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| ITU Logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | FG-AI4H-L-029 |
| **ITU-T Focus Group on AI for Health** |
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| **WG(s):** | Plenary | E-meeting, 19-21 May 2021 |
| **DOCUMENT** |
| **Source:** | FG-AI4EE |
| **Title:** | LS on invitation to review Artificial Intelligence Standardization Roadmap and provide missing or updated information (reply to [SG13-LS174](https://www.itu.int/ifa/t/2017/ls/sg13/sp16-sg13-oLS-00174.zip)) [from FG-AI4EE to SG13] |
| **Purpose:** | Information |
| **LIAISON STATEMENT****(Ref:**[**FG AI4EE-LS3**](https://www.itu.int/ifa/t/2017/ls/fgai4ee/sp16-fgai4ee-oLS-00003.docx)**)** |
| **For action to:** | ITU-T Study Group 13 |
| **For comment to:** | - |
| **For information to:** | IEEE, Khronous Group, ISO/IEC JTC1/SC42, SC29, ITU-R SG6, W3C, DMG, FG-AI4H, FG-AI4AD |
| **Approval:** | Approved by correspondence by FG-AI4EE Co-Chairmen on 29 January 2021 |
| **Deadline:** | N/A |
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| **Abstract:** | This liaison statement informs ITU-T SG13 on the work being carried in FG‑AI4EE. |

Focus Group on Environmental Efficiency for Artificial Intelligence and other Emerging Technologies (FG-AI4EE) thanks ITU-T Study Group 13 for the Liaison Statement [SG13-LS174](https://www.itu.int/ifa/t/2017/ls/sg13/sp16-sg13-oLS-00174.zip).

FG-AI4EE would like to update SG13 on its current work items, with the aim to possibly include them in the draft supplement ITU-T Y.sup.aisr. Please see below the scope of the Technical Reports and Technical Specifications under study.

FG-AI4EE stands ready to offer more information as necessary and looks forward to collaborating closely with SG13.

**Initial agreed** **work programme (deliverables) of FG-AI4EE**

The list of all three FG-AI4EE Working Groups deliverables can be found online on [Focus Group homepage](file:///M%3A%5CSG_DOC%5CFG-AI4EE%5CFG-AI4EE%20Meetings%5C02-2020-virtual_December%202020%5CoLS%5CFocus%20Group%20homepage):

* Working Group 1 deliverables:
* <https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/WG1deliverables.aspx>
* Working Group 2 deliverables:
* <https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/WG2deliverables.aspx>
* Working Group 3 deliverables:
* <https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/WG3deliverables.aspx>

## 1. Working Group 1 (WG1) - Requirements of AI and other Emerging Technologies to Ensure Environmental Efficiency

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| Provisional # | Deliverable title | Category | Scope | Leader |
| D.WG1-01 | Standardized Glossary of Terms | Technical Report | This document will contain a dictionary of common terms and phrases used in the Focus Group's deliverables that will help readers to have common definitions and frames of reference. | Neil Sahota, University of California |
| D.WG1-02 | Scorecard to identify enhanced eco-friendly business processes | Technical Report | This document will provide the following:– Impact assessment document to help organizations quantify their environmental impact on how they conduct work;– Rating system so that organizations can self-assess how much positive or negative impact they are creating;– Guidelines on finding more environmentally friendly practices as substitutes for a business process/function. | Neil Sahota, University of California |
| D.WG1-03 | Solution scorecard on environmental behavioral influencers | Technical Report | This document will provide a scoring system for organizations to measure how much positive impact they have created (internally and/or externally) on individuals who have incorporated more eco-friendly behaviors and practices in their regular activities. | Neil Sahota, University of California |
| D.WG1-04 | List of KPIs/metrics | Technical Specification | The document will define how environmentally sensitive issues could benefit from Artificial Intelligence (AI), Machine Learning (ML), and other emerging technologies, by providing a set of standard measurements and definitions in the form of a list of Key Performance Indicators (KPIs)/metrics. This KPIs system will focus on finding indicators which are easy to measure and give a broad range of coverage. This system will be designed for easy and simple use by Small and Medium-Sized Businesses (SMBs) and other smaller organizations. Therefore, a set of maximum 50 indicators will be defined. Whenever possible, solutions will rely on existing best practices and globally respected sources. | AnnikMagerholm Fet,Norwegian University of Science & Technology |
| D.WG1-05 | Reporting templates on AI, AR and ML | Technical Specification | This document will generate a set of standard reporting templates/dashboards to visualize data produced from technology solutions such as AI, Augmented Reality (AR) and ML, that employ defined eco-friendly practices. This document will aim to display the results gained from D.WG1-04 in an instinctive way. The graphical interface will share a design language with D.WG1-09 and results may be used in D.WG1-10 and D.WG1-11. | AnnikMagerholm Fet,Norwegian University of Science & Technology |
| D.WG1-06 | High-Level Qualitative Impact Matrix of Artificial Intelligence and Blockchain on Sustainable Development Goals and on environmental efficiency | Technical Specification | This document will contain a set of high-level impact matrix that supports policymakers, operators and other relevant stakeholders in assessing the implication of different AI and blockchain solutions. The objective of the matrix is to provide:– The necessary tools for relevant stakeholders to determine the AI and blockchain solutions with the highest impacts, allowing them to prioritize solutions and design possibilities that are aligned closest to the values of the Sustainable Development Goals;– The necessary tools for relevant stakeholders to determine the AI and blockchain solutions with the highest impacts, allowing them to prioritize solutions and design possibilities necessary to improve the environmental performance of AI and blockchain. | Barbara Kolm, Austrian Economics Center |
| D.WG1-07 | Visions of Best Practices on Artificial Intelligence and Blockchain in 2025 | Technical Specification | This document will discuss the vision of best practices on artificial intelligence and blockchain in 2025. AI and blockchain are revolutionizing every aspects of society. The capability and performance of these technologies will substantially be improved and expanded in the next decades, from enhanced AI prediction, rising AI assistant and automation in all aspects of operation, boosting transparency, further decentralized networks, further blending between physical and digital computing, further security concerns and more. It is crucial to anticipate the policy, procedure and environmental frameworks needed to ensure the sustainability and accessibility of these technologies. | Barbara Kolm, Austrian Economics Center |
| D.WG1-08 | Connecting Environmental Efficiency of Digital Technologies to the Sustainable Development Goals (SDGs) | Technical Report | This document is intended to raise awareness on the growing concern over the environmental impacts of digital technologies. The double-edged sword nature of digital technologies on the one hand offer promising solutions to resolve the most pressing global issues from climate change, social equality, preserving biodiversity and more. Yet, more and more data centres are being built to process data. In order to achieve the SDGs, it is crucial to start reducing the carbon footprint of these technologies. This document will highlight the 5 ways environmental efficiency of digital technologies are directly connected to the SDGs and will consider the policy needs of environmental efficiency of digital technologies. This document will not consider the energy consumption of digital technologies. | Paolo Gemma, Huawei Technologies Co., Ltd. |
| D.WG1-09 | A method for Intuitive Human interaction with data model (ML & AI etc.) | Technical Report | This document will demonstrate a method for elegantly connecting complex data, including (ML & AI) into a system level solution designed for humans, allowing communication between man and machine which cultivates mutual enhancement.Interfacing humans to data is key to using its power to accelerate the speed with which we can solve our environmental problems. Machines are very powerful at working with data including ML & AI. Humans need to interact effectively with this information. This means building it into an interface which is manageable and allows comparison between data sources. The aim is to create a system for adding many data sets and being able to compare these with one another in a way machines and humans can understand. This could have a measurement score system based on a “traffic light” concept covering environmental factors, for example:– Heating/cooling & energy consumption– Impact on plant and animal life– Carbon & other air-based emissions– Waste & water managementIncreasing amounts of the world’s population live in cities. This is also the source of many of our environmental key pressures for climate change. This group will therefore use cities as a model for this report. | Joel Alexander Mills, AugmentCity AS |
| D.WG1-10 | Guidelines on applying U4SSC KPIs in a digital twin city using ML, AR & AI for better climate mitigation solutions | Technical Report | This document will provide guidelines on how to use the United Nations ''United for Smart Sustainable Cities” (U4SSC) Key Performance Indicator (KPI) system in a digital twin city, to identify high impact climate mitigation solutions. It will include a set of case studies showing examples of projects where emerging technology, such as ML, AR & AI, has or could have been used to reduce the negative impact of climate change in cities. It will contain a set of online video and testimonials to illustrate those examples. | Joel Alexander Mills, AugmentCity AS |
| D.WG1-11 | Best practices on how AI & ML for data processing can scale and be used in different locations globally | Technical Report | This report-based example will focus on how emerging technology solutions can have most impact on environmental issues within cities. The data used will be based on information gained from the United Nations ''United for Smart Sustainable Cities” (U4SSC) reports. The focus will be on comparing results from different cities and looking at the areas where cities gained low results. What are the emerging technologies that could improve these results? How should the data be structured to improve results? | Joel Alexander Mills, AugmentCity AS |

## 2. Working Group 2 (WG2) - Assessment and Measurement of the Environmental Efficiency of AI and Emerging Technologies

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| Provisional # | Deliverable title | Category | Scope | Leader |
| D.WG2-01 | Environmental Impact self-check assessment | Technical Specification | This document will contain a scorecard for an organization to grade itself on how well they have built a product or service based upon environmental impacts. It will define a set of standard areas to be scored (e.g. power consumption, water consumption, etc.) as well as standardized scoring criteria so that scoring is measured the same across industries and products/services. | Neil Sahota, University of California |
| D.WG2-02 | Computer processing, data management and energy perspective | Technical Report | We live in an era that is defined the “Cambrian explosion of data”, and advanced data analytics (Deep and Machine Learning, mainly) is ready to drive us in this world. The volume of data produced hourly and daily is enormous and is intended to dramatically increase in the next years –just consider the IoT revolution. Data centers of the future will be data driven. A clear limiting factor is their energy consumption. Presently, data centers consume more power than several European Union Member States, producing a larger footprint than all aircrafts. For these reasons, innovative strategies and technological solutions are needed to allow a scalability that is essential to enable and support the AI revolution. The document aims at recognizing important areas of innovation addressing this issue and facilitating the AI uptake by our Society. | Stefano Nativi, European Commission |
| D.WG2-03 | Requirements on energy efficiency measurement models and the role of AI and big data | Technical Report | This document will provide an overview of existing evaluation metrics and methodologies for energy efficiency and the role of Information and Communications Technologies (ICTs), based on a gap analysis of existing relative standards and on a detailed and systematic literature review on corresponding assessment models: – Resources: scientific databases (e.g., sciencedirect, scopus, etc.)– Keywords: "energy efficiency" AND "assessment" AND "model" AND "big data" AND "AI" | Leonidas Anthopoulos, University of Thessaly |
| D.WG2-04 | Guidelines on Evaluating and Measuring the Impacts of Artificial Intelligence and Blockchain on Environmental Efficiency  | Technical Specification | This document will contain a framework for evaluating and measuring the impacts of AI and blockchain on environmental efficiency. The objective of the framework is to support operators and other related stakeholders in assessing the environmental impacts of AI and blockchain. The results aim to inform them to make better environmental decisions, improve the operational quality and efficiency of the two technologies, and identify a clear pathway for AI and blockchain stakeholders to align their values with the visions of the United Nations Sustainable Development Goals. | Barbara Kolm,Austrian Economics Center |
| D.WG2-05 | Guidelines on Energy Efficient Blockchain Systems | Technical Specification | This document will describe the rationale, principles on transitioning from Proof of Work to Proof of Stake in blockchain systems. In contrast to Proof of Work, the Proof of Stake model introduces ‘validators’ to add the next block, effectively eliminating the incentive to compete to be the first miner to solve the puzzle that is given to them in order to obtain the rewards.This document will consider also a comparison of traditional implementation of algorithm with respect to the new proposed implementation. | Leonidas Anthopoulos, University of Thessaly |
| D.WG2-06 | Assessment of Environmentally Efficient Data Centre and Cloud Computing in the framework of the Sustainable Development Goals (SDGs) | Technical Report | This document will conduct a more comprehensive environmental sustainability assessment with a multi-impact and life cycle approach. It includes the following aspects:– An assessment of environmental impacts of data centre and cloud computing through a life cycle approach– An assessment of the current sustainability matrixes of data centre and cloud computing– An analysis on the links to the 17 SDGs with breakdown indicators being evaluated– A gap analysis of policies that facilitating the development of environmentally efficient data centre and cloud in support of the achievement of the Paris agreement and the UN SDGs– Policy recommendations– A section of a gap analysis on existing standards (e.g., [ITU-T L.1302] Assessment of energy efficiency on infrastructure in data centres and telecom centres, [ITU-T L.1351] Energy efficiency measurement methodology for base station sites, [ITU-T L.1502] Adapting information and communication technology infrastructure to the effects of climate change etc.) could be developed upon the availability of expertise, with potential adoption by ITU as sector standards. | Xiao Wang, UNEP DTU Partnership |

## 3. Working Group 3 (WG3) - Implementation Guidelines of AI and Emerging Technologies for Environmental Efficiency

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| Provisional # | Deliverable title | Category | Scope | Leader |
| D.WG3-01 | Guidelines on the implementation of eco-friendly criterias for AI and other emerging technologies | Technical Specification | This document will define a set of guidelines for organizations to review their implementation and build process to assess the technological impact to environmental factors like:– Materials used;– Energy consumed;– Water consumed;– Waste generated.These guidelines will serve as common factors, not a comprehensive list, for technologists to consider as they design and build any piece of technology. | Bosen Liu, Ladder Education Group |
| D.WG3-02 | Smart Energy Saving of 5G Base Station: Based on AI and other emerging technologies to forecast and optimize the management of 5G wireless network energy consumption | Technical Report | The energy consumption of 5G base stations is three to four times that of 4G. With the help of AI, intelligent pattern recognition, deep learning prediction, and automatic hierarchical control of energy-saving scenarios could be achieved, the customer-oriented cross-network 5G base station intelligent energy-saving capability could be established.This document will establish model algorithms for intelligent identification of base station energy saving scenarios, business load forecasting, etc.; It will set up the basic framework scheme of perception-oriented hierarchical base station energy saving strategy; develop basic functions of 5G base station smart energy-saving experimental system. | Rumeng Tan, China Telecom |
| D.WG3-03 | Application of AI technology in improving energy efficiency of telecom equipment rooms and IDC infrastructure | Technical Report | Most of the existing equipment rooms do not have the full ability to identify indoor temperature distribution. Therefore, they are unable to analyze power consumption in real-time and make appropriate and timely adjustments. As a result, it causes energy to be wasted. This document will cover how AI-based power management capabilities can:– Collect data in telecom equipment rooms and IDC infrastructure;– Analyze the historical power consumption and real-time parameters of the target equipment room;– Train an intelligent model; and – Make reasonable adjustments to the equipment room air- conditioning and temperature, so as to achieve energy saving in the equipment rooms and IDC infrastructure. | Ying Shi, China Telecom |
| D.WG3-04 | Methodology for Supporting the Implementation of Artificial Intelligence and Blockchain Solutions at the Government Level | Technical Specification | This document will contain a four-step methodology for supporting policymakers and other government entities in implementing artificial intelligence and blockchain solutions. Policymakers play a decisive role in shaping the environment in which AI and blockchain applications operate in. This four-step methodology will contain a set of guidelines that allow governments to take the initiative in determining the environmental efficiency aspect of AI and blockchain application. It will consider the global market needs of these technologies in the coming decades, and in particular the way in which they can be aligned with visions and values of the Sustainable Development Goals (SDGs). The outcome will allow policymakers to foster the development of AI and blockchain related applications in a more sustainable and efficient manner. The results will also allow government entities to develop a strategic vision on their application, serving as the foundation for collaboration with other stakeholders. | Barbara Kolm, Austrian Economics Center |
| D.WG3-05 | Best Practice Catalogue on Environmentally Efficient Artificial Intelligence and Blockchain Application | Technical Specification | This document will contain a list of best practices on artificial intelligence and blockchain applications that have taken environmental efficiency into full consideration. The growing energy demands of AI and blockchain is directly contributing to carbon emissions. The best practices contained in this specification will support relevant stakeholders in making better environmental decisions and reduce the environmental footprint of these technologies. The best practices also act as benchmarking tools that allow operators and service providers to assess their own operation, improve process management and learn from the industry leaders. | To be defined |
| D.WG3-06 | Guidelines on the Environmental Efficiency of 5G Usage in Smart Water Management | Technical Report | This guidance document is intended to support researchers and practitioners in measuring and improving the environmental efficiency of IoT technologies, in particular 5G connectivity in water management systems. The requirements, recommended processes, best practices and other considerations regarding the measurement and verification of environmental impact/efficiency contained in this document are developed based on inputs from leading academic experts and industry leaders. These requirements provide general guidelines applicable to the use of IoT connectivity of 5G. Other stakeholders may also utilize this guidance to gain new understanding on the environmental impacts from the use of IoT and 5G to connect and enable further networked sensors and applications to manage water supplies and reduce water loss. | To be defined |
| D.WG3-07 | Guidelines on the Environmental Efficiency of Machine Learning Processes in Supply Chain Management | Technical Report | This guidance document is intended to support ML researchers and operators to measure and improve the environmental efficiency of ML use in supply chain management. The requirements, recommended processes, best practices and other considerations regarding the measurement and verification of environmental impact/efficiency contained in this document are developed based on inputs from leading academic experts and industry leaders. These requirements provide general guidelines applicable to the use of ML in supply chain management. Other stakeholders may also utilize this guidance to gain new understanding on the environmental impacts of ML use in supply chain management.Big data impact will also be considered as well Blockchain and the circular economy. | Claudio Bianco, Telecom Italia S.p.A. |

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