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Green Management White Paper

Joint Release: China Mobile Communications Group Co.,Ltd. and Huawei Technologies Co., Ltd.

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We would like to thank all the colleagues and partners who participated in the preparation and release of the white paper, for supporting operators in implementing the green and low carbon strategy, enabling society, enterprises, and the environment to energy saving, carbon emission reduction, digital intelligent transformation, and contributing to sustainable development.

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Executive Summary

This white paper provides an overview about the motivation of Green Management standardization. The primary objective is to outline the scope of the proposal and set the stage for collective actions.

The Information and Communication Technologies (ICT) industry plays a significant role in addressing climate challenges, and this white paper emphasizes the need for sustainable practices within the industry. This release begins by providing a background on the relationship between ICT and climate challenges. It highlights the urgent need to address these challenges and the role that the ICT industry can play in driving positive change. Key pillars of Green Management are introduced, emphasizing the importance of optimizing energy consumption, enhancing network efficiency, and maximize carbon handprint creation.

To encourage industry stakeholders to actively engage in pursuing green goals, a proposed Green Management Framework is presented. This framework serves as a guide for organizations to govern, plan, and execute their green initiatives and commitments. By adopting this framework, stakeholders can navigate the path towards sustainability and contribute to the broader global efforts.

The overarching goal of this white paper is to foster collaboration and participation in sustainable practices within the ICT industry. By addressing the environmental impact of ICT, we can make significant strides in reducing greenhouse gas emissions, optimizing resource usage, promoting renewable energy adoption, and creating carbon handprints to vertical industries.

In conclusion, this white paper serves as a call to action. Let us embrace the proposed framework and actively engage in pursuing green goals within the ICT industry. By doing so, we can make a tangible impact on the environment, foster innovation, and contribute to a sustainable future.

1. Introduction

1.1 Background

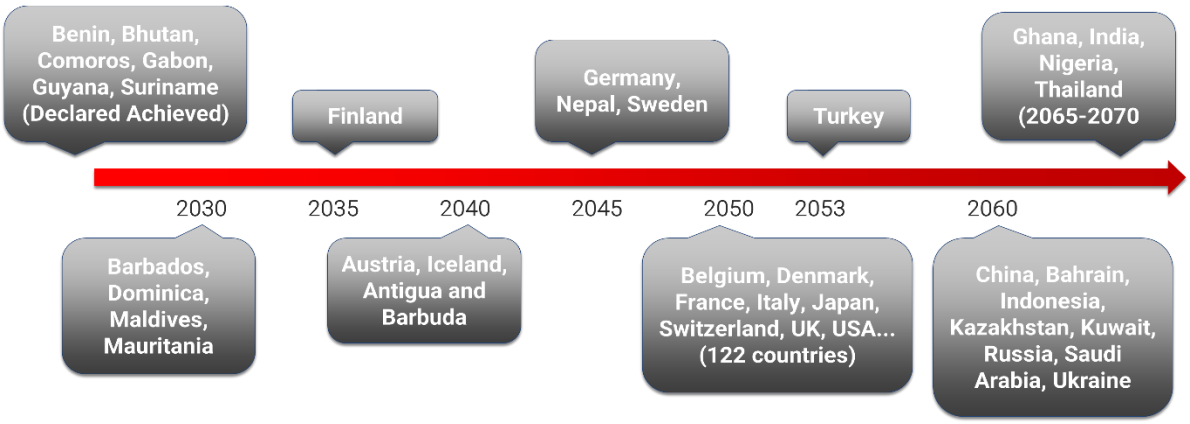
The latest development of global warming is continuing to accelerate. The year 2022 was the fifth warmest year on record, and the first six months of 2023 have been even warmer than that. This is due to the continued increase in greenhouse gas emissions from human activities. In 2015, Paris Agreement was signed by 196 countries with the goal of limiting global warming to well below 2 degrees Celsius, and preferably to 1.5 degrees Celsius, above pre-industrial levels. We all have a role to play in addressing global warming. By taking action now, we can help to protect our planet for future generations.

The Paris Agreement sets out a global framework for action to reduce greenhouse gas emissions and adapt to the impacts of climate change. Although the agreement is a landmark achievement in the fight against climate change, it is not enough on its own to prevent the worst impacts of climate change. More action is needed from all industries to reduce emissions and adapt to the impacts of climate change.

Significant progress has been made in the realm of standardization, particularly in energy-saving technologies, leading to the emergence of numerous energy-saving standards. However, despite the increasing importance of ICTs in the world and their significant contribution to technology and economic growth, an established standardization specifically focused on Green Management is essential. This highlights the need for comprehensive standards in this domain to address the environmental impact of ICT networks together and further promote sustainable practices.

1.1.1 Legislation & Compliance

Legislation and compliance development in the globe varies across countries and regions. Many countries have implemented legislation to address climate change and environmental concerns. By 2022, 148 countries have committed to Carbon Neutrality, Net Zero or Climate Neutral [2]:



Actions are taken by enacting or advancing national climate laws. These laws establish legal frameworks and targets to guide the transition towards a low-carbon economy. By implementing comprehensive legislation, ICTs must put resources to fulfill the compliance.

To accelerate progress towards carbon neutrality, adopting more vigorous policies and measures is crucial. ICTs are setting ambitious renewable energy targets, implementing energy efficiency programs, promoting sustainable network development, and supporting research of low-carbon technologies.

1.2 Trend & Insights

The trend for ICTs to meet carbon neutrality's timeline and target is gaining momentum. Companies are increasingly investing in renewable energy sources to power network infrastructure and data centers, meanwhile adopting energy-efficient technologies to reduce their carbon footprint. Additionally, advancements in ICT hardware and software have enabled more efficient computing and data processing, further contributing to carbon reduction efforts.

However, as the world becomes increasingly reliant on digital services, there has been a significant increase in the demand for reliable and high-speed connectivity. With the imminent rise of technologies like 5G, Internet of Things (IoT), and artificial intelligence (AI), it is estimated that traffic demand will surge by multiple folds in near future. The industry is actively investing in research and development to upgrade infrastructure and develop innovative solutions that can support the increasing network demands while minimizing environmental impact.

Recent achievements, green innovation, and development by ICTs [3-7]

Vodafone

- Committed to carbon emissions to net zero (Scope 1 & 2) by 2030 and across the full value chain (Scope 3) by 2040

- Hosted a customer summit at 2023 London Green Tech Festival to actively engage Business customers about green digital transition.

Orange

- Committed to achieve Net-Zero carbon emissions by 2040

- Energy saving plan in line with the electricity consumption reduction objectives set by the French government

- Develop Orange Sustainable and Circular Ambition for Recertification (OSCAR) program for buying and selling reconditioned equipment

Axiata

- Committed to achieve net-zero carbon by 2050

- Introduced the hybrid system charge discharge battery (CDC) to power BTS in remote locations, resulted in a 54% reduction in diesel consumption

Telefónica

- Committed to achieve Net-Zero carbon emissions by 2040

- Committed 100% of energy from renewable sources by 2030 (In 2022, 100% renewable in Europe, Brazil, Peru & Chile)

China Mobile

- Committed the 30-60 Decarbonization Goals to reach CO_2 emissions peak before 2030 and achieve carbon neutrality by 2060, in line with Chinese Government's commitment

- Carried out AI-based energy efficiency management and developed AI-based water-cooling adjustment and optimization in their data centers, core machine buildings, 5G base stations

At the standardization level, the management of green ICT networks requires more than just energy-saving technologies. While standardization organizations have invested significant time and effort into researching energy-saving technologies, it has become clear that these solutions are unique to each manufacturer. Instead, the focus shall be shifted to the importance of standardizing the management of energy-saving measures. By implementing a unified management process, we can ensure that energy-saving measures are effectively implemented and maintained, leading to a more sustainable and efficient network for all.

To accomplish green and low-carbon business goals, ICTs need a green management platform that enables visualization and management. This platform should establish key green indexes and monitor these indicators. By monitoring the green indexes through the platform, operators can identify poorly performing indicators, pinpoint corresponding areas or items that require improvement, and provide optimization recommendations through analysis and management. Additionally, operators can analyze trends to formulate measures for continuous improvement and optimization

The contribution of ICT to emission reduction in industries is far greater than its own carbon footprint. The ICT industry is not a high-carbon emitting industry. Global Enabling Sustainability Initiative (GeSI)'s research [8] indicates that the future contribution of the ICT industry in enabling emission reductions in other industries is nearly ten times greater than the emissions generated by deploying it.

1.3 Vision

As the world increasingly recognizes the importance of sustainable practices and environmental responsibility, it is imperative that we address the ecological impact of ICTs and ensure their alignment with global sustainability goals. To this whitepaper, we propose the following initiatives:

A. Joint Formation of Standardization on Green Management

The industry acknowledges a compelling need for Standardization on Green Management, so a collective call should be made to industry leaders, experts, and relevant stakeholders to collaborate in the development. The standard will serve as a guiding framework to minimize the environmental footprint of ICT networks, promoting energy efficiency, resource optimization, and enablement throughout different industries. By collaborating on the creation of this standard, we can collectively drive transformative change and foster a sustainable digital future

B. Creating a framework for Green Management

To effectively visualize, plan, and manage the operation of Green Management, this proposal supports the development of a dedicated Green Management Framework. The framework will serve as a guidance for Planning and Execution, suggesting a centralized platform to offer real-time monitoring, analytics, and decision-making tools to optimize the environmental performance of ICT infrastructures. By enabling stakeholders to actively track and evaluate energy consumption, carbon emissions, and other key sustainability metricsthe Green Management Framework will empower organizations to make informed choices and drive continuous improvement in their business and operations.

C. Measurement of ICTs' Carbon Handprint across Vertical Industries

To measure the positive environmental impact that ICTs have across various vertical industries, a quantification and assessment approach can be used. By assessing the benefits achieved through the adoption and utilization of ICTs, this measurement approach aims to incentivize sustainable practices and encourage further innovation in green technologies. Recognizing the importance of promoting sustainability beyond the ICT sector, it is crucial to extend the measurement of ICTs' positive environmental impact to other industries, ensuring a comprehensive evaluation of their contribution to greenhouse gas (GHG) reduction.

ICT is the locomotive propelling us towards carbon neutrality. It enables efficient communication, optimizes resource utilization, and fosters innovation. By harnessing its potential, we can accelerate towards a greener future, where technology drives sustainability and economic growth while minimizing our environmental impact.

2. Green Management Framework

The Green Management Framework is a holistic approach to advance environmental sustainability within the ICT industry. This framework is designed to promote sustainable practices across the entire green ecosystem, with a focus on the areas of governance, planning, and execution. In this section, we will provide a brief description of each item within these pillars, outlining their significance and role in supporting environmental sustainability within the ICT sector.

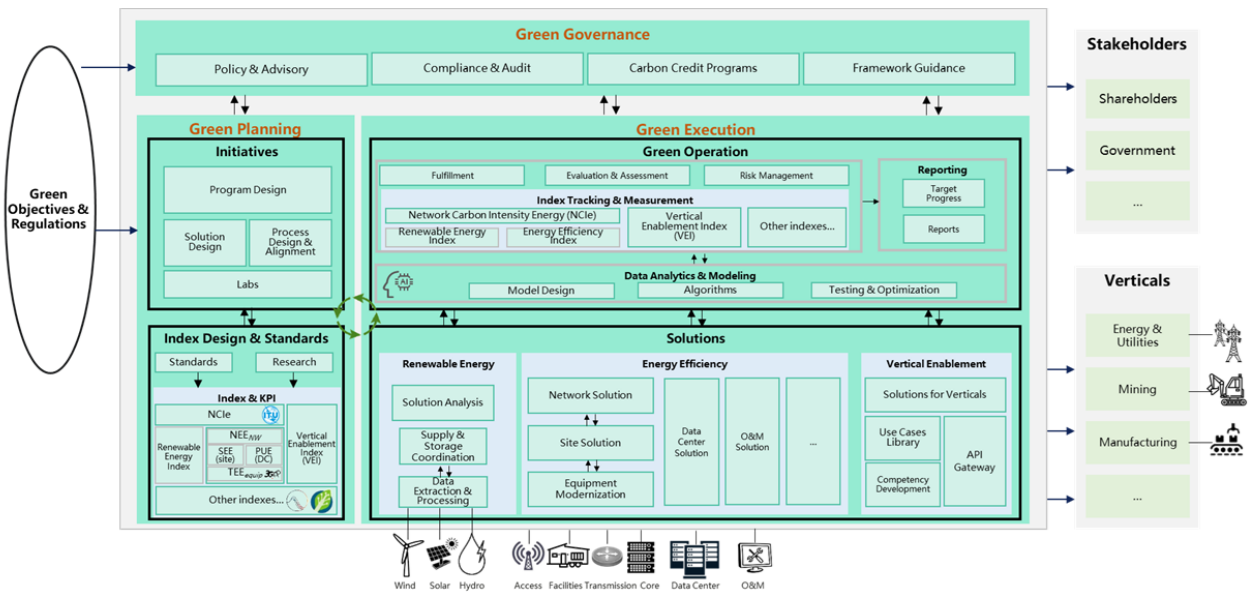


Figure 1 Green Management Framework

2.1 Green Governance

Establishment of policies, guidelines, and decision-making processes within an ICT to promote and ensure environmentally sustainable practices. It involves creating a framework for responsible environmental stewardship and integrating green energy considerations into the company's overall strategy and operations.

Policy & Advisory

- Policy: creation of guidelines, rules, and frameworks that guide the company's actions and decision-making processes regarding green energy usage
- Advisory: provide guidance, expertise, and support to ICTs in their efforts to adopt and implement green energy practices (e.g. Sustainability Consulting, Financial and Investment Advisory)

Compliance & Audit: refers to the adherence to relevant environmental laws, regulations, standards, and policies

- Compliance: ICTs need to comply with environmental regulations and laws set forth by the government
- Reporting and Disclosure: Compliance often involves reporting and disclosing relevant environmental data and information to regulatory authorities. Information includes periodic reports on energy consumption and carbon emissions etc.
- Energy Management Advisory: energy management can help ICTs optimize their energy usage, identify energy-saving opportunities, and implement energy-efficient technologies, such as energy audits, analysis of energy consumption patterns, and recommendations for energy optimization measures (e.g. Environmental audits, energy audits)

Carbon Credit Programs： market-based approach to incentivize and promote greenhouse gas (GHG) emissions reduction and mitigation efforts, designed to help organizations and countries take responsibility for their carbon emissions

Framework Guidance： a set of principles and detail guidelines that provide direction and support for organizations to implement sustainable and environmentally responsible practices

2.2 Green Planning

Green planning of ICTs is of utmost importance in the framework of Green Management. It plays a pivotal role in driving sustainable practice within the ICT. It encompasses program development, the establishment of green indexes and the setting of sustainability standards. Effective planning enables organizations to define their sustainability goals, outline strategies, and allocate resources necessary for implementation. In many different industries, these indexes are primarily focused on reducing GHG emissions. This paper aims to explore and target standardization of sustainability indexes for the ICT industry, which has a unique role in driving communication technology advancement and fostering carbon handprint creation for other industries. In the following section, a set of indexes for the ICT industry will be proposed.

Focus on the strategic integration of green energy solutions and environmentally friendly practices into the ICT's infrastructure, network expansion, and service delivery. It involves careful assessment, analysis, and implementation of sustainable technologies and practices.

Initiatives

Program Design:

1.Goal Setting and Target Establishment: setting clear and measurable goals and targets

2.Comprehensive Assessment and Baseline Analysis: conducting a comprehensive assessment and baseline analysis of the organization's current environmental performance

3.Integration of Environmental Considerations: incorporating sustainable practices, aim to embed environmental sustainability throughout the organization's activities

Solution Design**:** Problem identification & analysis; Solution Development and Evaluation; Integration and Implementation Planning; Monitoring, Evaluation, and Continuous Improvement

Process Design & Alignment**:**

1.Set clear targets and objectives

2. Engage with different stakeholders: employees, management, customers, suppliers, and regulators

3. Develop strategies for power management and demand response

Labs**:** play a crucial role in this process by conducting experiments, developing prototypes, and testing new ideas; contribute to the advancement of sustainable practices, the discovery of renewable energy sources, the optimization of resource utilization, test the new equipment or integrated green solutions and verify expected results.

2.2.1 Green Indexes for ICTs

GHG Emission is the most common index used to measure the environmental impact of ICTs. However, it is no longer sufficient to address the growing sustainability challenges faced by the industry. While ICT technologies continue to grow, it is important to enhance their efficiency and minimize their carbon footprint. Therefore, it is necessary to develop additional sustainability indexes that account for the multiple environmental impacts of ICTs.

Here is a figure showing the measurement of environmental impact of a typical telecom network, which involves a layering of indexes that encompass different aspects of the network, infrastructure, and operations. The first layer is the Equipment Layer, which utilizes the Telecom Energy Efficiency (TEE) to measure the energy efficiency of individual network equipment; The second layer is the Site Layer, which utilizes the Site Energy Efficiency (SEE) and Power Usage Efficiency (PUE) to measure the energy efficiency of sites and data centers; The third layer is the Network Layer, which utilizes the Network Energy Efficiency (NEE) to measure the overall energy efficiency of the entire network; The fourth layer is the Operations Layer, which utilizes the Network Carbon Intensity Energy (NCIe) index to measure the carbon intensity of data transmission across networks. Overall, this layering system provides a more logical understanding of sustainable development of green ICTs, which considered not only the development of telecom system, but also the environmental impact.

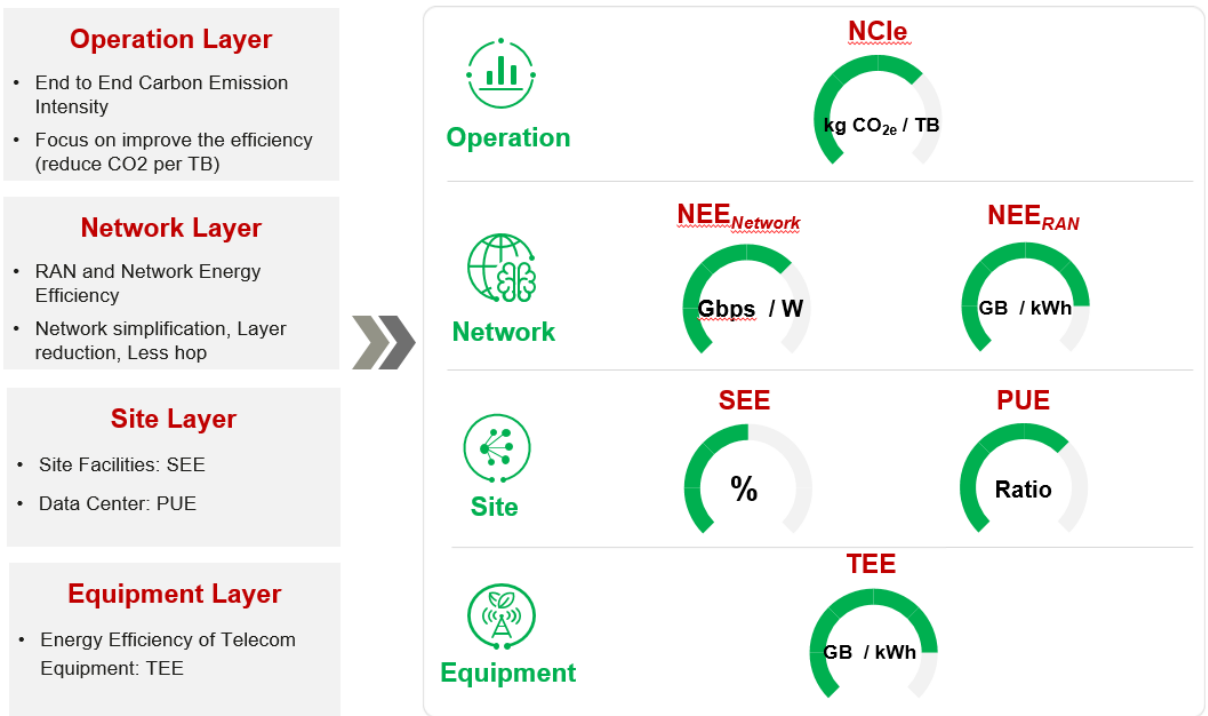


Figure 2: Four-layer index system for Green management for ICT

Among the four-layer index system, there are four indexes to be highlighted and will be introduced further: Network Carbon Intensity Energy (NCIe), Network Energy Efficiency (NEE); Site Energy Efficiency(SEE), and Vertical Enablement Index (VEI). The NCIe measures the carbon intensity of data transmission across networks; the NEE and SEE measure the efficiency of energy usage at the network and site level, while the VEI is used to express the effect that ICT enable other industry's carbon emission reduction.

Network Carbon Intensity Energy (NCIe)

The Network Carbon Intensity energy (NCIe)[1]. It is a key indicator defined in ITU-T Recommendation L.1333, which is a standard for measuring the environmental impact of ICT networks. NCIe is calculated as the amount of carbon dioxide emitted per unit of data traffic.

The NCIe index can be used to track the environmental impact of ICT networks and identify opportunities to reduce their carbon footprint. For example, ICT organizations could use the NCIe index to identify networks or data centers that are consuming a lot of energy and take steps to improve their efficiency.

The formula for calculating the NCIe index is as follows:

$$NCIe = EC_{total}(kWH) * CF_{av}(kg\ CO_2e/kWh) / DV_N(TB)$$

Where:

- ECtotal is the total energy efficiency of the network
- DV_N is the data volume of the network
- CFav is the average carbon emission factor

To improve NCIe, two key strategies can be employed. The first is to improve energy efficiency, which involves reducing the amount of energy required to transmit data (per TB) across the network. The second strategy is to reduce the emission factor, which involves using cleaner and more sustainable energy sources to power the network. Here is a figure illustrates the strategies:

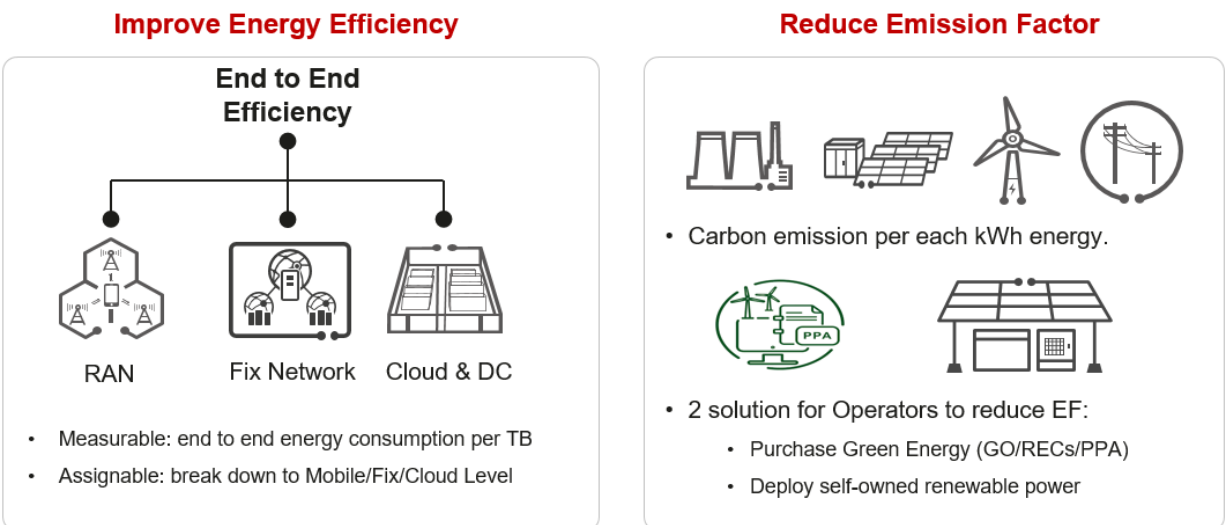


Figure 3: Measure and improve the end-to-end NCIe

Network Energy Efficiency index (NEE)

The Network Energy Efficiency index (NEE) is an important measure of the overall energy efficiency of an entire network. By improving the energy efficiency of the network, the NEE index can be increased, ultimately reducing the environmental impact of ICT networks. Here is the formulae:

$NEE_{Network}$ = Total Mobile Traffic(GB) / Total Energy Consumption (kWh)

In order to measure the energy efficiency of mobile access networks as an example and continuously pursue both optimal energy efficiency and experience, the formula can be improved to

NEE_{RAN} = f(Mobile Traffic, Coverage, Experience) / Total Energy Consumption (kWh)

The following figure illustrates the NEE_{RAN} for a typical mobile access network, to show the measurement of the energy efficiency of the mobile networks and a continuous pursue both optimal energy efficiency and user experience

$$= \frac{Total\ Mobile\ Traffic\ (GB)}{Total\ Energy\ Consumption\ (kWh)} \qquad = \frac{f(Mobile\ Traffic, Coverage, Experience)}{Total\ Energy\ Consumption\ (kWh)}$$

Improve mobile network energy efficiency | **Multi-dimensional energy efficiency**

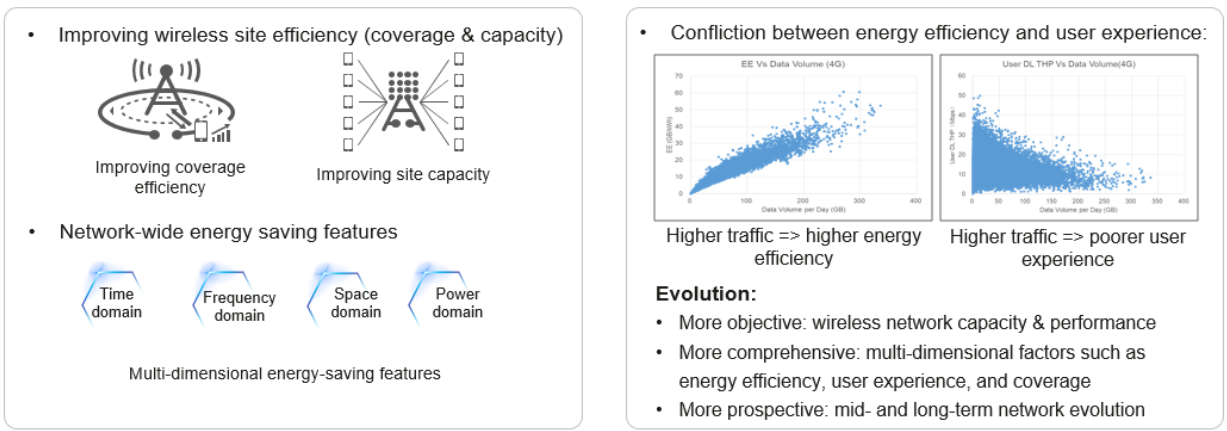


Figure 4: Measure and improve the Energy Efficiency of Mobile Networks

Site Energy Efficiency index (SEE)

The Site Energy Efficiency index (SEE) is a measure of the overall energy efficiency of a network site:

$SEE = EC_{CT} / EC_{MN}$

Where:

- EC_{CT} is the Energy Efficiency of the Telecom equipment
- EC_{MN} is the Energy Consumption of the mobile network
- EC_{MN} is the energy consumption of the whole site, including the support equipment like the rectifier, power storage, security lights, air conditioning, etc

The above metric gives an indication of Site Energy Efficiency (SEE) in terms of how big fraction of energy is used for actual telecommunication equipment. However, site scenarios are complex. Sites have different sizes and types and the telecom equipment types are also different. The composition and scale of the support equipment are also multivariable. Therefore, the SEE values vary greatly. Sites with low energy efficiency and sites with energy efficiency to be improved cannot be directly recognized. Therefore, further research and experiment is required on the universality of the preceding metric in actual scenarios

Here is a figure illustrates how the Energy Efficiency of a typical site can be measured.

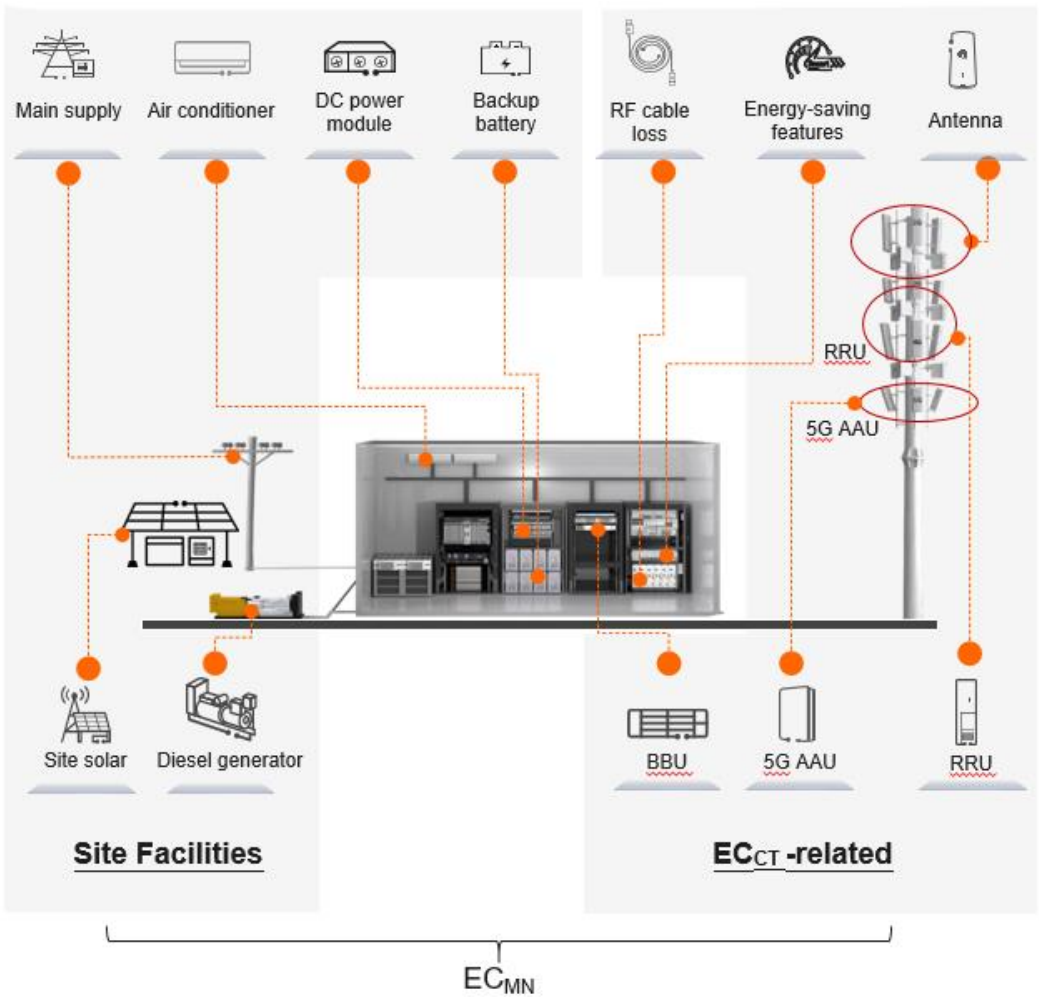


Figure 5: Measure site energy efficiency for a Mobile Network

Vertical Enablement Index (VEI)

For the enablement scenario, the main indicator is the vertical enablement index

We assume: The object is unit product or service. Enablement carbon emission reduction is an indicator to describe the difference between the carbon emissions without the enabling carbonreduction solution (i.e. baseline scenario) and the carbon emissions of the enabling carbon reduction solution.

Vertical Enablement Index is the Ratio of the enablement carbon emission reduction to the carbon emissions of the enabling carbon reduction solution, reflecting the carbon emission reduction degree for other industries enabled by ICT

$VEI = (CE_{BS}-CE_{ES}) / CE_{ES}$

Where:

- VEI is the vertical enablement index which indicates the carbon emission reduction degree and effect for other industries enabled by ICT
- CE_{BS} is the carbon emission of the baseline scenario
- CE_{ES} is the carbon emission of the enablement emission reduction solution

2.3 Green Execution

Implementation of green energy initiatives and the ongoing management of sustainable practices within the ICT. It focuses on translating the strategic plans into tangible actions and ensuring their successful implementation.

Green Operation

Fulfillment: Implementing the environmentally friendly solutions and considering sustainability throughout the process.

Evaluation & assessment: Network evaluation, customer assessment and technology assessment etc, enable companies to identify strengths, weaknesses, and areas for improvement

Risk management: Systematic process of identifying, assessing, and mitigating potential risks associated with environmentally friendly practices. It involves identifying risks specific to green operations, evaluating their potential impact, and implementing measures to manage or minimize those risks

Index Tracking & Measurement: Continuous tracking on defined indexes from Planning stage. They are used to measure progress and review its effectiveness

Reporting

Target progress: Accurately measuring and transparently reporting the company's environmental performance and progress towards achieving sustainability goals related to resource efficiency, carbon emissions reduction, and adoption of eco-friendly practices

Reports: Provide comprehensive information on the company's environmental initiatives, performance, and progress, showcasing its commitment towards sustainability and accountability

Data analysis & modelling

Model design: Incorporation of environmentally friendly practices and sustainable principles throughout the entire operational framework, ensuring minimal environmental impact and optimal resource efficiency

Algorithms: Discover patterns, trends, and insights from environmental data, enabling informed decision-making and the identification of opportunities for optimizing resource efficiency and reducing carbon emissions

Testing & optimization: Systematic evaluation and refinement of environmentally friendly practices, technologies, and processes to maximize resource efficiency

A centralized platform is highly valuable for ICTs to manage their green initiatives, goals, measures, and detailed operations. Such a platform can provide a centralized hub for monitoring, coordinating, and optimizing sustainability efforts within an organization. Here is an example incorporated with the green governance, planning and the indexes:

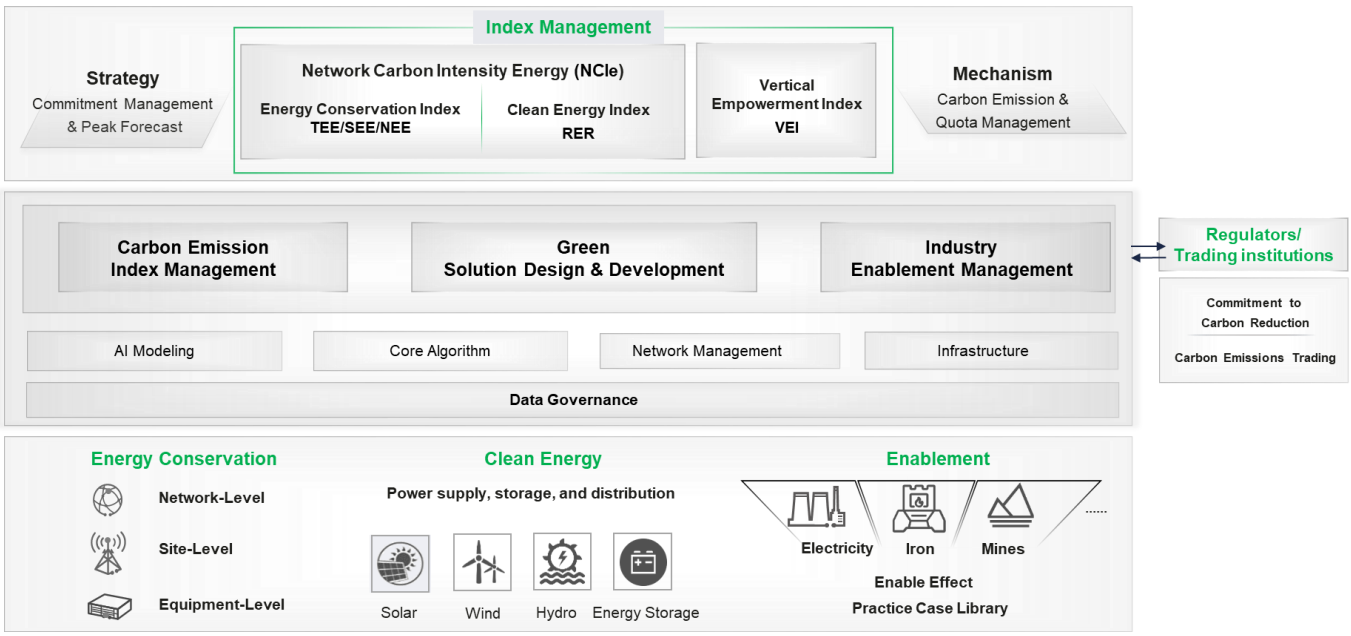


Figure 6: A centralized platform for the Green Management

The platform enables the collection of key data, including traffic, service quality, and energy consumption information from network and equipment. This data provides CSPs with enhanced visibility, manageability, and actionable insights for intelligent operations on energy efficiency. In addition, the platform can be capable for solution development and capex planning, empowering CSPs to optimize their investments and achieve greater efficiency and sustainability.

Furthermore, the platform can be interconnected with carbon emission regulators, trading institutions, and vertical industries to support regulatory requirements and facilitate wider societal efforts towards digital transformation and carbon emission reduction.

Green Solutions

Green Solution refers to a set of sustainable practices and technologies that are designed to promote sustainability, particularly in the ICT industry. This includes the use of renewable energy sources, the adoption of energy-efficient technologies and practices, and the implementation of vertical enablement solutions to other industries. These practices and technologies are developed from the experience of ICTs in implementing those solutions.

Renewable Energy

Solution analysis: Process of assessing the viability and potential advantages of integrating sustainable energy sources into telecom infrastructure to minimize reliance on non-renewable energy

Supply & storage coordination: Strategic management and optimization of renewable energy resources to ensure a reliable and efficient supply of clean energy for various applications, example is the use of smart grids and battery energy storage systems to capture excess energy generated from renewable sources

Data extraction & processing: Data analysis techniques are employed to derive insights and inform decision-making for optimizing renewable energy systems, such as gathering real-time data from solar panels or wind turbines to monitor energy production)

Energy Efficiency

Network solution: Implementing strategies optimize the use of energy in network infrastructure, equipment, and operations to minimize energy consumption

Site solution: Comprehensive set of strategies, technologies, and practices implemented at a telecom site, such as a base station or data center, strategy could be Implement of energy-efficient equipment

Equipment modernization: Specifically involves upgrading or replacing outdated or energy-inefficient equipment within the network, such as servers, cooling systems, and power distribution units

Data center solution: Implementing measures such as use of renewable energy, efficient cooling systems, virtualization, and optimizing server utilization to reduce energy consumption and maximize efficiency of data center operations

O&M solution: optimizing the performance of green network systems by using innovative technologies such as digitalization, automation, and AI to monitor and manage performance, detect and fix problems, and make the best use of resources to reduce energy consumption and carbon emissions

2.4 Vertical Enablement

The ICT industry has a crucial role in facilitating emission reductions and advancing sustainability across diverse industry verticals. Leveraging their expertise, ICT companies should harness their own experiences to drive development and contribute to the enablement of sustainability practices within these verticals.

Solutions for verticals: Services offer to vertical industry, like digital transformation, cloud virtualization, IoT system, automation, or AI, eventually reduce carbon footprint

Use cases library: A collection of best practices and insights gained from self and B2B deployment experiences.

Competency development: Providing training and consultancy to personnel in other industries to enable them to adopt and implement green solutions or sustainable practices.

API Gateway: A centralized ecosystem that connects diverse systems and technologies, including those related to green solutions or sustainable practices, to improve efficiency and reduce environmental impact.

Examples of Vertical Enablement to other industries:

Digital Transformation

Paperless: cloud storage, digital signatures, and collaborative platforms to manage documents electronically, minimizing the need for physical paper-based processes

E-commerce platforms: provide online marketplaces to sell products and services

Digital payment solutions: mobile wallets and payment gateways, these contactless payment methods enable secure and convenient transactions

Virtualization and Edge Services

Virtualization: Allows multiple users or customers to share physical resources such as servers, storage, and networks. This increases efficiency and flexibility in resource allocation.

Edge Services: Edge virtualization brings computing resources closer to end-users. Allows faster processing and customization, enabling real-time services like virtual/augmented reality and autonomous vehicles. Faster and more reliable applications that require low latency can be rollout.

Smart Cities

Help develop smart cities by technologies like sensors, 5G coverage and automation:

IoT devices apply sensors to collect data, enabling cities gain valuable insights into patterns, trends, facilitating informed decision-making

5G technology enhances connectivity by providing ultra-fast and low-latency communication

Optimize energy usage, traffic management and waste management, leading to more livable cities

In addition to enabling sustainability practices, ICT offers significant opportunities for other industries to reduce carbon emissions and create positive environmental impacts, often referred to as "carbon handprints." By leveraging digital technologies, industries can optimize resource utilization, streamline processes, and implement innovative solutions that lead to substantial carbon footprint reductions. For instance, through advanced data analytics and real-time monitoring, ICT enables industries to identify energy-intensive areas, implement energy-saving measures, and optimize transportation routes, thereby reducing carbon emissions throughout the value chain. Furthermore, ICT solutions facilitate remote collaboration, telecommuting, and digitalization of services, reducing the need for physical travel and resulting in additional carbon savings. By embracing ICT's enablement, industries can actively contribute to global climate goals, demonstrating their commitment to sustainability and fostering a greener future for generations to come.

Use case in Mining Industry:

Intelligent Mining Site

A trial involves one of the largest steel company in western China. In collaboration with China Mobile and Huawei, the 5G+ Intelligent Mining Innovation Base has been established to promote the formulation of industry standards for intelligent mining.
The overall solution for the 5G unmanned mining site consists of three parts: "terminal," "network," and "edge." Intelligent equipment includes remotely controllable electric shovels, mine trucks, and electric drills, as well as autonomously driven mine trucks. The 5G private network provides a basic communication network for unmanned mining sites, meeting the requirements of high upstream transmission, low latency, high reliability, and security in mining scenarios. The edge data center integrates mining-edge containerized equipment rooms, network/computing resources, and various unmanned mining applications. It centrally stores mining production data, enabling simplified deployment and operation.
Through the application of ICT technology, the mining industry has achieved significant carbon emissions reductions. By calculating the carbon reduction factor:
- Estimated 642 tons annual reduction in carbon dioxide emissions
- Approximately 8.4-fold increase in the Vertical Enablement Index (VEI) which is a significant increase in our carbon handprint.

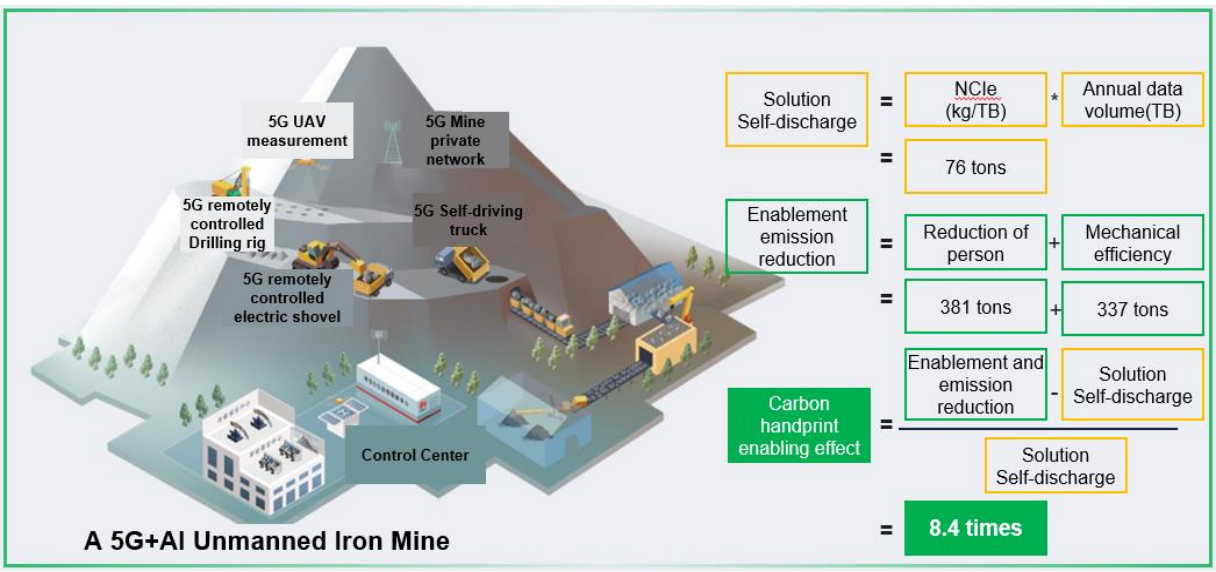


Figure 7: A trial intelligent mining site as example of vertical enablement by ICT

3. Conclusion

This white paper is an important step towards promoting green development in the ICT industry, as we work together to standardize Green Management. By establishing a systematic framework, we hope to facilitate the reduction of carbon emissions and promote greater sustainability across various sectors.

The proposed framework in the white paper serves as a pivotal idea that empowers ICT organizations to effectively govern, plan, and execute their green commitments and initiatives. With further standardization on practices and guidelines, the industry can harmonize efforts, share best practices, and drive meaningful change in the environmental impact.

We call upon all stakeholders, industry development organizations, standards organizations and academia to actively participate in this standardization initiative. Together, we can shape a greener and more sustainable future, leveraging the transformative power of ICT to address environmental challenges and achieve a low-carbon economy.

Through this collaborative endeavor, we envision a future where Green Management becomes a fundamental component of ICT operations. The time for action is now. Let us unite in our commitment to develop a common language on green management and pave the way for a more environmentally conscious and resilient world. Together, we can drive innovation, foster collaboration, and create a lasting positive impact on our planet.

4. Administrative Appendix

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