European Technology Platform Networld Europe

Workshop on Green Telecom

POST-EVENT DETAILED REPORT

Jointly Organized by

March 02nd, 2022

Event Overview

Objective

The event aimed to provide a deeper understanding of the present and future needs and requirements of green telecom, sharing the valuable experiences and practices of Europe and China. Information on the event will be made public afterwards.

- **Location: Hybrid, Virtual and onsite Barcelona**
- **Date:** 02/03/2022
- **Duration**: 3 hours
- **Number of registrations:** 170
- **Maximum number of simultaneous attendees:** 95
- **Event Post-Report drafted by:**
  Fatma Marzouk, with contributions from Networld Europe and CCSA organization teams.

Agenda

Webinar	Green Telecom Workshop NetworldEurope & CCSA (Offline Barcelona W Hotel + Online)	
Date	Mar. 2nd CET 9:00 – 12:20, Beijing 16:00 – 19:20	
Agenda	Talk Title	Speakers
09:00-09:20	Opening speech and introduction	Rui Luis Aguiar NetworldEurope, Steering board chair / Wen, Ku Vice Chairman of the Board and Secretary-General of CCSA
	Experiences & Challenges	
09:20-09:40	Experience and challenges of Green and Low-Carbon Development in ICT / China Telecom's Evolution roadmap & action plan towards Green and Low Carbon NW	Shi, Denian CAICT Vice Chief Engineer Shi, Ying ITU-T FG AI4EE WG3 Co-Chair, CCSA TC9 Vice Chair
09:40-10:00	Experiences and challenges of green ICT in Europe / Towards a green future - why industry standards and technology innovation must go hand in hand	Luis Neves GeSI CEO Steffen Roos Detecon Managing Partner
10:00-10:40	**Experiences & Challenges** Panel discussion (offline + online) - 4 previous speakers + guests Lutz Schade Telecommunications Strategy Advisor, Peter Williamson Cambridge GIDC Chair	
10:40-10:50	**Break**	
	Future Requirements & Innovation	
10:50-11:10	Digital Technologies and the Green Economy/ 5G and Beyond - Energy Efficiency Challenges and Opportunities	Willem Jonker EIT Digital CEO Rahim Tafazolli 5G/6GIC
11:10-11:30	Energy saving and carbon reduction potential of digital technology and standardization / Practice and Exploration of Digital Innovation driving green and low-carbon development	Qi, Shuguang Acting Chair of ITU-T SG5, CCSA TC4/WG1 Chair Zhou, fanke Alibaba Product Supervisor
11:30-12:10	**Future Requirements & Innovation** Panel discussion (offline + online) – 4 previous speakers + guests Jukka K. Nurminen professor at University of Helsinki, Alvaro Valcarce head of Department Nokia Bell Lab, Xuemin Wang VP of Huawei ERI	
12:10-12:20	Closing words	Wen, Ku Vice Chairman of the Board and Secretary-General of CCSA / Rui Luis Aguiar NetworldEurope, Steering board chair

Program Summary

Opening Speech and introduction

Rui L. Aguiar (Networld Europe, Steering Board Chair/ University of Aveiro)

Prof. Aguiar welcomed the speakers and the audience, described the motivation of the workshop, and stated the main open challenges. These go beyond the basic telecommunication engineer challenge of energy per bit to encompass not only a system-wide rationale of the energy spent by the ICT but also a system wide rationale of the benefit provided to the society. Prof. Aguiar expressed that the workshop aims among others to brainstorm solutions to these challenges. Prof. Aguiar concluded his opening speech by describing the workshop overall program and the interaction guidelines.

Wen, Ku (Secretary-General, CCSA)

Mr. Wen, Ku welcomed the participants on behalf of CCSA and affirmed that Greening and digitalization are the inevitable direction of society and require joint efforts globally. Then Mr. Wen specified some critical requirements, toward green and sustainable development: The E2E PCF (Product Carbon Footprint) is a process that spans multiple countries, spans multiple industries, and spans multiple enterprises. Without global cooperation, the process of Carbon Dioxide (CO_2) emission cannot be fully presented and there is no way for effective management. He further highlighted that innovation should be the most critical element of green and sustainable development. However, innovation needs to be measurable and comparable based on a clear E2E presentation of Carbon Dioxide emissions, from specific parameters to overall solutions. Furthermore, ICT itself accounts for a small proportion of Carbon Dioxide emissions, but it can contribute to a wide range of industries and society as a whole.

Through his presentation, Mr. Wen pointed out that CCSA attaches much importance to participating in the development of international standards and that it will be more open and inclusive in 2022. As such, CCSA is considering inviting more vertical industries and foreign companies to join the board of CCSA. Mr. Wen's talk elaborated further on the requirement toward green and sustainable development identifying the main critical aspects. According to Mr. Wen, although ICT Technologies has contributed greatly to global industry digitalization and Carbon Dioxide reductions, E2E innovative solutions are not fully reflected in the current green evaluation, and there is not even a clear PCF definition for the mobile Base station. CCSA's General- Secretary emphasized also the importance of continuously enhancing the methods and criteria for assessing the green contribution of ICT technologies to vertical industries, which would be more and more important in B5G and 6G.

Session 1 Discussion

Presenter: Shi, Denian (CAICT)

Mr. Shi started his presentation by describing the total development in ICT in China in response to the hot issue of the mitigation of climate change. In this context, Mr. Shi spoke about China's main initiatives to reach low-Carbon development as well as the plans to reach Peak volume of Carbon emission, zero CO_2 emission, and Carbon neutrality.

Mr. Shi affirmed that although the proportion of carbon emission from ICT is small, the increasing rate in important when compared to the other industries. He also explained that the roadmap for carbon emission reduction in ICT can be taken to infrastructure, network and sharing. Then, Mr. Shi went through the best practices on green and low carbon development and cited representative examples from China which include among others: the construction of solar energy data center; recycling for energy resource use such as residual heat recycling, as well other examples on the application of energy saving technology for cooling. After evoking

the work plans of Chinese carriers and Internet companies on Carbon Neutrality, the speaker explained how ICT can enable low carbon across various aspects/sector namely industry, power, building and traffic. The speaker concluded his presentation with his vision on future development in China, which involve among others: deeply applying innovative ICT in different industries, studying and publishing standards, building a GHG emissions accounting and evaluation platform; continuing international cooperation in sustainable and digitalization transition and achieving NetZero goal.

Presenter: Shi, Ying (China Telecom)

Ms. Shi, Ying presented China Telecom's Implementations toward Green and Low Carbon Networks. The speaker started her talk by showing how China Telecom responded to the national requirement of peak carbon dioxide emission and carbon neutrality. Indeed, China Telecoms has been practicing a green development philosophy, which includes green networks/projects/office/applications, etc..., and participating in the development of ecological civilization. After going through the main energy consumption trends in China Telecoms. Ms. Shi, Ying shared main scenarios of China's Telecoms best practices in terms of the green networks and green projects. A first best practice in the scope of green networks relies on the use of a smart energy-saving system for 4G/ 5G base stations, which is based on cloud edge collaboration and the strength of IA big data as well as automatic control technologies, which enables the accurate decision-making in multiples scenarios. The widespread deployment of such a system by 2020 (over 350000 4G sector and 104000 5G sector) led to more than 12% on average in terms of daily energy efficiency and to save 95 Million KW of power. Mrs. Shi, Ying described also the actions undertaken by China Telecoms toward green networks. The latter involves actions to manage energy and emission reductions, to eliminate the outdated production capacity as well as to promote renovation for energy efficiency. China Telecom's best practices in terms of green projects involve co-building and sharing the network infrastructure assets with China Unicom which has resulted in considerable CAPEX OPEX reduction. The talk covered also examples of China Telecom's efforts in terms of green supply & Office and Green applications such as green campuses.

Presenter: Luis Neves (GeSI)

Mr. Neves started by describing GESI's strategy and experience highlighting that it is a global organization with a longstanding experience in technology and sustainability. Indeed, during the last 15 years, GESI has been working on valuable reports and studies. The latter includes among others, research on methodologies about carbon abatement and technologies, developed guidance for ICT companies setting science-based targets, ICT sector guidance built on the GHG Protocol, and an assessments methodology for evaluating the carbon-reducing impact of ICTs.
Then, the speaker presented GESI's most recent work based on a report analyzing the impact of digital technologies in the sustainable development of the United Nations. Based on the report, GESI launched a movement with the intention of getting the companies around the message of sustainability and climate change. With more than 40 major companies joining the movement, GESI developed a framework to help companies be more efficient. The framework has three main component parts. The first one is that the company has to adapt to the purpose of making sustainability part of the core business. The second is about the set of metrics to be used in problematic areas to help companies address them. The third is enabling how the technology acts in a responsible way to help the other industries become more efficient. As such, the framework represents a methodology to measure and identify a green technology. Mr. Neves talked also about the European green digital coalition that GESI leads in response to an invitation from the European Commission and about the standard for green technologies that is currently under development (target end of this year). The speaker concluded his presentation with an invitation to Networld Europe and CCSA to join the movement as stakeholders so the help framing the development of the methodologies.

Presenter: *Steffen Roos (Detecon)*

Mr. Roos's presentation aimed at explaining why standards and technology and innovation must go hand in hand. The talk started by evoking how standard such as the Carbon Footprint standards makes comparability (between competitors/ suppliers) possible and highlighting that every initiative/improvement has to be measurable. The biggest portion of the emission is associated with scope 3-carbon emission (defined by the GHG Protocol) (85%-99%) of emissions, wherein the latter the biggest factor is due to the use of the sold product. Through his presentation, the speaker provided several recommendations. This includes following respective initiatives (such as GHG protocol); Implementing sustainability in strategy and making it a priority; driving innovations "sustainability by design" and being very precise in the EE; together with all players push the common standard for comparable and overall PCF calculation, KPI for EE, the network carbon intensity of efficiency in ICT infrastructure;

Open Challenges from Panel Discussion 1

Speaker: Lutz Schade *(Telecommunication advisor)*

Dr. Lutz asserted that we are at the beginning of an important development and awareness phase about green telecom, which was not the case 10 years ago. He also emphasized that currently, the requirement is of aligning standardization between operators and suppliers and ICT companies on how to measure important metrics such as the PCF and the enablement factor.

Speaker: Peter J Williamson *(University Cambridge)*

Prof. Williamson commented that the telecom area encompasses a lot of potentially interesting techniques for achieving a green society. Nevertheless, the requirement of linking many new verticals and green applications in the broad ecosystem can cause many issues; some were touched in some of the presentations, but still need more emphasis beyond technical standards. For instance, by adopting the combination of new sensing schemes; IA algorithms, and data sources several drawbacks can arise mainly around cybersecurity and how to build trust in the ecosystem.

Prof. Williamson's thoughts included also the idea of setting a panel between industries, to provide data transparency and work on standards and beyond technical standards and on common and secure interfaces to set the rules on how the ecosystem will work.

Speaker: Shi, Ying *(China Telecom)*

Ms. Shi, Ying affirmed that many efforts have been already implemented so far in order to reduce carbon emissions and that digital transformation is quite crucial and has become an important engine to drive the green transformation of industries. In this context, the next generation of digital technologies such as BigData, Cloud Computing has begun to be widely used in various links and chains such as production, consumption, operations, management, and trading. Furthermore, CCSA and ITU could empower the vertical industries with ICTs for enabling a 10-fold effect to reduce carbon emission. The next steps include achieving peak carbon and carbon neutrality, which is a quite challenging mission. In China telecom, the next steps involve collaborating with verticals and providing ICT solutions to help them improve efficiency and lower carbon emission. In addition, China Telecom will increase the promotion of wind power and hydropower as a means to lower carbon emissions.

Speaker: Steffen Roos *(Detecon)*

Mr. Steffen Roos acknowledged that when looking to the future, the next step includes getting rid of all components that are built on energy that comes out of oil or gas, and that from a target picture, which is implemented in a NetZero discussion. From a technology perspective, techniques to get more efficient are now widely known. Nevertheless, the open challenge is to get to the overall target picture.

Following a further comment related to ensuring inside the telecom operators a system process management capable of ensuring different tradeoffs in terms of Key performance indicators (KPIs), Mr. Roos evoked that in the future we might see some management orchestration layers that can help the operators decide and negotiate the different KPIs and find a compromise. Finally, Mr. Roos concluded by a reminder that the ICT sector has a huge potential however it is important that it does not get stuck into details.

Speaker: Luis Neves *(GeSI)*

Mr. Neves provided an important message, which is not to be worried about the PCF of ICT industries.
Indeed, the enabling impact of digital technologies/ the ICT sector on other sectors such as agriculture, manufacturing, mobility represents a huge contribution. When compared to the contribution, the PCF will always be negligible. To support further this statement, Mr. Neves, followed up with the conclusion that through many studies performed, GESI could establish evidence that ICT is part of the solution for sustainability. Indeed, these studies concluded that a 9% Net positive is always achieved when considering even a 50 % of rebound effect on ICT technology. Furthermore, Mr. Neves recommended to ICT industries to focus their strategies on three things: Investing in renewable so to make the network greener; having the circular economy strategy in their business; seeking ways to be more energy-efficient. Last and not least, the speaker emphasized that ICT industries need to be aligned on the terminology also to be serious and transparent in their activities.

Following a further discussion related to developing common methodologies, Mr. Neves commented that GESI has started gathering all players in an IPCC like panel of the industry so to collaborate on developing a common methodology for measuring.

Session 2 Discussion

Presenter: William Jonker *(EIT Digital)*

Mr. Jonker started with a brief description of EIT Digital, an innovation community of the European Institute of Innovation and Technology (EIT), an EU body created by the European Union in 2008 to strengthen Europe's ability to innovate. Through his presentation, Mr. Jonker talked about one of the recently published reports titled digital technologies and the green economy. The report details the scenarios, regulations, framework needed for public and private actors in order to drive the green economy through digital technology. In more detail, the report is built on four scenario approaches evaluated according to two determining axes namely: Digital Technologies' Energy Efficiency and Economy-wide energy efficiency. This allows qualifying not only the degree of digital technologies' Energy Efficiency but also the economic impact in terms of energy consumption following the introduction of the digital technologies in the physical world. The ideal case is called utopia and stands for the case where we have very energy-efficient technology that leads to saving energy consumption in the physical world. The report covers also the assessment of the four identified scenarios according to other relevant metrics such as growth, energy transition, innovation, and social cohesion. As such, the report intends overall to help the decision-makers reach these scenarios and support their decision on regulatory frameworks leading towards a sustainable digital future. Mr. Jonker concluded his presentation with a set of important

highlights including the fact that, although important, reduction of energy consumption of digital technologies can only decrease 10 % of the total energy consumption.

Presenter: Rahim Tafazoli *(University of Surrey)*

Prof. Tafazoli's presentation focused on energy efficiency and the green impact of 5G and beyond technology. The speaker started by displaying the share of ICT emission in global emission (maximum 4% if accounting for the ICT supply chain) and by reminding that the green evaluation does not include the role of ICT to vertical industry. Then, the speaker gave a brief overview of the results of other related reports among others, on the potential of ICT to enable a 20% reduction of global CO_2 emission by 2030, which by itself is more important than EE metric. The presentation evoked also a study comparing different technologies such as 4G, 5G, LTE, FTTH, etc,..in terms of Greenhouse emission considering video streaming as a use case. The speaker pointed out that although 5G seemed to be the most energy efficient when looking into the radio part, the data centers contributes to the highest contribution to the CO_2. This calls for the requirement of considering the end-to-end aspect of the telecom network instead of only improving the efficiency at the radio side. Furthermore, when breaking down the total power consumption in cellular networks, the most power hungry component is the analog Power. After citing some of the current trends that goes against Energy Efficiency in cellular network (OpenRAN/OpenArchitecture/MIMO/Blockchain...), the speaker followed up the statement by showcasing the use case of reconfigurable intelligent surfaces. The latter is based on the holography principle and represents a newly emergent technology with the potential of extending the coverage without the requirement of increasing the power consumption, which promises substantial energy efficiency improvement in future cellular networks.

Presenter: Qi, Shuguang *(CAICT)*

Ms. Qi's presentation aimed at providing an overview about the potential of digital technology in enabling energy saving and carbon reduction as well as about the relevant standardization activities in China. As for the potential of digital technologies, the speaker mainly pointed out that the carbon emissions in cellular networks do not only emanate from HW products but also from other aspects in the network. In this context the speaker, emphasized that is important to account for the emission in these aspects namely by: rethinking construction thanks to the modular structure, evolving the operation and the maintenance by pushing for decarburization and relying on coordination and good maintenance platforms; also by achieving a circular economy by putting into practice more reuse solutions such heat reuse. Ms. Qi shared the results of the carbon emission share collected from different reports/organizations and provided the share expected by 2030 according to a CAICT study (12%-22% considering ICTs used in different industries). The speaker followed up the presentation by describing the status of relevant standardization activities in China, which include among others: ITU recommendations on energy efficient smart energy and sustainable building, CCSA recommendation on Green energy transition such as the one about embedded solar photovoltaic power system for telecommunication; CCSA standard on the holistic level of management in energy consumption and carbon emission. The speaker concluded her presentation by speaking about ongoing works namely: a standard from both CCSA and ITU on clean energy transition; and recommendations on enabling effect to other sectors to achieve Net Zero targets enabled by ICT.

Presenter: Zhou, Fanke *(Alibaba Cloud Energy)*

Mr. Zhou presented the practice and exploration of digital innovation driving green and low carbon development from Alibaba Group and China. The speaker started by introducing the Alibaba Group Carbon Neutrality Action report. According to the report, Alibaba will achieve carbon neutrality by 2030 Scope 1 and 2 by 2030. As for scope 3 emissions, Alibaba group will collaborate with chain partners to reduce intensity by 50% when compared to 2020. Alibaba report includes also scope 3+ reporting by enabling low carbon circular digital, leveraging Alibaba digital platform. As such by 2035, the Alibaba group is expected to facilitate 1.5GigaTo of GHG emissions

reductions over 15 years In the Alibaba digital ecosystem. As for the practices of Alibaba group in China, the speaker detailed the Alibaba Smart Cloud for dual carbon Tactic. The latter stands for the fact that China would reach its carbon emission peak before 2030 and becomes carbon neutral before 2060. To achieve this target, Alibaba derived 3 circles according to their respective influencing potential: inner one for reducing emissions from the enterprises internally; middle one for supporting urban and industries to reduce emissions, and the outer one for encouraging low emission and environmentally friendly activities to the community. The speaker detailed three products from Alibaba group each supporting one of the three sub-targets, which are respectively: The energy-saving and carbon reduction tool for enterprises namely to manage carbon assets, reduction transaction, and finance; a city carbon neutrality operating system for the government to make carbon visible and help set targets and roadmap; a community-oriented carbon inclusive platform to include public welfare science popularization and carbon operation. The presentation covered also video demos about each of these products. The speaker affirmed also that the energy expert practice is serving 1476 enterprises in China and leading to saving: 2 million KWH/day and reducing carbo of 1400 Tco2 e/day. Furthermore, the application of energy consumption optimization in Alibaba Park led to a daily saving of 12% in average and 30% in maximum.

Open Challenges through Panel Discussion 2

Speaker: Alvaro Valcarce *(Nokia Bell Lab)*

Mr. Valcarce raised the question of how much more energy efficient 6G can get with respect to 5G? At Nokia Bell Labs, it is estimated that 6G can get potentially 10-fold more energy efficient with respect to the 2020 5G baseline. Mr. Valcarce continued that the target is to enable this improvement purely via software and techniques like MIMO muting and cell switch off. The speaker highlighted also four technical challenges that call for further efforts and breakthrough which are:

- Idle mode power consumption for radio systems such as baseband systems and CPUs which are currently always into active mode even in case of no traffic.
- Spectrum scarcity is pushing to look for capacity in higher bands, where the path loss can be significantly high. Therefore, 6G should use the same 5G bandwidth but more efficiently than 5G does.
- Size of MIMO: MIMO is a great technology for spectrum efficiency but has a very high power consumption – a conflict that calls for further research efforts.
- Intelligence vs Electricity: An example is Machine Learning, which represents a great technology for obtaining energy saving thanks to smarter management of resources, but also consumes a considerable amount of power, especially during the training phase. (Mr. Valcarce addressed machine-learning practitioners with this open challenge emphasizing the importance of performing a carbon emission assessment of their algorithms.)

Following a further discussion related to the facility of addressing the power consumption when transitioning from hardware-based to software-based network–Mr. Valcarce explained that is not feasible to shut down some components due to time and system functional dependency constraints. Nevertheless, recently emerging proposals such as digital power amplifiers and photonic-based computing might be a game-changer in the future.

Speaker: Wang, Xuemin *(Huawei)*

Through his intervention, Mr. Wang affirmed that 6G has many promising solutions but that require further investigation when it comes to their potential of decreasing the cellular network power consumption and enabling globally a more sustainable society. Mr. Xumin summarized a set of other relevant open challenges, which include among others: Artificial Intelligence can also be leveraged for reducing the cellular network power

consumption by optimizing the idle/active mode of the network resources according to the traffic load; recycling remains a challenge when it comes to products such base stations and phones. Finally and yet importantly, Mr. Wang concluded that green topic has a very common consensus from the EU and China and that he is looking forward to more collaboration between both, particularly on this subject.

Speaker: Jukka K. Nurminen *(University of Helsinki)*

Prof. Jukka K. Nurminen provided his view on the opportunities and the open research challenges from a different perspective namely from the software and technology innovation perspective namely by brainstorming the research track of cellular network power consumption reduction enabled from the software layer. In this context, Dr. Nurminen shed the light on a set of main open challenges that includes:

- Applications are very important and future approaches need to focus on the popular applications/patterns looking at the end-to-end operations to enable power saving and the green perspective.
- Machine learning is computationally intensive and leads to substantial power consumption, which represents an incentive for investigating new ways to apply machine learning while still striving for energy efficiency.
- Edge computing design in particular the cooling solution for edge need to be further studied/optimized.

Speaker: Rahim Tafazolli *(University of Surrey)*

Prof. Tafazolli provided also further recommendations such as the requirement to further investigate:

- Alternatives technologies that do not rely on the power amplifier such as reconfigurable surfaces.
- The power consumption of Air-conditioning
- What represents a greener solution: A Centralized computing and servers Vs many smaller number of network nodes. Which solution is better when considering the requirement of both solutions in terms of energy for communication and cooling
- Potential of combining several technologies to enable more EE. For instance, for forthcoming 6G, it could represent the network of network – coexisting with terrestrial system and satellite communication in a complementary way to provide EE coverage along with short-range communications for sensing and monitoring dynamically the system EE among other KPIs.

Closing Words

Mr. Wen, Ku, and Prof Rui Aguiar concluded the seminar with some brief words on lessons learned during the session, and with some comments on the necessity to repeat this type of information exchange in the future.
In this context, Mr. Wen highlighted that in order to solve the emerging green telecom challenge globally; there is a need for close collaboration to share the best practices and experiences, which is transparent, measurable, and comparable, between different stakeholders. There is particularly a need for joining forces between CCSA and Networld Europe so to demonstrate together the added value of innovative solutions and encourage new solutions for a green and sustainable society. In this context, both CCSA and Networld Europe will continue to work together on strategic topics not only green. Prof Rui concluded also that the telecom sector is in the early stages of the roadmap to the green target and that future steps will include the development of both common standards and new technologies with impact on hardware and software components considering not only the energy-related KPIs but also the benefit and the ultimate usage of consumers.

Feedback after the session

Several formal and informal feedback was received after the session, from the participants globally. There was a large agreement on the feedback, with compliments on the quality of the webinar and its content.