ICT

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BP	Best Practices
CoC	Code of Conduct
EAG	External Advisory Group
EC	European Commission
EN	European Standards / Norms
ERF	Energy Reuse Factor
ETSI	European Telecommunications Standards Institute
GHG	Green House Gases
GPP	Green Public Procurements
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LCA	Life Cycle Analysis
PUE	Power Usage Effectiveness
REF	Renewable Energy Factor
SAT	Self-Assessment Tool
SAT-O	Self-Assessment Tool for an ICT-intensive Organisation
SAT-S	Self-Assessment Tool for an ICT Service
SDO	Standard Development Organisation
SME	Small Medium Enterprise
WEEE	Waste Electrical and Electronic Equipment

Executive Summary

The aim of the ICTFOOTPRINT.eu project is to deliver a practical response to the barriers identified to the adoption of ICT environmental footprint calculation methodologies among the European ICT sector (both providers and users of ICT goods and services). The work conducted during project completion constituted an opportunity to gather information on potential levers towards reduced environmental impacts from ICT, with a particular focus on dedicated methodologies. Feedback originated from selected experts, from ICTFOOTPRINT.eu services, during events, as well as when working with existing initiatives or projects, etc. A dedicated workshop was also organised in Paris by the project consortium in September 2018 on this topic, and the outcomes were used in this deliverable.

The present report outlines the need for the EU to develop a global strategy to reduce the environmental impacts from the ICT sector (covering goods, services, as well as organisations activities). Indeed, the growing demand for ICT goods and services leads to increased environmental impacts from the sector; while further knowledge is needed to efficiently understand these impacts.

Some difficulties are also identified as preventing stakeholders' commitment and actions towards ICT with reduced environmental footprint, including lack of awareness (e.g. on potential benefits). Finally, many initiatives are launched at regional, MS and EU levels, however coordination is still missing before a global strategy on "green ICT" is established. It should be noted that "green ICT" is a common term, used in the context of the project and the deliverable to reflect on ICT with reduced environmental impacts.

Using the above elements, the deliverable provides Recommendations towards a Policy Action Plan on "green ICT", organised in three categories: increase awareness and knowledge on ICT environmental impacts; convince ICT stakeholders of benefits from reduced ICT impacts; and facilitate commitment and actions to a more environment-friendly ICT sector. This document should be considered as a first set of recommendations, dedicated to "green ICT" rather than "ICT for green", and covering – but not limited to – policy aspects.

There is a large variety of ways for the EC or MS to encourage the ICT sector towards more environment-friendly activities. Many initiatives and networks already exist at EU, MS or regional levels with this perspective. A recommended approach therefore would be to capitalise on existing assets, provide them with means to go further, and give them a global perspective by building a Policy Action Plan dedicated to "green ICT", and directly integrated in digital strategies at EU and MS levels.

In this context, the ICTFOOTPRINT.eu platform appears as a first step towards increased knowledge and involvement in ICT activities with known and reduced environmental impact. A sustainability plan was realised to ensure its legacy after project completion, i.e. that the services currently provided by the platform remain available, even updated on a regular basis when relevant.

1   Introduction

1.1   Purpose and Scope

The aim of the ICTFOOTPRINT.eu project is to deliver a practical response to the barriers identified to the adoption of ICT footprint calculation methodologies among the European ICT sector. Previous observations[1] showed that too many organisations (providers or users of ICT), while wanting more energy-efficient products and services, do not know where to start nor have the adequate time, skills or resources to pursue this efficiently.

The work conducted during project completion was the opportunity to gather information on potential levers towards reduced environmental impacts from ICT, with a particular focus on dedicated methodologies. Feedback originated from identified experts, from ICTFOOTPRINT.eu services, during events, as well as when working with existing initiatives or projects, etc. A dedicated workshop was also organised in Paris by the consortium in September 2018 on the topic, and the outcomes were used in this deliverable.

The present report constitutes a summary of these feedback and considerations gathered all along the project. It also establishes the **need for the EU to develop a global strategy** to reduce the environmental impacts from the ICT sector (covering goods, services, as well as organisations and cities' activities). The deliverable also provides **recommendations towards "greener ICT"**. It should be considered as a first set of recommendations, dedicated to "green ICT" rather than "ICT for green", and covering – but not limited to – policy aspects.

1.2   Structure of the document

The document is structured as follow:

Section 1 introduces the deliverable, in the framework of the ICTFOOTPRINT.eu project.

Section 2 aims at giving an overview of the current environmental impacts of the ICT sector, with regards to the growing demand for ICT, the lack of knowledge and awareness on its impacts, as well as potential barriers to commitment from stakeholders.

Section 3 provides with a first set of recommendations for the European Commission towards more sustainable ICT in the EU, organised in three categories: increase awareness and knowledge on ICT environmental impacts; convince ICT stakeholders of benefits from reduced ICT impacts; and facilitate commitment and actions to a more environment-friendly ICT sector.

Section 4 draws some conclusions with regards to the potential perspectives for the coming years, and how the ICTFOOTPRINT.eu platform may contribute.

A summary of the Recommendations and their characteristics is displayed in **Annex**.

1.3   Relationship to other project outcomes

The deliverable is part of WP3 which focuses on stakeholder engagement, from the identification of relevant stakeholders to the definition of Recommendations for a Policy Action Plan to the EU to raise awareness on the needs, challenges and opportunities related to ICT sustainability and carbon footprint.

The documents summarises elements further described in previous reports, such as deliverable D3.2 "Towards an uptake of methodologies in the ICT sector" (on the barriers and levers to implementing ICT calculation methodologies) and deliverable D2.5 "Third market watch, best practice report, SDOs update & voice of the users" (additional elements on the first and second market watch may be found respectively in deliverables D2.2 and D2.3). The relationship between the Recommendations for a Policy Action Plan and the ICTFOOTPRINT.eu platform sustainability roadmap is briefly mentioned here; further elements are provided in deliverable D2.4 "Impact assessment report".

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[1] BIO Intelligence Service (2012), Towards an overall measurement methodology of the carbon and energy footprints of the ICT sector, Study prepared for European Commission, DG CONNECT, in association with Fraunhofer IZM and Öko-Institut.

2   Brief overview of the environmental impacts of the ICT sector in the EU

The present section summarises key elements of the current situation in the European ICT sector, in terms of environmental impacts generated and existing solutions and initiatives to assess and reduce these impacts. References are made to other deliverables when relevant, to avoid any redundancy with content already provided, in particular in deliverable D3.2 "Towards an uptake of methodologies in the ICT sector" on the barriers and levers to implementing ICT calculation methodologies, and deliverable D2.5 "Third market watch, best practice report, SDOs update & voice of the users".

The overview summarises the increasing demand for ICT goods and services in the past decade, combined to a relative lack of awareness from the general public and professionals from the ICT sector, as well as a need for better knowledge on some ICT environmental impacts. In addition, feedback gathered during the project showed difficulties to implement best practices or metrics and thus commit to a reduced environmental impact of ICT. Finally, while many initiatives are being launched at the international, EU, national or regional level, the sector would benefit from a global and coherent strategy on the environmental impacts of ICT.

2.1   A growing ICT demand and associated environmental impacts

Although results may vary depending on the sources, there seem to be a consensus on the growth of environmental impacts from the ICT sector. A more detailed analysis is provided in deliverable D2.5 "Third market watch, best practice report, SDOs update & voice of the users": various aspects are likely to affect the overall environmental footprint of the sector.

The demand for ICT products increased in the past years, among other things as a consequence of changes in consumer patterns (e.g. from DVD to video streaming), lower prices of ICT goods and services, and use of ICT to optimise processes and impacts from other sectors ("IT for green" concept).

An increased number of users and number of terminals (laptops, tablets, connected home devices, Industrial Internet of Things (IoT)) for each user is expected. For instance, the number of smartphones used worldwide is expected to grow from 4 billion in 2017 to 5.5 billion in 2020, i.e. a 11% annual increase.[2] The demand for content streaming, bigger data storage, etc. is also growing, at a faster rate than the number of users. For instance, data traffic is expected to increase by 25% annually on networks and by 35% annually in data centres.[3]

In addition, recent and future evolutions in technology should be considered: on the overall, significant improvements in energy efficiency of the IT equipment were made, with labels or certifications to highlight such products. However, it does not mean that all ICT goods with lower performances but currently in use should be replaced before their expected lifespan, as the in-use stage is only one of the contributors to the environmental impacts of an ICT good over its lifecycle.

Moreover, the development of a new technology does not always come with reduced environmental impacts. For instance, the energy consumption of data exchange is respectively 15 times and 23 times bigger with 3G and 4G compared to Wi-Fi, for the same bandwidth consumed[4]; while with higher speeds, users are encouraged to exchange more data. Work is currently being done to assess and reduce the energy consumption of future 5G network, which will require extensive infrastructure (in addition to current networks) and is expected to be expanded globally within the next 10 years.

Finally, potential bouncing effects are likely to increase the environmental impacts of the ICT sector: mostly linked to changes in consumer patters, these 'hidden' effects are complex to include in environmental assessments. For instance, data storage on cloud servers rather than internal, local servers allow for mutualisation of servers based on need. However, it usually comes with an extra-number of servers to ensure data safety (multiple copy), estimation of the maximum usage scenario, and an incentive for end-users to store more data as more storage capacity is available. Another

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[2] Cisco (2017), Cisco Visual Networking Index: Forecast and Methodology, 2016-2021
[3] The Shift Project (2018) Lean ICT - Pour une sobriété numérique
[4] https://www.greenit.fr/2016/03/15/internet-mobile-la-4g-est-elle-une-abomination-energetique/

example is the decreased time of use of some ICT equipment (e.g. fast turnover of smartphones, used for a shorter period than expected lifespan), which limits the effects from increased efficiency of products.

2.2   A lack of awareness and knowledge of environmental impacts from the ICT sector

Despite initiatives being launched, the work conducted during the project showed a relative lack of awareness among some stakeholders regarding ICT environmental impacts. Many ICT organisations, as well as the general public, consider ICT services as a possible solution to reduce the environmental impacts from other activities ("ICT for green") rather than comparing impacts in both scenarios, for a same service expected. Moreover, services from the cloud are often considered intangible, without considering the hardware needed to provide these services. Finally, the focus is often done on energy efficiency (and associated GHG emissions) during the use stage, without addressing the complete lifecycle (e.g. from extraction of raw materials to manufacturing of ICT goods; or treatment at end of life) nor the diversity of impacts (e.g. material usage, water consumption, etc.).

Another difficulty, for stakeholders already aware of these environmental impacts, is to know which best practices to implement, such as increased lifespan of ICT equipment, responsible purchasing, etc.

As detailed in deliverable D3.2 "Towards an uptake of methodologies in the ICT sector", several barriers are identified with regards to data on ICT environmental impacts and therefore limit knowledge on these aspects. Among the potential reasons is the complexity of ICT equipment (in terms of number of distinct materials used, associated quantities, etc.) and the high changeover speed, with the introduction of new technologies. Moreover, few data are available on impact indicators distinct from energy consumption and climate change; with few transparencies on the hypothesis considered in the calculations (of impact factors or results). Finally, only a limited number of suppliers share data on the environmental footprint of their products. A few examples may however be found in deliverable D2.5.

The work conducted in the context of deliverable D3.2 also showed a need for fewer methodologies to assess the environmental footprint of ICT goods, services and activities (either at organisation or city scope). The current multiplicity of methodologies makes it difficult for potential users to identify which is the most appropriate, and limits consistency between assessments. For example, not all environmental footprint methodologies recommend including impacts others than from the use stage; or assessing impact indicators other than on energy and climate change.

On the overall, despite a need for awareness raising and better understanding environmental impacts from the ICT sector, recent benchmarks show an increasing knowledge and interest on the topic among private organisations, in particular on recycling of equipment.[5]

2.3   Various difficulties to implement best practices or metrics and thus commit to a reduced environmental impact of ICT

Several obstacles are identified as potential constraints for an informed audience to effectively commit to best practices and reduction of the environmental footprint of ICT products and activities.

The difficulty to identify clear benefits, other than direct economic savings, is a major one. Although an increasing number of stakeholders now see benefits related to better brand image or green procurement, it seems that only a limited number of them effectively share their success stories externally, which thus limits the effect on awareness raising to the general public.

The lack of resources (time, budget) dedicated to these topics is another potential constraint, further detailed in deliverable D3.2. It is often linked to the lack of internal expertise on the topic, in particular environmental footprint assessment methodologies, and the difficulty to identify the most appropriate method (see section 2.2).

Moreover, the topic of green IT is often siloed within a given department of an organisation (e.g. Sustainability Department) distinct from the IT department. Further elements are provided in deliverable

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[5] AGIT (2018) Baromètre des pratiques green IT des entreprises en France - 2017

D3.2 on the potential barriers to involve the relevant departments, although vital to ensure the success of a "green IT" approach.

Regarding public administrations, the main difficulty identified is to fully understand the energy and environmental "bill" paid for ICT and how "green ICT" could bring benefits (including economical).

Finally, the implementation of best practices (e.g. eco-design approach) is more difficult when applied to an existing service (e.g. improvement during use stage of the solution) rather than considered from the design stage. However, in the latter case, it is more complex to clearly assess the effective benefits (comparison to a fictive scenario).

2.4   A missing global and coherent strategy on the environmental impacts of ICT

Many initiatives are being launched or already exist at regional, MS and EU levels. Various types of stakeholders may be involved (with most initiatives being developed jointly by several stakeholders), among which: associations, private organisations, SDOs, policy makers, etc.

At the EU level, various research projects were launched by the JRC on circular economy in the ICT sector. In particular, in the context of the EU Ecodesign Directive, the analysis of material efficiency in smartphones is currently under progress and should be completed in 2019. Work is also conducted for the development of EU Green Public Procurement (GPP) criteria for data centres, to develop a set of environmental criteria, based on a life-cycle approach and a scientific evidence base.

However, existing strategies for the ICT in the EU do not refer to sustainability aspects or environmental impacts. For instance, the EU Digital Single Market launched in 2015 aims at creating a better and larger space for the digital economy to grow. Although performance of existing and future technology is mentioned and may include energy consumption aspects (e.g. on 5G networks), the strategy does not aim at ensuring a reduced environmental footprint of the sector or a given technology.[6]

National initiatives launched by governments or national public authorities reveal an increasing commitment at Member State level in the European Union, towards the inclusion of environmental aspects with regards to the ICT impacts. However, these initiatives remain limited to a number of Member States, and do not seem to be applicable to the entire ICT sector, nor integrated in a national ICT strategy. Further elements may be found in deliverable D2.5.

Private organisations, associations and other stakeholders (e.g. from the civil society) are also involved in the implementation of various initiatives, at the EU, national and regional levels. Examples are provided in section 3 to illustrate some recommendations with existing initiatives.

In conclusion, the environmental footprint of ICT products and activities is of concern in many existing initiatives. However, coordination is still missing before a global strategy on "green ICT" is established.

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[6] https://ecipe.org/publications/the-next-steps-for-the-digital-single-market-from-where-do-we-start/

3   Recommendations towards a Policy Action Plan on "green ICT"

It appears from the overview provided in section 2 that there is a need for the European Union to develop a global strategy to reduce the environmental impact of the ICT sector (including products, services, organisations and cities using it).

The ICTFOOTPRINT.eu proposition towards a Policy Action Plan is a first set of recommendations, focusing on aspects related to methodologies and their implementation; and dedicated to "green ICT" rather than "ICT for green". The recommendations are intended for the European Commission, covering – but not limited to – policy aspects.

The content of the proposition capitalises on outcomes from feedback collected during the workshop in Paris (September) as well as other ICTFOOTPRINT.eu events, namely ICTFOOTPRINT.eu final event; the project platform usage and content (webinar speakers, marketplace, surveys sent to EAG members, success stories, etc.); and desktop research conducted during the project (incl. similar initiatives, e.g. at French level with the White Paper on Digital and the Environment).

The following recommendations aim at providing some insight gathered during the project, in order to start discussions about a dedicated Policy Action Plan. Further work would be needed to evaluate and compare their impact and priority, then implemented in a policy roadmap. However, for each recommendation, the consortium tried to include information on:

- Level of implementation of the recommendation: international, at EU or MS level, regional, etc.;
- Time of implementation of the recommendation: short- (2021-2022), mid- (2024) or long-term (2026 and more);
- Potential leaders of the recommendation and its implementation;
- Associated motivational incentive for the recommendation (in particular voluntary or regulatory).

The recommendations are categorised and distinguished according to three goals: increase awareness and knowledge on the environmental impacts of ICT (section 3.1); convince stakeholders of the potential benefits associated with reduced ICT environmental impacts (section 3.2); and facilitate commitment and actions to a more environment-friendly ICT sector (section 3.3).

3.1   Increase awareness and knowledge on ICT environmental impacts

The following recommendations aim at ensuring that stakeholders (from the ICT sector, but not limited to) are aware of the existence of environmental impacts from using ICT and that there is robust and consistent evidence to support it.

Recommendation 1: Make **awareness raising** possible among targeted audience(s), thanks to content available to any relevant stakeholders

⚡	**Level of implementation:**	All
⏱	**Time of implementation:**	Short term
⍉	**Potential leaders:**	Trade associations, representatives of civil society and professionals, with potential incentives from MS and the EU
✓	**Motivational incentives:**	Currently based on voluntary incentive, could remain the same (e.g. funding of platforms dedicated to awareness raising)

Various means already exist and may be extended on the short term, with the potential support from the MS and the EU (official recognition, financial support, etc.).

Awareness raising among the **general public** is tackled by stakeholders such as the WWF, the European Environmental Bureau (EEB) or The Shift Project with the dedicated initiative Lean ICT. Annual benchmarks provide with relevant and illustrative information on current practices in the sector: for instance the WeGreenIT on responsible IT practices among French organisations (conducted by Club Green IT, C3D, e-RSE.net and WWF France) or the Baromètre Green IT among French organisations as well (conducted by AGIT). Communication thanks to labels and certifications (e.g. EPEAT, Blue Angel, TCO Certified, Energy Star, etc.) may also contribute to awareness raising on reduced environmental footprint for ICT products.

Other initiatives such as the We Act for Good (WAG) application launched end of 2018 in France (jointly by the WWF France, the ADEME, MAIF and La Poste) may be used as inspiration and declined for specifically for ICT activities (depending on the targeted public). The WAG application aims at helping consumers to better understand and commit to environment best practices, and

When looking at **ICT providers and professional ICT users**, content for awareness raising is available thanks to initiatives launched such as Green IT Global at the EU level (which gathers national and regional actors such as Green IT Amsterdam in Netherlands, Sustainability for London in the United Kingdom, Green IT SIG in Switzerland and Alliance Green IT in France. The ICTFOOTPRINT.eu platform also aims at increasing commitment from the ICT community and providing information on the environmental footprint of the ICT sector, online and during dedicated events.

Finally, an important aspect for awareness raising is the availability of **educational and training material** on "green IT" (for instance to explain the concepts of green coding), in particular among scholars and professionals. A few initiatives already exist, with incentives based on reward mechanism, such as the international Design4Green challenge aimed for both students and professionals.

The following table provides an overview of recommendations for each targeted audience.

Table 1: Examples of recommendations to make awareness raising possible among targeted audience(s)

Targeted audience	Example of recommendation
Professionals	Provide Green ICT skills to professionals and future professionals, across distinct economic sectors, on how to make ICT more sustainable: How to implement and benefit from Green ICT and how different experts can work together for this cross-sectoral challenge.
	One of the main barriers for organisations to adopt Green ICT is due to the lack of professionals trained on this, on software, hardware, networks, amongst others.
	O e.g. Electrical and Mechanical Engineers need to be properly trained and work together
Academics / scholars	Include Green ICT curricula topics to be covered in university course programs
Public authorities	Promote capacity building and exchange between the (currently) few frontrunners and the many public organisations that would like to design and implement green ICT policies and procurement
Citizens	Promote the Green ICT lifestyle amongst citizens, to promote behavior-change. This could be carried out with delivering some financial statistics on savings if you become greener in ICT
Young Generations	Educate the young generation on why it is important to adopt sustainable behaviors, namely on Green ICT: What is circular economy? How to decrease energy consumption? Educating and raising e-awareness of the young generation, since childhood, brings a high-value for the future, since it is a life-long learning process

Recommendation 2: Have **adequate methodologies and tools** to encourage assessment of environmental impacts of ICT

Depending on the purpose of the assessment, distinct levels of complexity of the modeling (and thus the calculations) may be needed. Simplified approaches, allowing for a generic screening of the environmental footprint of ICT equipment, services or activities already exist, and users may be encouraged to use them more often (see

Recommendation 8). The recommendation here focuses on more complex assessment of environmental impacts, e.g. through LCA calculation methodologies and related tools (i.e. following methodological requirements).

Level of implementation: International / EU level (convergence of methods)

Time of implementation: Midterm (already started, but further incentive needed)

Potential leaders: SDOs and MS / EU

Motivational incentives: Currently based on voluntary incentive (from SDOs) as well as from JRC (e.g. PEF initiative)

Convergence, consistency and complementarity between existing methodologies should be encouraged to simplify the choice of methodology for the user, while ensuring higher consistency between distinct assessments (e.g. on the perimeter / system under study, the choice of data, etc.).

A few initiatives already exist go in that direction and may be extended to a broader scale. For instance, the methodology ETSI ES 203 199 / ITU-T L.1410 shows convergence between **ETSI and ITU** methodologies at the international scale. The methodology covers the environmental footprint of ICT goods and services and the dedicated factsheet may be found on the ICTFOOTPRINT.eu platform.

At the EU level, the Product Environmental Footprint (PEF) Guide developed by the JRC in 2012 aims at providing a European harmonized methodology for environmental footprint studies, based on a life cycle approach.

However, these methodologies remain quite generic, applicable to any ICT products or activities (or broader). The **PEF Category Rules (PEFCR) Guidance** was an answer to the need to develop dedicated methodologies, on specific targets or topics. Each PEFCR contains a set of rules on how to measure the life cycle environmental performance of the product in scope, thus helping practitioners in the assessment with more specific guidance than provided in generic methodologies. PEFCR relevant for the ICT sector include IT equipment storage, and additional PEFCR could be created for the ICT sector, e.g. on additional ICT equipment and services.

The NegaOctet project, launched end of 2018, focuses for instance on ICT services, with the aim of creating and experimenting a methodology for the assessment of environmental performance of these services. Various assets will be developed within the 2 years of the project, including a methodology, a database and a calculator tool.

Recommendation 3: Increase **knowledge of impacts** thanks to better data availability

When looking at increasing knowledge of environmental impacts from the ICT, two scenarios can be considered: the relevant data does not exist yet; or the relevant data exists but is not collected or shared yet.

Level of implementation: International / EU level

Time of implementation: Short to midterm (depending on level of data availability)

Potential leaders: MS / EU

Motivational incentives: Could be both voluntary and regulatory incentives: e.g. encourage private organisations to share data vs. compulsory requirements to publish waste flows (traceability)

A first objective is to generate robust and representative data for assessments of environmental impacts of a product or an organisation. **Existing database** on environmental impacts of ICT over life cycle include ecoinvent or the ADEME Base Carbone (however, not limited to the ICT sector), and could be complemented with data on a product or process currently not considered; or for a specific technology, geographic and/or time scope (cf. section 2.2).

Additional initiatives such as the NegaOctet project are specific to ICT (here, ICT services) and the database generated during the project will contribute to a better data availability. Similar initiatives may be launched at a larger scale (e.g. European or international) on other

Moreover, **collection and sharing of existing data** could be enhanced, either from voluntary ICT providers (on manufacturing processes, origin of raw materials used in a product, etc.) or through increased regulatory traceability e.g. for waste flows. On the ICT providers' side, various organisations such as Fairphone now communicate on environmental aspects of the products or services they offer. Regarding traceability, national observatories on waste flows such as the French platform SYDEREP could be extended to all MS and the level of information expected further detailed (e.g. targeting ICT equipment in the requirements for the Eurostat waste statistics communicated by MS).

3.2 Convince stakeholders of benefits from reduced ICT environmental impacts

The following recommendations target in priority stakeholders already aware of the ICT environmental impacts, but not yet committed. The rationale is to convince the audience that there are effective benefits from doing so and stimulate motivation (e.g. through networking), while ensuring that public authorities set an example as ICT users.

Recommendation 4: Showcase **quantified benefits** from reduced ICT environmental footprint

Various benefits from reducing the ICT environmental footprint are identified for ICT provides and ICT intensive users, among which: direct economic savings, a better image & marketing, a competitive advantage, an anticipation of regulatory risks, etc.

Level of implementation: All

Time of implementation: Short term (to encourage other stakeholders on midterm)

Potential leaders: MS / EU as well as representatives of professional federations, etc.

Motivational incentives: Currently based on voluntary incentive, could remain the same

Green ICT is mostly seen only as a brand value. However, the society is not aware that Green ICT can also be a competitive business advantage. The greener one becomes, the more competitive also is. Companies are now becoming aware of the benefits from green ICT, but this mindset should be consolidated much more.

Experience from the ICTFOOTPRINT.eu project indicates that such recommendation should be focused on both ICT providers and ICT users. **Showcase of benefits** was implemented thanks to Success Stories collected and displayed on the platform. Each story refers to an organization implementing best practices in their processes or activities, or to an ICT intensive user such as organizations, cities or universities recording reduced ICT impacts from green procurement, etc.

The Green IT Global also showcases success stories of their members and partners on the platform, with the aim of promoting these examples while encouraging other stakeholders to follow a similar path.

The European Commission funded various initiatives to support organisations in the identification and quantification of benefits from reduced ICT impacts. The DC4Cities project, ended in 2016, aimed to work as an incentive for existing and new data centres to implement energy policies and adapt their power consumption to the availability of renewable energy. The outcomes of the project included market results and potential drivers and barriers to implementing the approach proposed.

To answer the strong need for a **proof of the "green IT" business case**, various white papers and publications have been published in the last years. An example is the business case developed by Cognizant in 2011, which indicates that "*businesses often gain new operational efficiencies through green IT, including reducing capital costs, improving regulatory compliance and greening their marketable image with stakeholders, including investors, employees and the public at large, at a time when environmental problems are of utmost concern*". Similar initiatives, targeting a specific category of ICT actors, could be encouraged thanks to public funding at the EU or MS level, and may be combined with showcase of success stories from organisations that effectively implemented the considered business case.

An identified target for these "green IT" business cases would be cities and more globally public administration, among which there seems to be a need for quantified benefits from "green ICT".

The following table provides an overview of recommendations for each targeted audience.

Table 2: Examples of recommendations to support showcasing quantified benefits from reduced ICT environmental footprint

Targeted audience	Example of recommendation
ICT suppliers / ICT users	**Make it clear what are Green ICT benefits:** Demonstrate the concrete benefits users can get with Green ICT. Without a real benefit for the users, they won't have the motivation to embrace sustainable ICT practices. What is the value? What is the business gain? Green ICT must be a priority.
ICT suppliers / ICT users	**Business-cases:** Create business-cases, demonstrating the return of investment of Green ICT, indicating how it was implemented, which standards & methodologies were used and make it clear that investments on green ICT are not risky.
ICT suppliers / ICT users	**A sustainable market opportunity:** Companies should exploit the generation that today are in their 30's years old. This is the first generation who does "conscious choices" on selecting products and suppliers. Companies with the "green ICT stamp" in their brand, will get attention form this market.
ICT suppliers	**Green IT in the business plan:** Different stakeholders shall be together involved in green ICT: users, technicians and service providers. Green ICT topic must be considered right from the business plan writing.

Recommendation 5: Enhance **networking between stakeholders**

Exchanges with multiple ICT stakeholders and representative of ICT professionals reveal a need for better communication within the sector, with the aim of sharing knowledge, best practices, success stories, etc. In addition, networking proves important among specific groups of actors, as well as among a broader audience (e.g. between specialists and the global public).

Level of implementation: All

Time of implementation: Midterm

Potential leaders: MS / EU as well as representatives of professional federations, etc.

Motivational incentives: Voluntary incentives

Various networking initiatives, **targeting a specific group of actors**, are already implemented. For instance, the Club green IT gathers private companies sharing good practices and knowledge on environmental impacts of ICT, and more globally on sustainable IT; the marketplace from the ICTFOOTPRINT.eu platform put ICT providers and users of "green IT" in relationship; etc.

Other initiatives launched, such as the PEF Guide, gather distinct types of stakeholders and experts on various topics. Although, in the case of the PEF Guide the aim is not specifically networking, it effectively contributes to sharing knowledge and insight on the environmental impacts of ICT between the stakeholders involved.

Events organised by local, national or European actors contribute as well to networking between specialists and/or non-specialist involved in "green ICT": the Greenconcept initiative, funded by the ADEME and the Occitanie region, gathers CEOs or employees of SMEs developing digital services and Green IT experts in order to implement digital service and software eco-design and reduce in the end their environmental impacts.

These events may also be the opportunity to welcome a **broader audience**, e.g. with the aim of raising awareness among the general public. In 2018, various events were organised and open to the public for the publication of Lean ICT (from the Shift Project) or the White Paper Digital Technology and Environment launched by Iddri, FING, WWF France and GreenIT.

Recommendation 6: Promote use of **purchasing tools (e.g. labels)** in purchasing activities

Public authorities can have a key role by being exemplary and setting the example for other stakeholders. Among the potential levers is green public procurement practices, in particular regarding ICT equipment and services used by public organisations.

Level of implementation: EU / MS levels

Time of implementation: Short term (immediate impact expected)

Potential leaders: MS / EU

Motivational incentives: Currently voluntary, could be regulatory (starting with public organisations)

Public authorities engaging with green procurements will have an immediate impact and will work as a **strong incentive for ICT providers** to engage in environment best practices (e.g. repair, eco-design, green coding, etc.). Various examples of labels and other purchasing tools exist for public authorities.

In particular, the definition of environmental criteria for data centres in public procurement is currently being addressed by the JRC at EU level (JRC GPP DC) and similar initiatives could be launched for other types of ICT equipment or services.

Regarding labels and certifications intended for any purchasers, the main ones include the EU Ecolabel (at EU scope and not limited to ICT), TCO Certified (dedicated to IT products), Blue Angel (not limited to ICT), EPEAT (not limited to ICT), Energy Star (at US scope and not limited to ICT, focusing on energy efficiency), GreenCode Label (focusing on websites), etc. Further information on existing labels may be found in deliverable D2.5.

The current incentives remain voluntary, however they become regulatory for specific types of procurements (e.g. given percentage of ICT purchases). In addition, such approach could be later enlarged to other stakeholders than public organisations, with distinct potential means (financial incentive, etc.).

3.3   Facilitate commitment and actions to a more environment-friendly ICT sector

The following recommendations mainly target stakeholders already aware of the environmental impacts of ICT, of methods and approaches to implement, as well as of benefits from reducing these impacts. The recommendations aim at offering potential solutions to accelerate the move towards a more environment-friendly ICT sector and put it in perspective of existing and new digital strategies.

Recommendation 7: Develop "green ICT" strategy at MS and EU levels and **integrate it to digital strategies**

⚡	**Level of implementation:**	EU / MS levels
⏱	**Time of implementation:**	Midterm
Ω	**Potential leaders:**	MS / EU
✓	**Motivational incentives:**	Could be both voluntary and regulatory incentives (depending on the strategy)

As indicated in section 2.4, existing strategies for the ICT in the EU do not currently refer to sustainability aspects or environmental impacts. For instance, the EU Digital Single Market launched in 2015 does not aim at ensuring a reduced environmental footprint of the sector or a given technology.

It is important that in the midterm, all policies connected to ICT include aspects on the environmental impacts of the sector, at MS and EU levels. A first step could be the development of a dedicated "green ICT" strategy on the short term, later adapted and included in existing and new policies on ICT activities.

For instance, the current development of 5G networks could include environmental aspects not limited to energy consumption of the base stations, and policies could help improve its environmental footprint during the design stage, before implementation.

The following table provides some examples of recommendations which could be implemented.

ICTFOOTPRINT.EU
European Framework Initiative for Energy & Environmental Efficiency in the ICT Sector

Table 3: Examples of recommendations to develop "green ICT" strategy at MS and EU levels and integrate it to digital strategies

Targeted audience	Example of recommendation
Policy makers/ICT industry	**Define an EU Common policy on Green ICT 2020:** With a roadmap, developed jointly by government and industry. The roadmap must consider goals to be achieved in the medium and long term
Policy makers/ICT industry	**Define KPIs for sustainable SME:** SMEs being the backbone of EU economy, it is important that achievable KPIs are customised for them

Policy makers/ICT industry	**Define Green ICT & sustainable policy regulations:**
	
	• **Tax benefits from Green ICT:** All those who adopt Green ICT products, services and procedures, shall benefit from lower taxes. Another solution would be to implement higher taxes on products and services that are not sustainable. These policies will increase the Green ICT usage and encourage financially the transition to sustainable business models.
	
	• **Circular Economy - Recycling & re-usage goals:** Define recycling and reuse goals, namely legislation on "design to be repaired" rather than buying new equipment. It would be very useful to define a percentage KPI related to recycling for each new equipment produced.
	
	    o E.g. In the car sector, EU legislation obliged companies to recycle % of each car components that were sent to disposal. Despite the strong resistance from automotive lobbies that said it was impossible to achieve in an economically viable manner, this has been successfully implemented. This forced manufacturers to vastly increase the level of recycling and reusage of their components. The same strategy and policy approach shall be applied in Green ICT in all Europe.
	
	• **Define priorities for each field**: Priorities must be customised for each ICT dimension. Different actions and drivers must be taken, depending on the focus.
	
	    o Hardware: An example would be to favour the improvement of the battery's full charge duration & the implementation of circular business models
	
	    o Networks and data centres: An example would be the use of renewable energy and improve energy efficiency.
	
	    o Software: An example would be to promote the implementation of eco-design procedures and circular business models.
	
	Raise awareness campaign: Enable a mass campaign on consuming habits based on sustainability level rather low price.

Policy makers/ICT industry	**Carbon reporting**: Make "carbon reporting" mandatory and easy to be done, especially for SMEs. Companies should report their carbon consumption to the public authorities, as easy as the financial reporting is. Carbon reporting will allow an accurate and close control and calculation of carbon consumption, but this knowledge must be accessible to all players, namely SMEs.

Recommendation 8: Turn **providers** into actors towards "greener ICT"

ICT providers may be encouraged to take actions towards reduced environmental footprint if being provisioned with appropriate and relevant tools and guidance.

Level of implementation: All

Time of implementation: Midterm

Potential leaders: MS / EU, representatives of ICT providers, SDOs, etc.

Motivational incentives: Could be both voluntary and regulatory incentives (depending on leader)

A first lever is to make **accessible assessment and awareness tools** among all ICT stakeholders, to encourage them to assess and reduce their environmental footprint. Distinct aims (e.g. identification of environmental hotspots, comparison of two design options, etc.) and targets are identified, depending on data availability, the level of detail expected, etc. Existing simplified tools include the SAT-O and the SAT-S developed on the ICTFOOTPRINT.eu platform to raise awareness on the assessment of ICT environmental impacts and related methodologies. More complex tools such as the CLEER Model or the EURECA tool were developed as well, here on data centres.

A second lever is to develop **guidance, e.g. such as codes of conduct**, on best practices to be implemented by ICT providers. The European Code of Conduct for Data Centres (EU CoC DC) is an illustrative example of a voluntary which aims at reducing the data centres environmental, economic and energy supply security impacts by improving understanding of energy demand within the data centre, raising awareness, and recommending energy efficient best practices and targets. Similar guidance could be extended to other targeted ICT activities or stakeholders.

Training and communication among ICT providers (see Recommendation 10) is also key for them to better understand how to use these tools and best practices guidance.

Table 4: Prioritisation of recommendations towards "greener ICT" by time of implementation

Targeted audience	Example of recommendation
SDOs/methodology providers	**Demystify complexity:** Make it easier to interpret and implement standards & methodologies. Their complexity is holding back their adoption, due to the difficulty and time consuming that is required.
ICT suppliers	**IT manufacturers to adopt methodologies:** Promote the adoption of standards & methodologies by IT manufacturers
SDOs/methodology providers	**Global problems need global solutions:** Standards shall be open and have minimal interoperability mechanisms, so support both industry and cities to create an open and global sustainable smart cities environment, based on cities' needs.

Recommendation 9: Turn **users** into actors towards "greener ICT"

With a similar approach than for

Recommendation **8** but with a different target, ICT users could be encouraged to take actions towards reduced environmental footprint if being provisioned with appropriate and relevant tools and guidance**.**

⚡ **Level of implementation:**   All

⏱ **Time of implementation:**   Midterm

♎ **Potential leaders:**   MS / EU, representatives of the civil society, etc.

✓ **Motivational incentives:**   Could be both voluntary and regulatory incentives (depending on leader)

The rationale is to make ICT users, including the general public, become actors by allowing them to choose the "greener" option when it comes to ICT purchases. This may be achieved thanks to purchasing tools (e.g. labels, certifications) deployed for ICT equipment and services, as well as awareness raising among users and providers.

Examples of labels and other purchasing tools may be found in Recommendation 6 as well as in deliverable D2.5, while Recommendation 1 suggests communication channels that could be used to increase awareness on the dedicated tools.

Recommendation 10: Continuous **communication and training** on the topic

Communication and training on "green ICT" are key to raise awareness on the topic (see Recommendation 1) as well as maintaining a minimum level of knowledge among key stakeholders. The recommendation focuses on the latter aspect as key to sustain commitment to "green ICT".

⚡ **Level of implementation:**   All

⏱ **Time of implementation:**   Short term

♎ **Potential leaders:**   MS / EU, representatives of the civil society, etc.

✓ **Motivational incentives:**   Could be voluntary incentives preferably

Among the potential communication means displayed in Recommendation 1, existing initiatives include the one from the Shift Project, information from websites such as greenIT.fr, annual benchmark such as the WeGreenIT, etc.

Training on "green IT" could include lessons on software eco-design to students and professionals involved in IT development or more generally in the IT department of any ICT intensive organisations; presentation of existing green purchasing tools in purchasing department; etc.

Recommendation 11: Develop dedicated **policy incentives**

The implementation of dedicated policy incentives is introduced in <u>Recommendation 7</u>, however the present recommendation focuses on specific topics associated with ICT rather than the development of a global "green IT" strategy.

Level of implementation: International / EU / MS levels

Time of implementation: Short (e.g. on eco-design or GPP) to long-term (e.g. on topics identified in Reco. 7)

Potential leaders: MS / EU

Motivational incentives: Could be voluntary incentives preferably

A few examples of current or potential policies are detailed hereafter and could be applicable to many topics associated with "green ICT". A first step therefore would be to **prioritise the topics to be tackled** first, e.g. during the elaboration of a green ICT strategy (cf. <u>Recommendation 7</u>).

For instance, the current <u>EcoDesign Directive</u> is a framework which sets mandatory ecological requirements for energy-using and energy-related products sold in MS, including ICT category products. An interesting option to accelerate the movement towards "greener ICT" would be to extend the scope of products currently considered to ICT services and software.

The Green Public Procurement for Data Centres (JRC GPP DC described in <u>Recommendation 6</u>) is currently being defined by the JRC to include a set of environmental criteria in public requirement specifications, here for data centres. A first step would be to promote it as much as possible among public and private organisations, and generate feedback and success stories; before extending the approach to other categories of ICT products.

Regarding repair, the JRC is currently conducting case studies on the potential implementation of a <u>Scoring System on Reparability</u>, including but not limited to ICT products. The aim is to develop an objective methodology to determine how easily a product may be repaired (e.g. potentially accounting for the availability time and price of spare parts; repair possible by an end-user or limited to professional; etc.). In France, following the publication of the national roadmap for circular economy in 2018, a dedicated working group started for the definition of <u>Reparability Index</u> for electric and electronic equipment, while two suppliers already defined implemented their own index. It is however important that such approached, at European and MS levels, do effectively tackle environmental aspects by covering the sustainability of the product, not limited to the reparability itself but also including product robustness and frequency of failures.

Reduced taxation (through VAT) to support re-use and repair would also be a strong incentive towards extended lifespan of ICT products. Various MS are currently considering a national implementation, which would apply to ICT equipment although not limited to it. Finally, **national initiatives** such as the <u>law against planned obsolescence</u> implemented in France since 2017, could be extended to other MS or at the EU level.

Various incentives may be implemented for each policy envisioned. Preliminary studies (e.g. as done by the JRC) will contribute to identify the most relevant and efficient incentives for a dedicated topic.

Finally, in order to give some consistency to all or part of these policy incentives, circular economy could be used as a "binder" for a global and adequate policy applicable to the ICT sector. The following propositions could be a starting point to the elaboration of a Circular Economy roadmap applied to the ICT sector:

- **Create business models:** Support the creation of circular economy businesses.

- **Promote reverse logistics and reduce urban mining:** Support the adoption of reverse logistics and the decrease or urban mining, to decrease e-waste. This concept shall be also considered during business plan writing.

- **Address E-Waste:** Define solutions and best practices to reduce e-Waste production or increase its recycling.

- **Circular Economy as a "must be":** Define rules on ICT equipment design. ICT equipment's must be designed to be easily recycled and repaired, to increase their lifetime. It shall be cheaper to buy a repaired or recycled ICT good rather than buying a brand new one.

- **Remanufactured instead of new:** Make mandatory for big organisations to include in their offer ICT equipment that is remanufactured, rather than having only brand-new equipment. Remanufactured equipment is not synonym of performance issues.

- **Adopt the "Hiroki Hondo" model:** This model for the "Sustainable management of ecosystem" developed by Hiroki Hondo, defends that business models shall solve various social problems while also securing profits by applying business and management skills (http://er-web.jmk.ynu.ac.jp/html/HONDO_Hiroki/en.html)

4   Conclusions

The work conducted during the three years of the project outlines the need for the EU to develop a global strategy to reduce the environmental impacts from the ICT sector (covering goods, services, as well as organisations activities). Indeed, the growing demand for ICT goods and services leads to increased environmental impacts from the sector; while further knowledge is needed to efficiently understand these impacts.

As explained before, the ICTFOOTPRINT.eu proposition towards a Policy Action Plan is a first set of recommendations, focusing on aspects related to methodologies and their implementation; and dedicated to "green ICT" rather than "ICT for green". The recommendations are intended for the European Commission, covering – but not limited to – policy aspects.

Eleven recommendations are suggested, distinguished according to three goals: increase awareness and knowledge on the environmental impacts of ICT; convince stakeholders of the potential benefits associated with reduced ICT environmental impacts; and facilitate commitment and actions to a more environment-friendly ICT sector. The recommendations differ as well in terms of time of implementation, stakeholders involved, etc. A proposition of prioritisation is included in Table 5 hereafter.

Table 5: Prioritisation of recommendations towards "greener ICT" by time of implementation

	Time of implementation		
	Short term (2021-2022)	**Midterm (2024)**	**Long term (2026 and +)**
Recommendations			
Increase awareness and knowledge on ICT environmental impacts	• **Recommendation 1:** Make awareness raising possible among targeted audience(s), thanks to content available to any relevant stakeholders	• **Recommendation 2:** Have adequate methodologies and tools to encourage assessment of environmental impacts • **Recommendation 3:** Increase knowledge of impacts thanks to better data availability • (for new data to be generated)	• **Recommendation 3**: Increase knowledge of impacts thanks to better data availability • (for better data collection and sharing)
Convince stakeholders of benefits from reduced ICT environmental impacts	• **Recommendation 4:** Showcase quantified benefits from reduced ICT environmental footprint • **Recommendation 6:** Promote use of purchasing tools (e.g. labels) in purchasing activities	• **Recommendation 5:** Enhance networking between stakeholders	
Facilitate commitment and actions to a more environment-friendly ICT sector	• **Recommendation 10:** Continuous communication and training on the topic • **Recommendation 11:** Develop dedicated policy incentives (e.g. on eco-design and green public procurements), articulated around the Circular Economy concept	• **Recommendation 7:** Develop "green ICT" strategy at MS and EU levels and integrate it to digital strategies • • Recommendation 8: Turn providers into actors towards **"greener ICT** • • • Recommendation 9: Turn users into actors towards **"greener ICT**	• **Recommendation 11:** Develop dedicated policy incentives (e.g. on topics identified in Reco. 7)

- **Recommendation 11:** Develop dedicated policy incentives (e.g. on reparability)

As highlighted in the present report, there is a large variety of ways for the EC or MS to encourage the ICT sector towards more environment-friendly activities. Many initiatives and networks already exist at EU, MS or regional levels with this perspective. A recommended approach therefore would be to capitalise on existing assets, provide them with means to go further (e.g. through the Horizon Europe program), and give them a global perspective by building a Policy Action Plan dedicated to "green ICT", and directly integrated in digital strategies at EU and MS levels.

In this context, the ICTFOOTPRINT.eu platform appears as a first step towards increased knowledge and involvement in ICT activities with known and reduced environmental impact. A sustainability plan was realised to ensure its legacy after project completion, i.e. that the services currently provided by the platform remain available, even updated on a regular basis when relevant. Further elements may be found in deliverable D2.4 on the topic.

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Annex: Summary of the recommendations' main characteristics

	Level of implementation	Time of implementation	Potential leaders	Motivational incentives
Recommendation 1: Make awareness raising possible among targeted audience(s)	All	Short term	Trade associations, representatives of civil society and professionals, with potential incentives from MS and the EU	Currently based on voluntary incentive, could remain the same (e.g. funding of platforms dedicated to awareness raising)
Recommendation 2: Have adequate methodologies and tools to encourage assessment of environmental impacts of ICT	International / EU level (convergence of methods)	Midterm (already started, but further incentive needed)	SDOs and MS / EU	Currently based on voluntary incentive (from SDOs) as well as from JRC (e.g. PEF initiative)
Recommendation 3: Increase knowledge of impacts thanks to better data availability	International / EU level	Short to midterm (depending on level of data availability)	MS / EU	Could be both voluntary and regulatory incentives: e.g. encourage private organisations to share data vs. compulsory requirements to publish waste flows (traceability)
Recommendation 4: Showcase quantified benefits from reduced ICT environmental footprint	All	Short term (to encourage other stakeholders on midterm)	MS / EU as well as representatives of professional federations, etc.	Currently based on voluntary incentive, could remain the same
Recommendation 5: Enhance networking between stakeholders	All	Midterm	MS / EU as well as representatives of professional federations, etc.	Voluntary incentives
Recommendation 6: Promote use of purchasing tools (e.g. labels) in purchasing activities	EU / MS levels	Short term (immediate impact expected)	MS / EU	Currently voluntary, could be regulatory (starting with public organisations)
Recommendation 7: Develop "green ICT" strategy at MS and EU levels and integrate it to digital strategies	EU / MS levels	Midterm	MS / EU	Could be both voluntary and regulatory incentives (depending on the strategy)
Recommendation 8: Turn providers into actors towards "greener ICT"	All	Midterm	MS / EU, representatives of ICT providers, SDOs, etc.	Could be both voluntary and regulatory incentives (depending on leader)

	Level of implementation	Time of implementation	Potential leaders	Motivational incentives
Recommendation 9: Turn users into actors towards "greener ICT"	All	Midterm	MS / EU, representatives of the civil society, etc.	Could be both voluntary and regulatory incentives (depending on leader)
Recommendation 10: Continuous communication and training on the topic	All	Short term	MS / EU, representatives of the civil society, etc.	Could be voluntary incentives preferably
Recommendation 11: Develop dedicated policy incentives	International / EU / MS levels	Short (e.g. on eco-design or GPP) to long-term (e.g. on topics identified in Reco. 7)	MS / EU	Could be voluntary incentives preferably