Building Green Networks Through International Standards

How ITU is supporting sustainable networks

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Chairman of Working Party 2
of ITU-T Study Group 5

May 2024

Study Group 5 – Leading on Key Topics

Energy efficiency and data centres

Sustainable Digital Transformation

E-waste, the circular economy and supply chain management

ICT and the net-zero challenge

ICT impacts on biodiversity

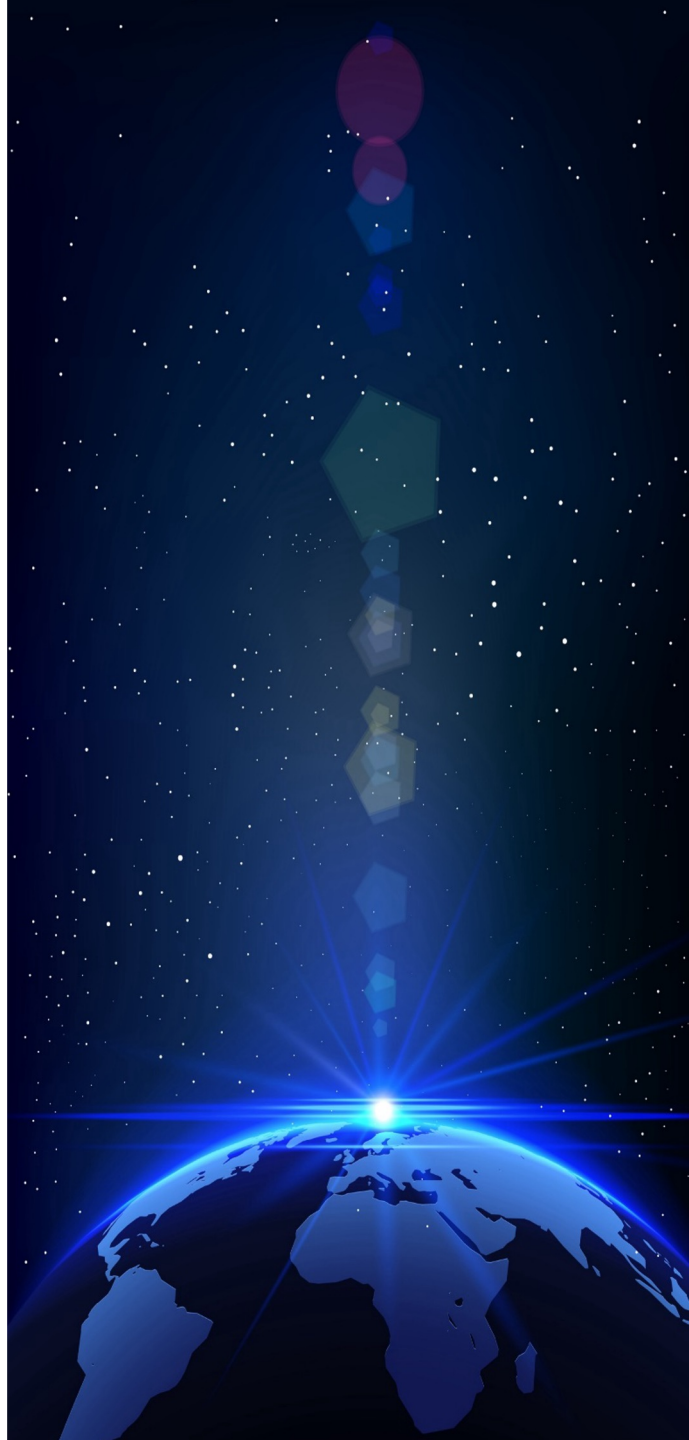
Circularity of cities

Increasing connectivity worldwide

Technological innovation is on the rise
As technological innovation continues to advance at an unprecedented pace

Growing dependence on networks
More and more people rely on technologies seamlessly connected to the internet

Urgent need for sustainable networks
Now more than ever there is a need to reduce ICTs impact on the environment

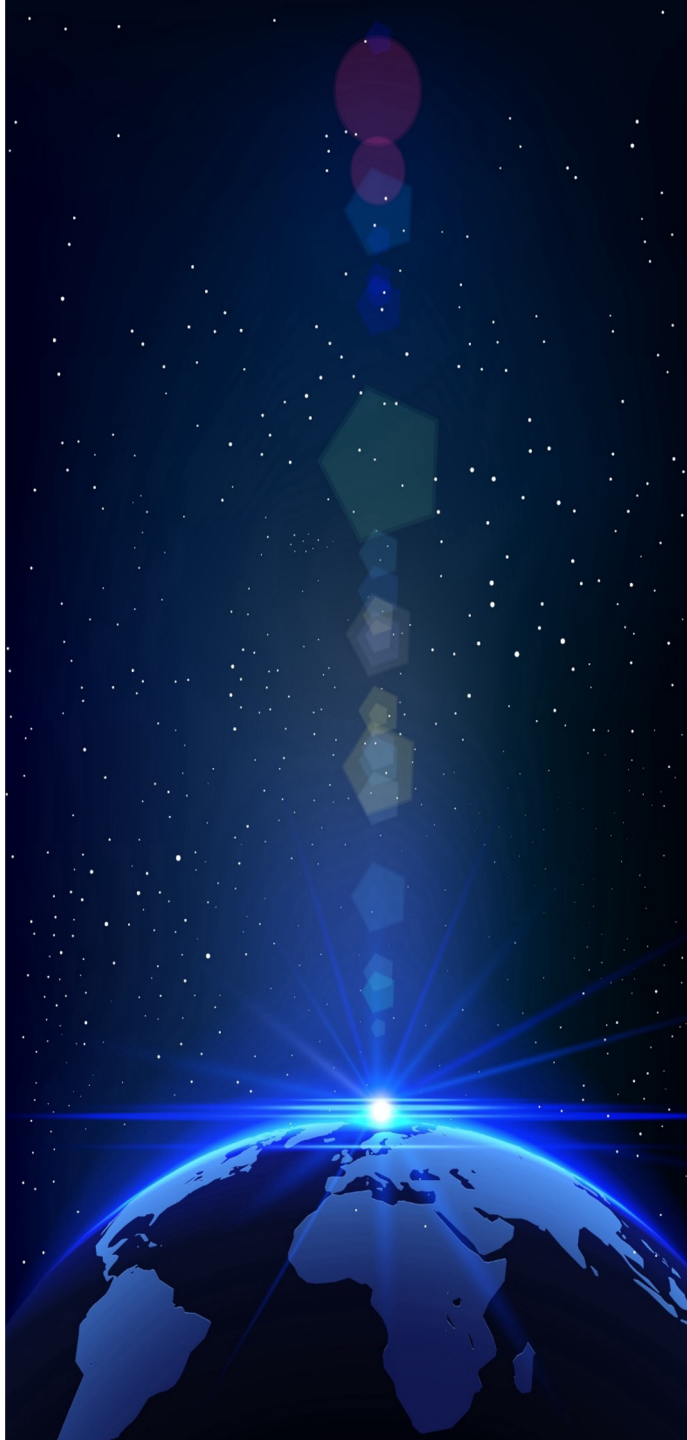


There is a significant need for sustainable ICT networks

3% of total globally energy consumption, are from telecom operators. Placing them at the forefront of the most energy-intensive companies worldwide.

90% of network cost spent on energy, consisting mostly of fuel and electricity, the demand for energy-saving measures from telecom operators is growing

Despite the ICT sector's efforts there is still a long way ahead



How ITU is supporting environmental sustainability sites and networks

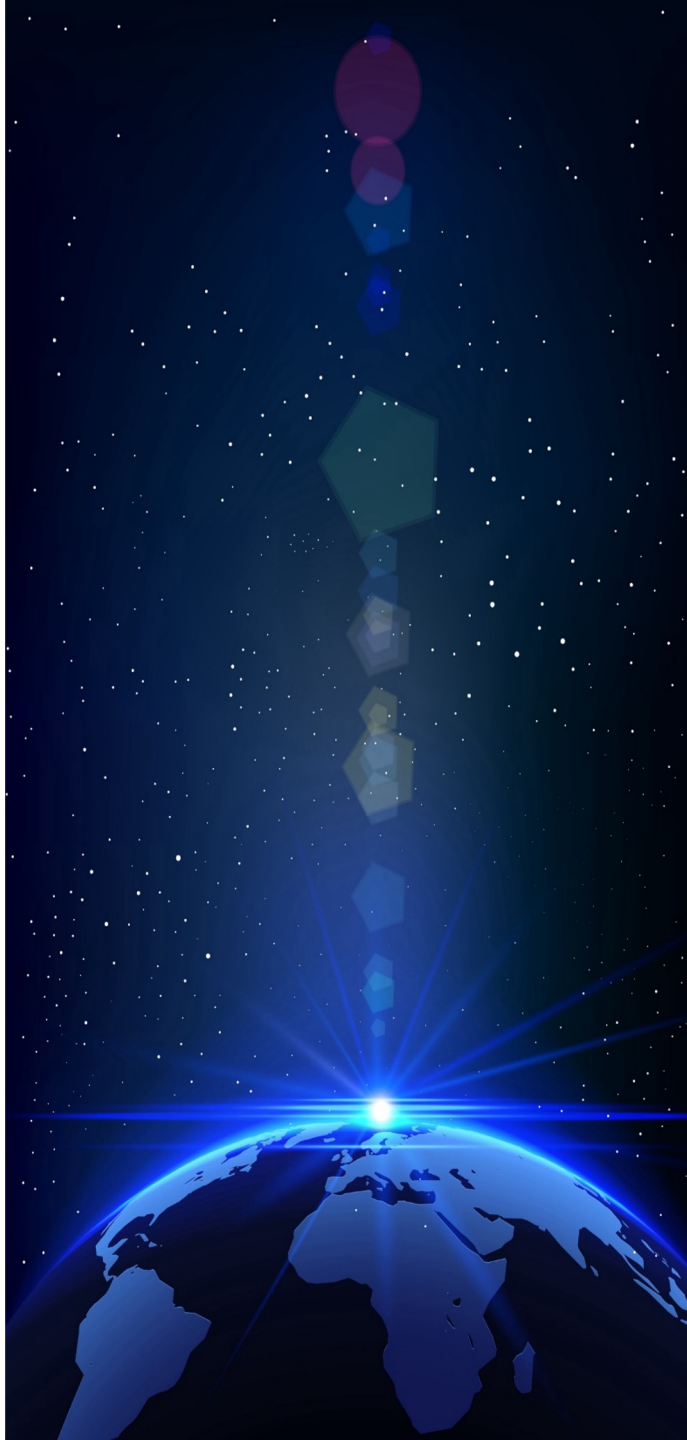
ITU-T Standardization Sector

Sets International Standards green telecom sites and environmental efficiency infrastructure

ITU-T Study Group 5

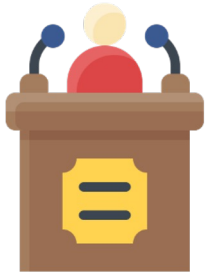
EMF, environment, climate action, sustainable digitalization, and circular economy

- Electromagnetic compatibility, resistibility and lightning protection
- Soft error caused by particle radiations
- Human exposure to electromagnetic fields (EMF)
- Circular economy and e-waste management
- ICTs related to the environment, energy efficiency, clean energy and sustainable digitalization for climate actions



How to use standards to achieve net zero and how ITU is helping?

The standards are developed on a **consensus environment** involving different stakeholders: Member states, Telecommunication Operators, Industry, Regulators, Academia, Research centres



Open communication and helpful working methods and tools

Publications and **standards are available for free** on the ITU website

Participation in numerous conference and organization of **raising awareness workshops** and fora

Support to the Administrations, Government and Industry in the implementation of the standards.

The use of standars is a matter of individual appropriation and implementation by companies and/or administrations

www.itu.int

Energy Efficiency Standards

At product level

- ITU-T L.1310: Energy efficiency metrics and measurement methods for telecommunication equipment
- ITU-T L.1320: Energy efficiency metrics and measurement for power and cooling telecommunications and data centres equipment for
- ITU-T L.1390: Energy saving technologies and best practices for 5G RAN equipment

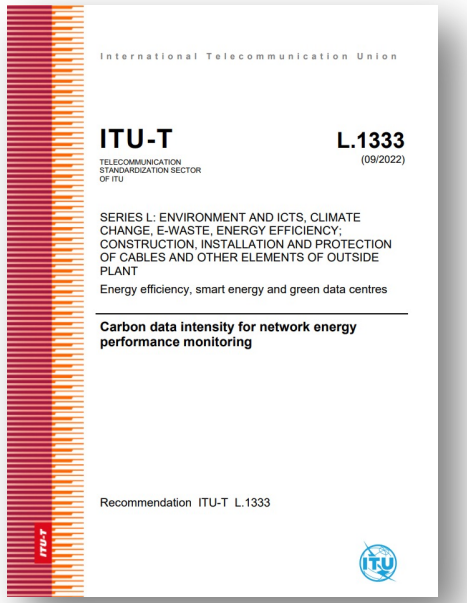
At site level

- ITU-T L.1350: Energy efficiency metrics of a base station site
- ITU-T L.1351: Energy efficiency measurement methodology for base station sites

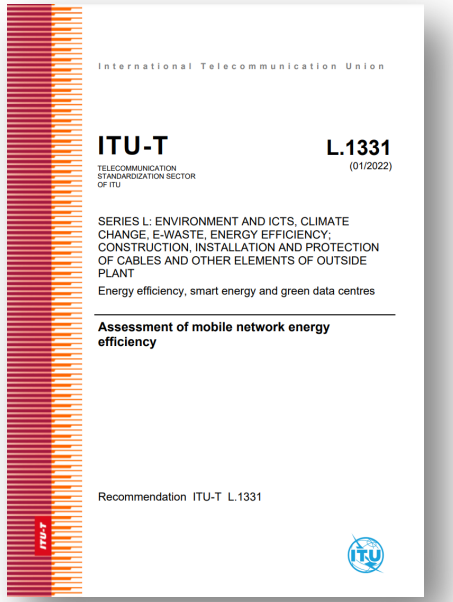
At network level

- ITU-T L.1331: Assessment of mobile network energy efficiency
- ITU-T L.1332: Total network infrastructure energy efficiency metrics
- **ITU-T L.1333: Carbon data intensity for network energy performance monitoring**
- **L.FNEE - Assessment of Fixed Network Energy Efficiency the KPIs for the network**

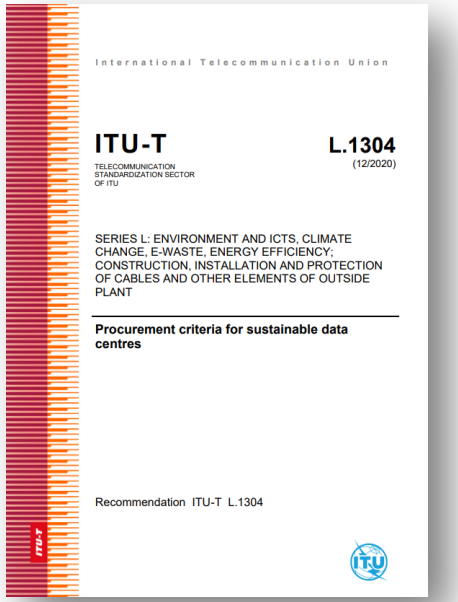
Energy Efficiency, Green Network and Data Centers



Defines a **KPI useful to evaluate network emission** and give an indication on how a network can reduce its emission due to energy usage

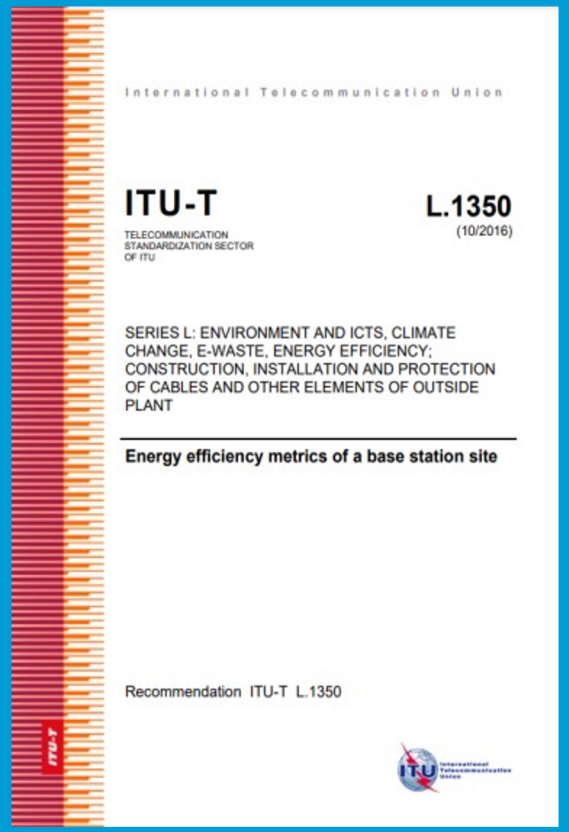


Provides **metrics and methods of assessing energy efficiency** in operational networks



Support public authorities in purchasing data centres related products, services and items with reduced environmental impacts through establishing a set of procurement criteria

ITU-T L.1350 - Energy efficiency metrics and methodology



Approved: 2016

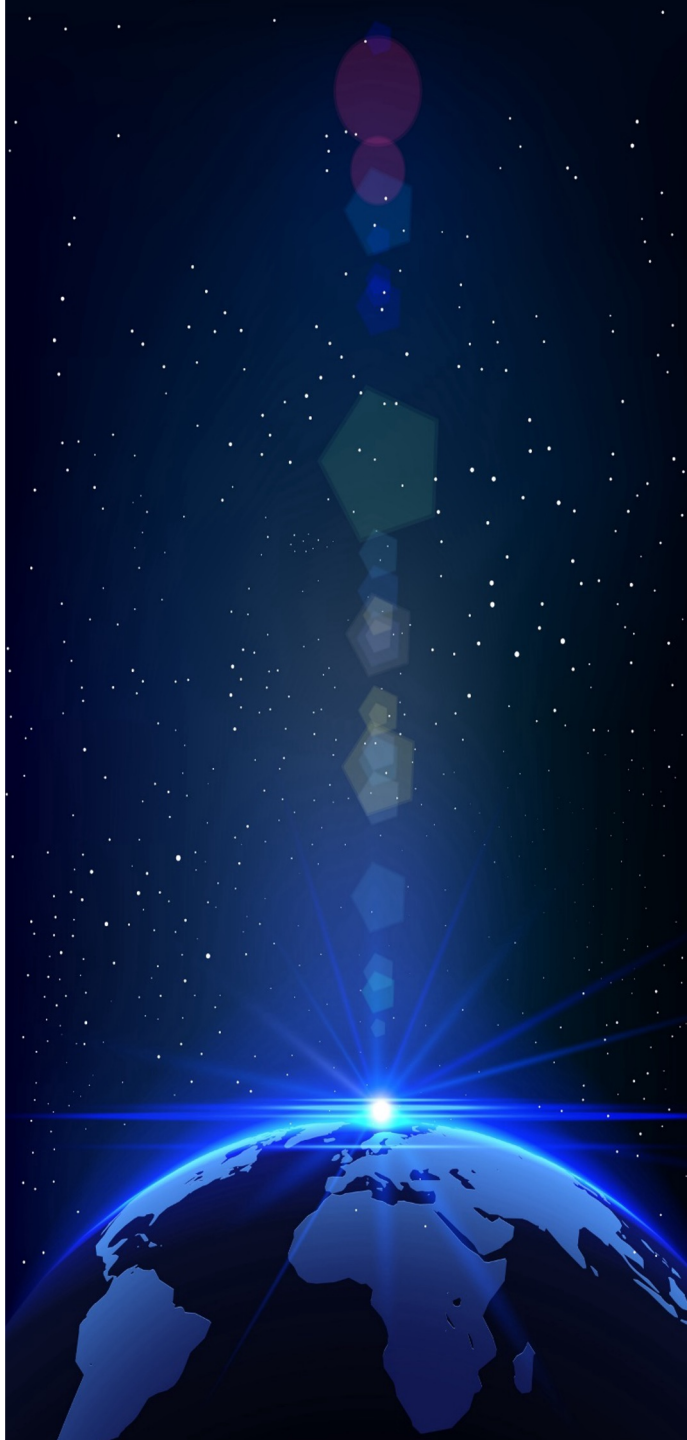
Energy efficiency metrics of a base station site

Contains basic definitions of energy efficiency metrics, to evaluate the energy efficiency of a base station site

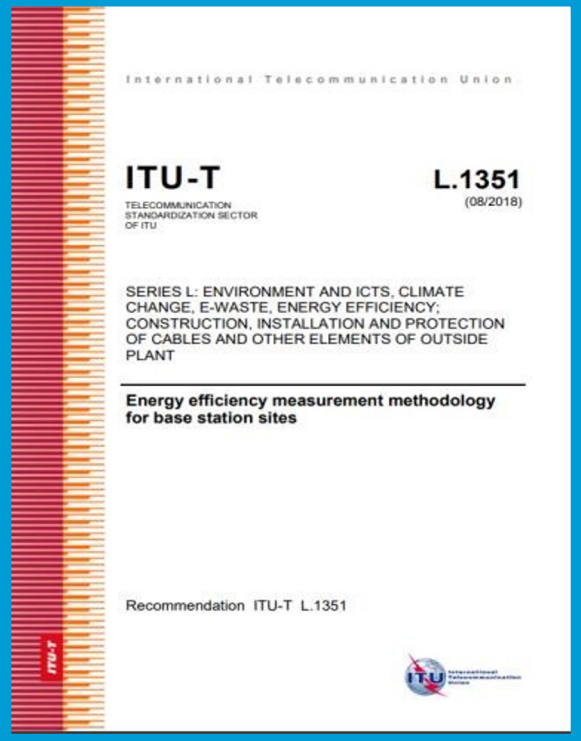
The definitions and metrics are used in:

- **ITU-T L.1210:** Sustainable power-feeding solutions for 5G
- **ITU-T L.1382:** Smart energy solution for telecommunication rooms

(Site energy efficiency) $SEE = \frac{ECT}{E_{TS}} \times 100\%$



ITU-T L.1351 - Energy efficiency metrics and methodology



Approved: 2018

Energy efficiency measurement methodology for base station sites

Describes and establishes requirements for energy efficiency measurements applicable to base station sites.

Current work item on
L.TR_CR_BS: Energy Efficiency Classification Criteria of Base Station Sites:

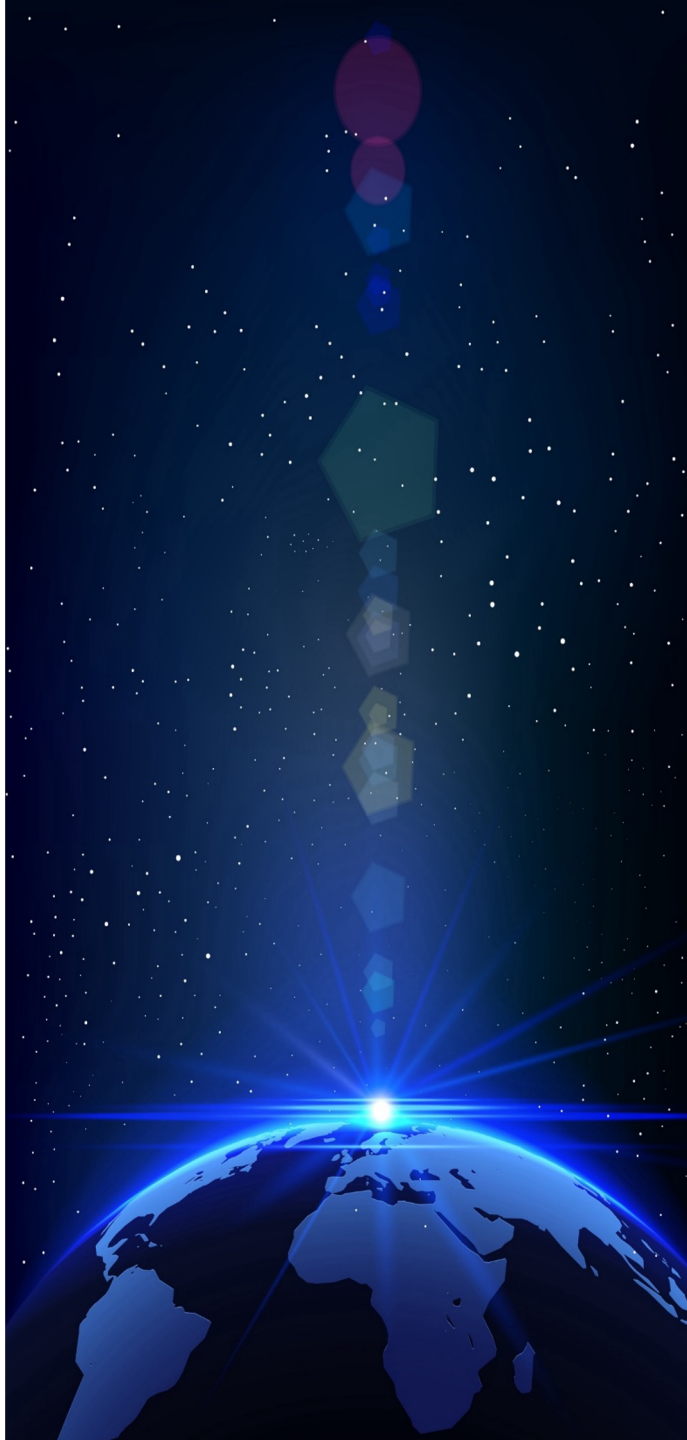
- Uses the KPI in **ITU-T L.1351** for the classification of base site.

L Suppl. 45: Radio base station site best practices

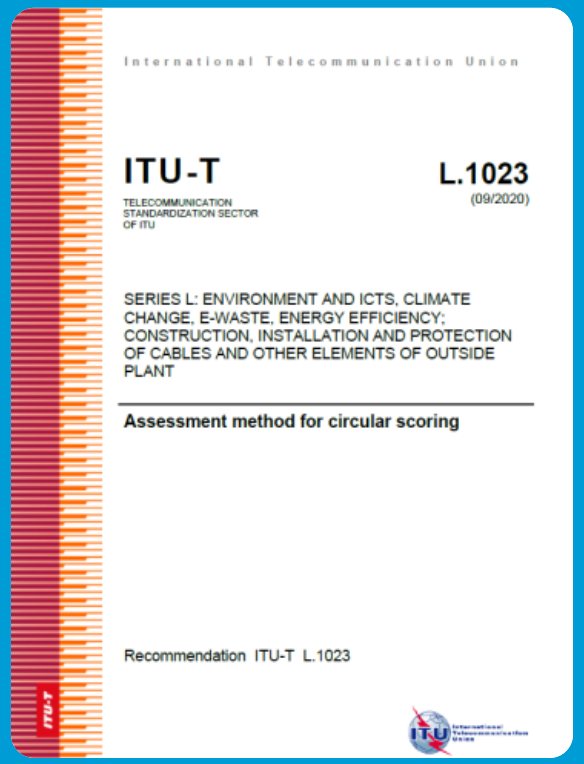
- Contains the best practices considering the measurement method reported in ITU-T L.1351

For example:

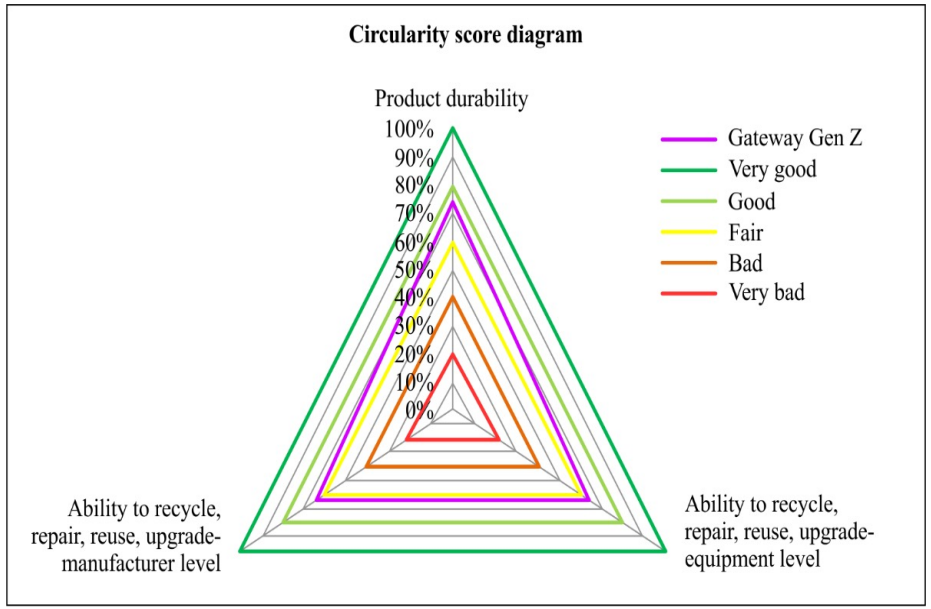
- Transformation of base station site from an indoor to and outdoor cabinet.

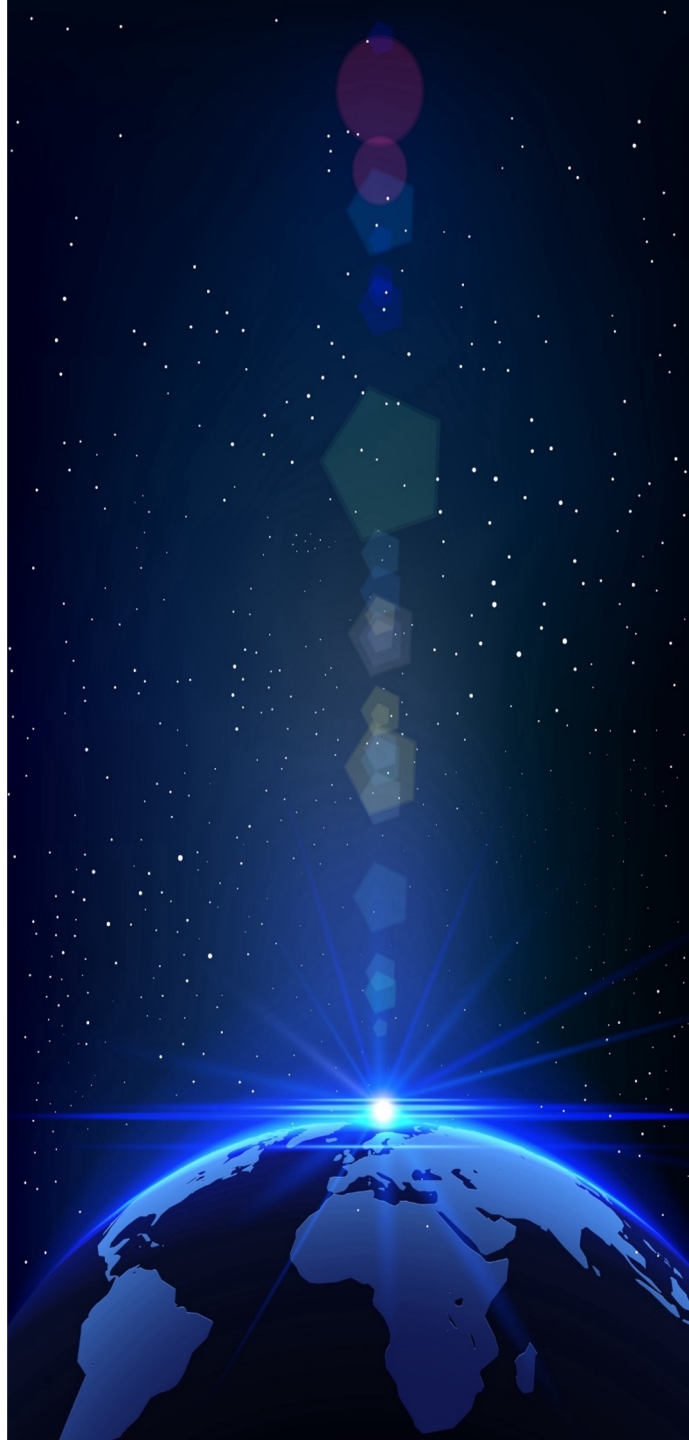


ITU-T L.1023 – Assessment method for product circularity: A design and verification tool

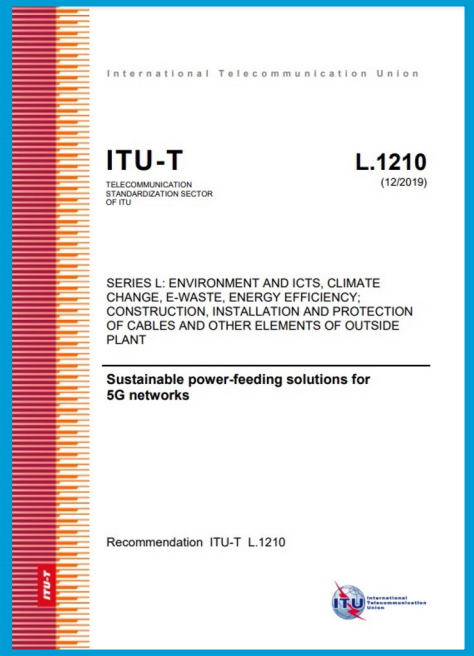


Approved: 2020

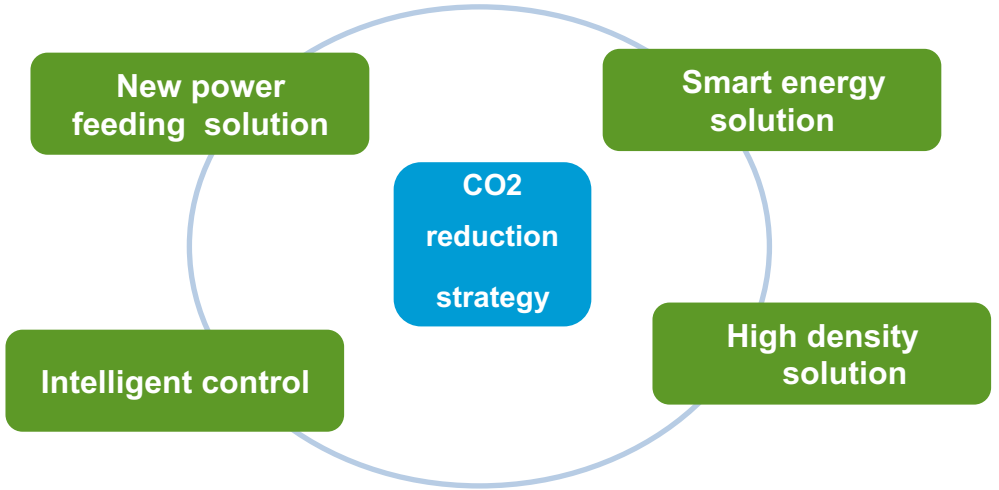


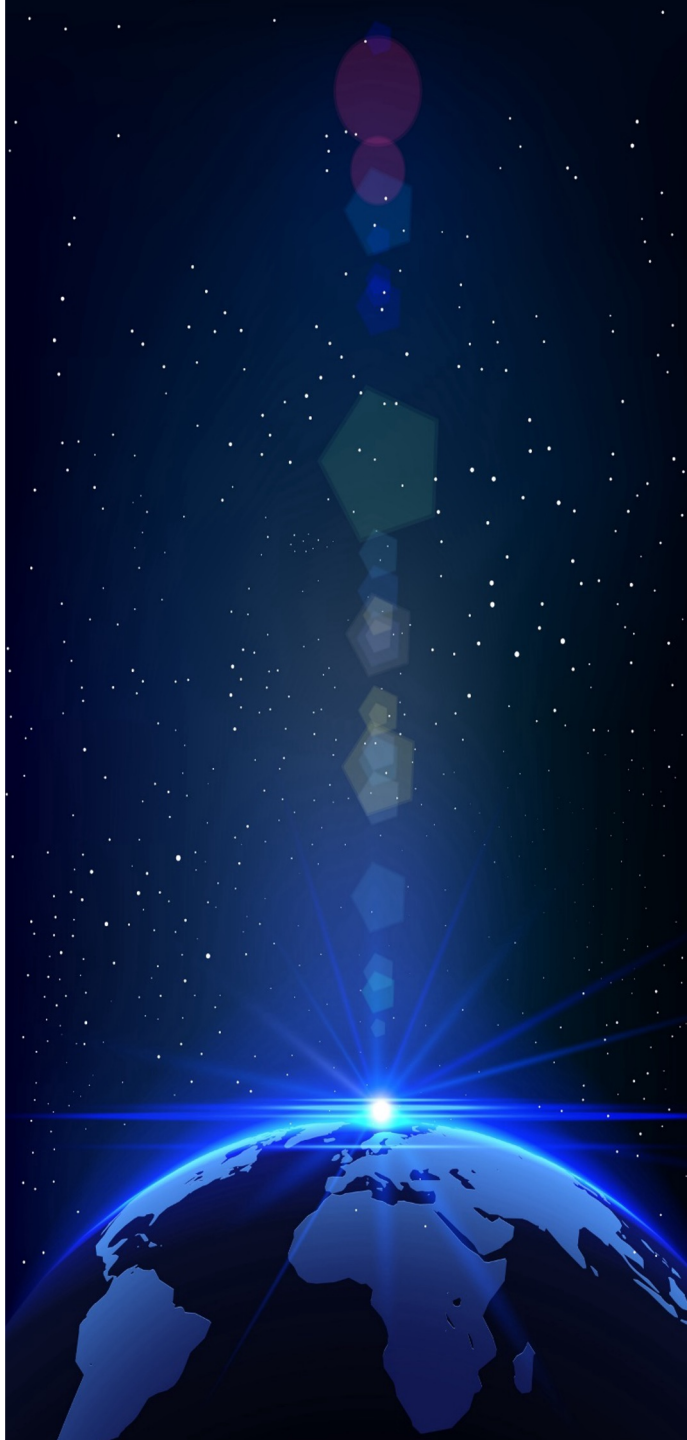


ITU-T L.1210 - Sustainable and efficient solutions for the power requirements of 5G networks defines:



Approved: 2019





ITU-T L.1210 - Sustainable and efficient solutions for the power requirements of 5G networks (2)

Renewable energy

- A solar energy access module can be installed in the same slot as the rectifier module to implement on-demand configuration.
- Energy source priority:
  1-solar;
  2- grid (main),
  3- battery;
  4- Generator.

Electricity from fossil ↓

CO2 emission reduction

Move to outdoor solution

(Site energy efficiency) **SEE** ↑

- Outdoor cabinet with Heat exchanger
- Blade power scenario

Power distribution energy saving solutions

intelligent dynamic voltage boosting and intelligent shutdown

- bus voltage is boosted to 57 V.
- Dynamic voltage boosting.

Energy wasted ↓

Module efficiency requirement

- Rectifier efficiency should be higher than 97%

Energy wasted ↓

ITU-T L.1382 - Smart energy solutions for telecommunication rooms

Renewable

Possibility to insert solar module in the power station replacing rectifier

High efficiency conversion

- Inverter efficiency module ≥ 94%.
- Solar converter efficiency ≥ 98%.

Outdoor Site efficiency requirement

- Site with air-conditioner: SEE > 80%;
- Site with heat exchanger SEE > 92%;
- Natural-cooling site SEE > 95%.

New infrastructure solutions

Bus voltage boosting at 57V

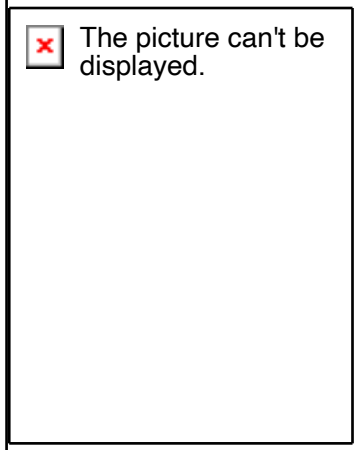
Transform small indoor room on outdoor cabinet

Intelligent supervision

- Efficient O&M asset management.
- Closed-loop management of energy efficiency visualization, optimization.
- Battery SOH O&M

New storage: Lithium and intelligent

Direct Current & Alternating Current in a unique solution



ITU-T L.1332 – Total network infrastructure energy efficiency metrics

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Approved: 2018

Evaluate the energy efficiency of a total network

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Example of energy flow in a typical telecommunication installation showing the losses in the total energy flow. (2018)

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The metric for the total network infrastructure energy efficiency (NIEE) is defined as:

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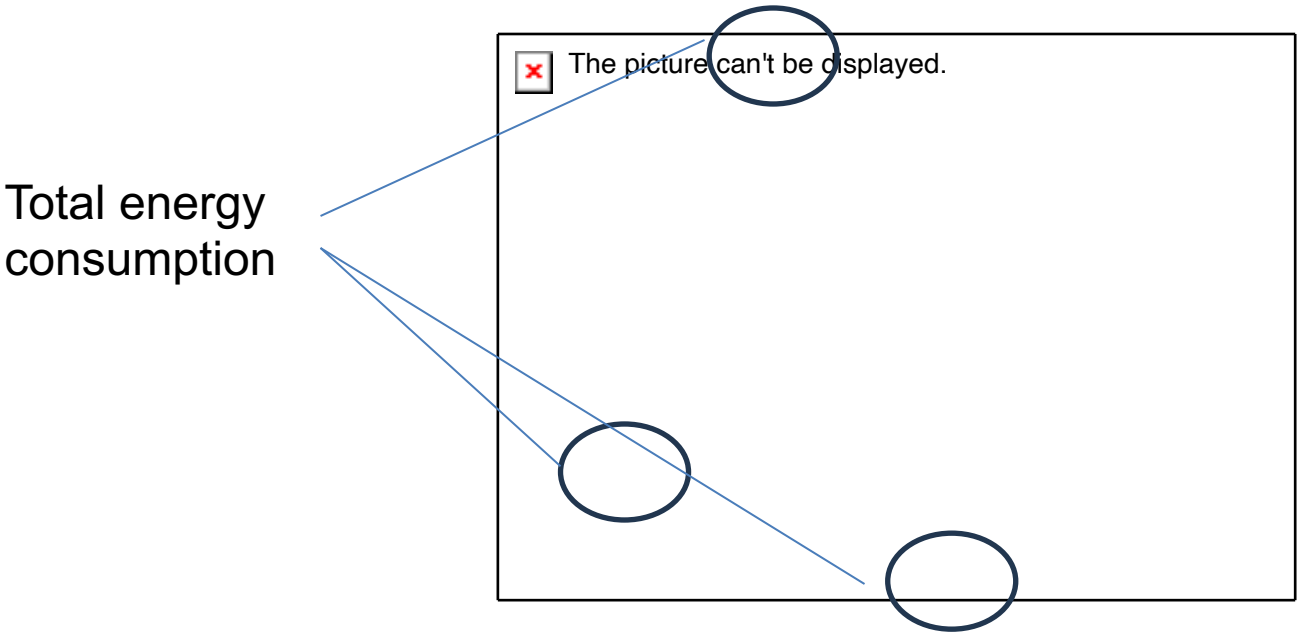
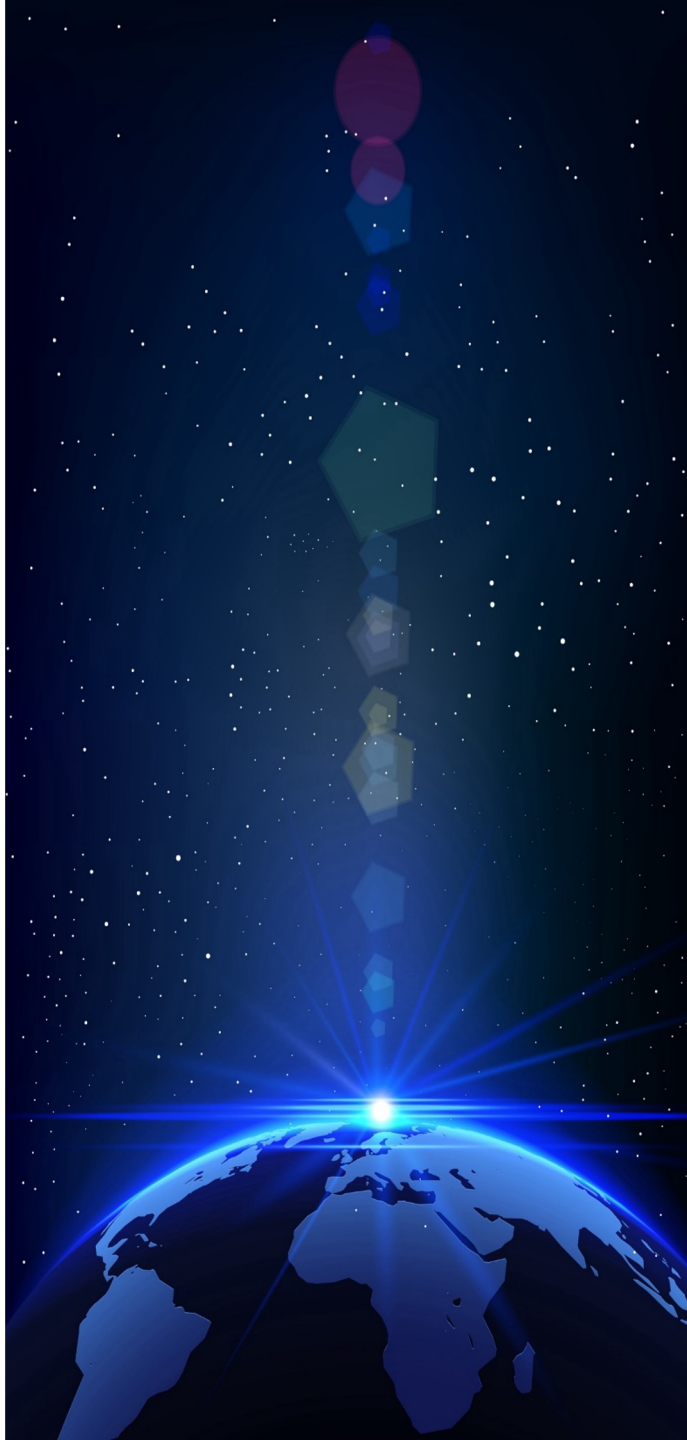
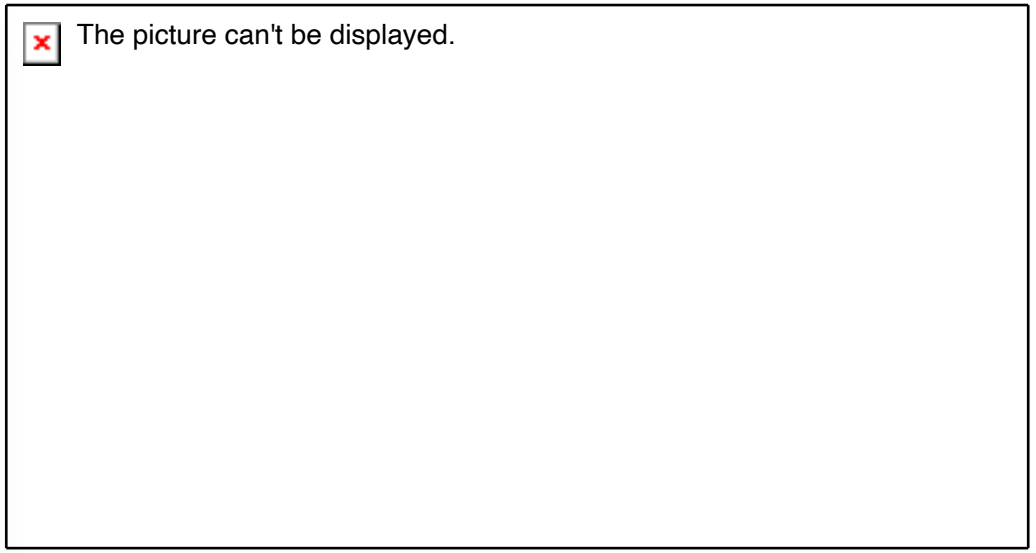


A telecom operator can use this indicator to measure what is the efficiency of their telecommunication facility including the maintenance



Assessment of Mobile Network Energy Efficiency



Provide a **KPI to measure the efficiency of the entire mobile network**: consider the traffic data volume and the total energy consumption of the network .

$$EE_{MN,DV} = \frac{DV_{MN}}{EC_{MN}}$$

Assessment of Fixed Network Energy Efficiency

This Recommendation will provide a definition and an assessment method of network-level energy efficiency (EE) for the end-to-end fixed network, including network side equipment of access network, transport network and IP network. This EE metric will be useful for energy monitoring, management, and optimization of the network, and is primarily targeting Operators and CSPs who wants to assess EE of their network over time.

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Define a KPI for Fixed Network Energy Efficiency

For transport network a possible proposed KPI is

Considering the important factors UNI rate, transmitting distance factor A_1 and protection factor A_2 and according to EER definition described in clause 7, a first proposal for EER of transport network can be presented as

$$EER_{TN} = \frac{Total\ UNI\ rate \times A_1 \times A_2}{Total\ used\ energy}$$

- UNI rate: it is measured as the bandwidth of tributary board, which is used to receive data signal transmitted from the user side (from routers or OLTs) and translate to ODUk signal.
- Transmitting distance factor A_1: Longer transmitting distance represents higher capability but costs more energy. This factor is proportional to the transmitting distance.
- Protection factor A_2 ($A_2 \geq 1$): this factor is used to compensate the extra energy consumption of the network protection. It is related to protection ratio and level.

Carbon Data Intensity for Network Energy Performance Monitoring

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Defines a simple **KPI to evaluate the GHG emission performance of a complete network** (composed by fixed, mobile, access network and also enterprise network)

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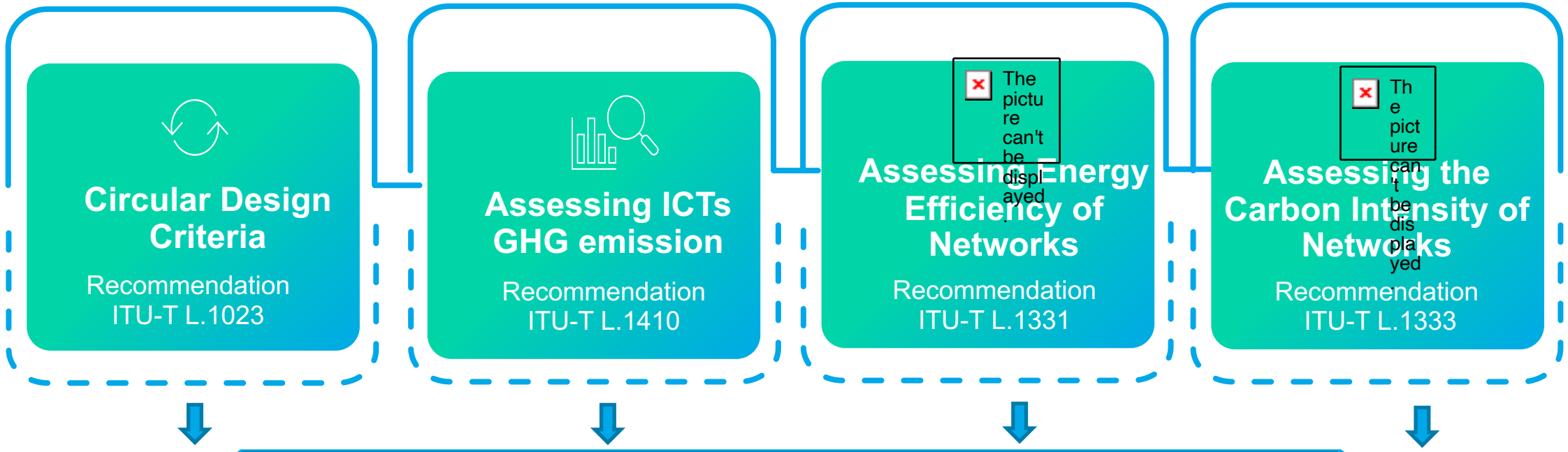
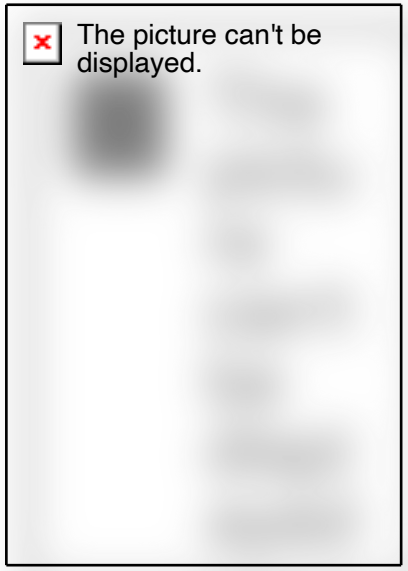
ICT sector's commitment to 1.5°C and the Sustainable Development Goals

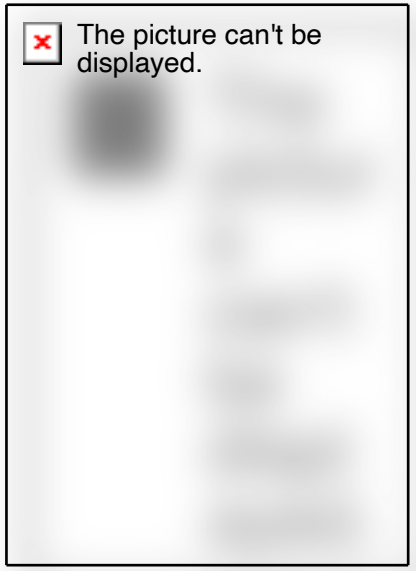
ITU-T Standards Driving Sustainable ICTs



Leveraging Digital Technology for GHG Reduction

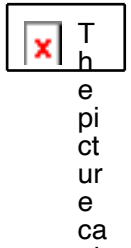


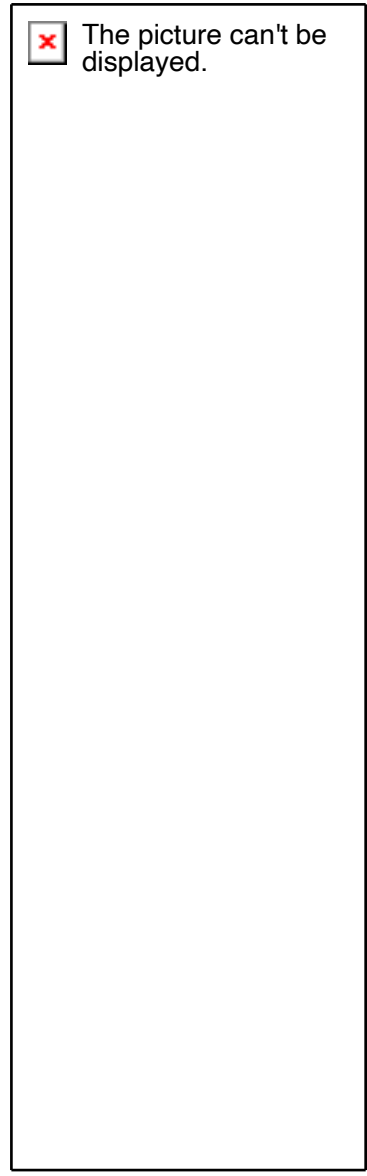
Provides a methodology for calculating the **ICT sector footprint with respect to life cycle GHG emissions**



As of today, it is the **only international standard that deals with the life cycle assessment of ICT goods and services**

Standards provide **detailed trajectories on how to reduce the ICT Sector's GHG emissions by 45% by 2030**.





The Double-Edged Nature of ICTs

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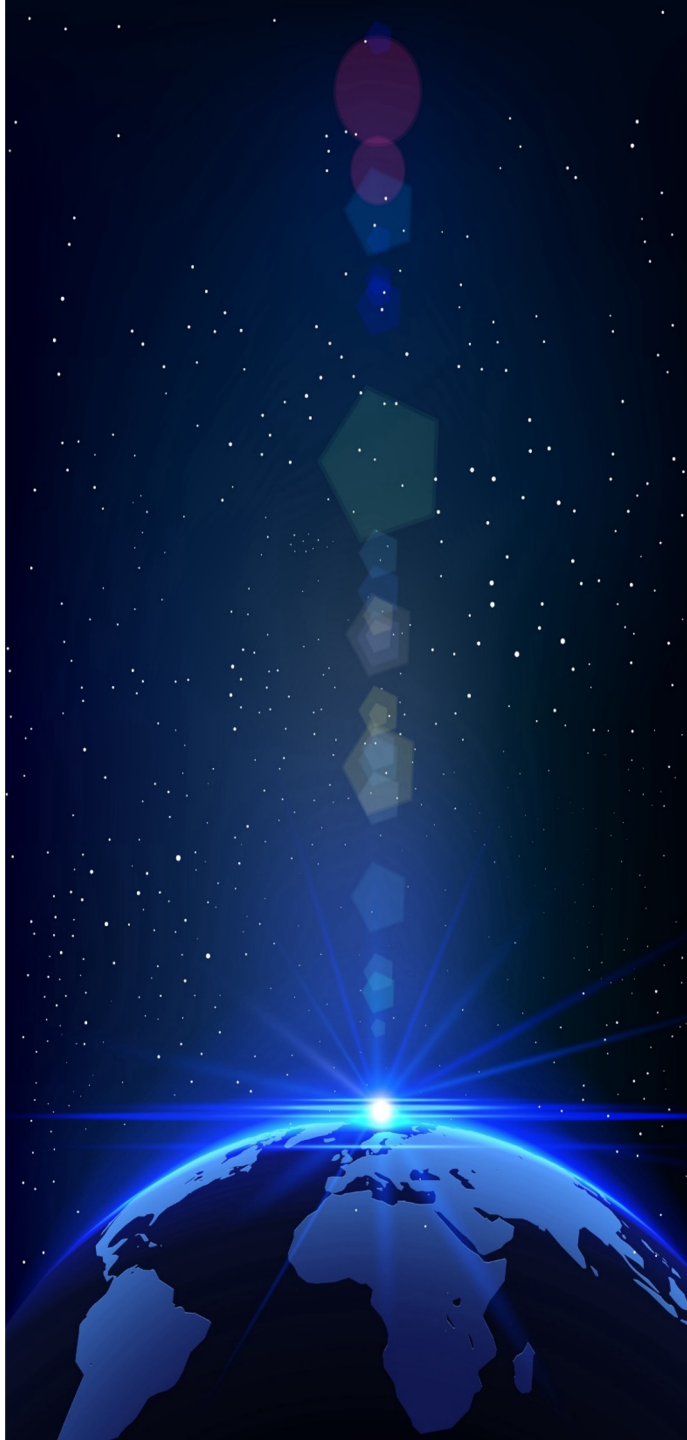
Source : Bergmark, Coroama, Kamiya, Masanet 2021

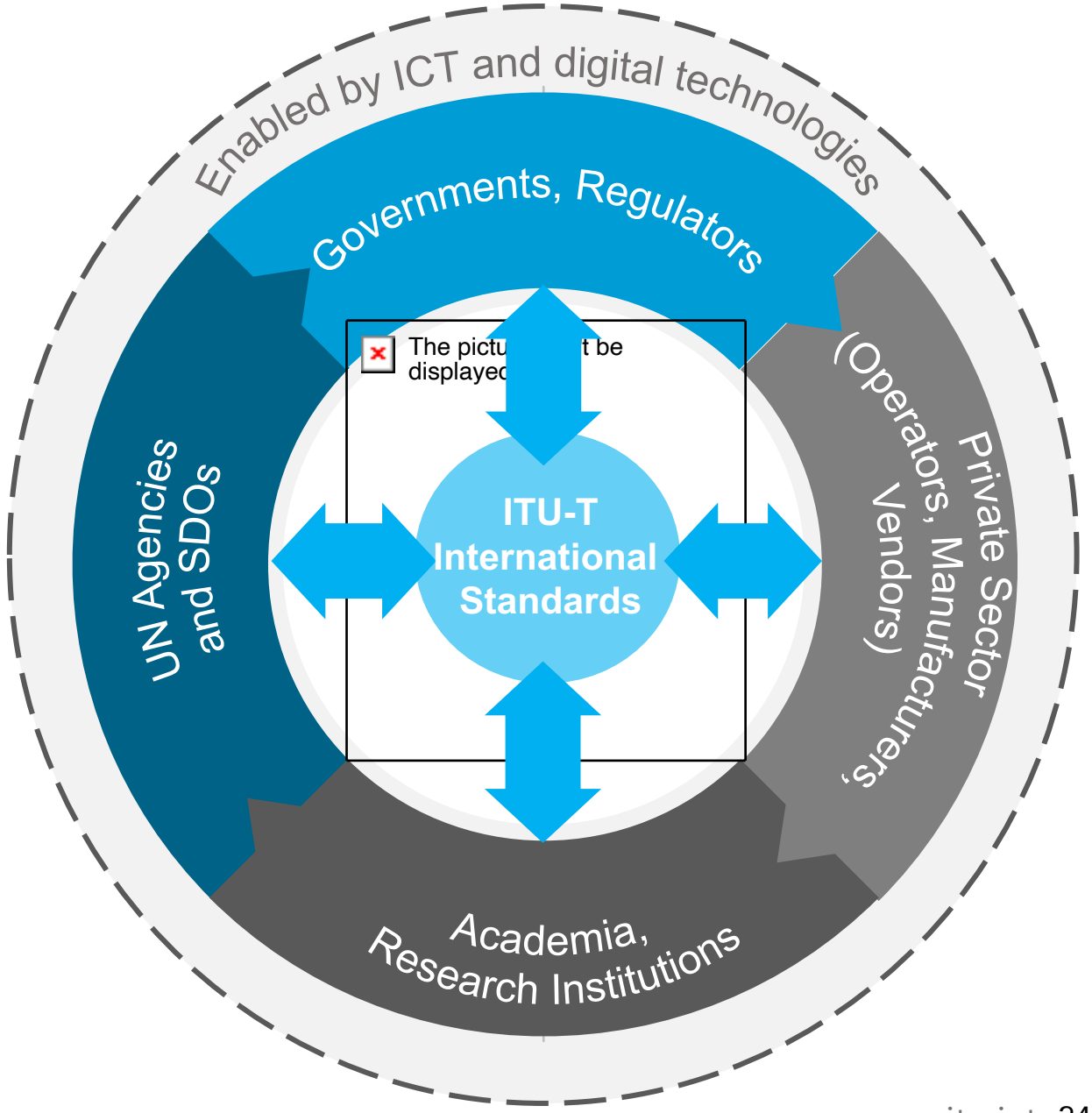


Our future agenda

Bringing countries and industries together to help industry and governments. A mutually beneficial partnership.

Don't miss your opportunity to contribute

SG5 Meeting
17-21 June 2024
Wrocław University of Science and Technology, Wroclaw, Poland

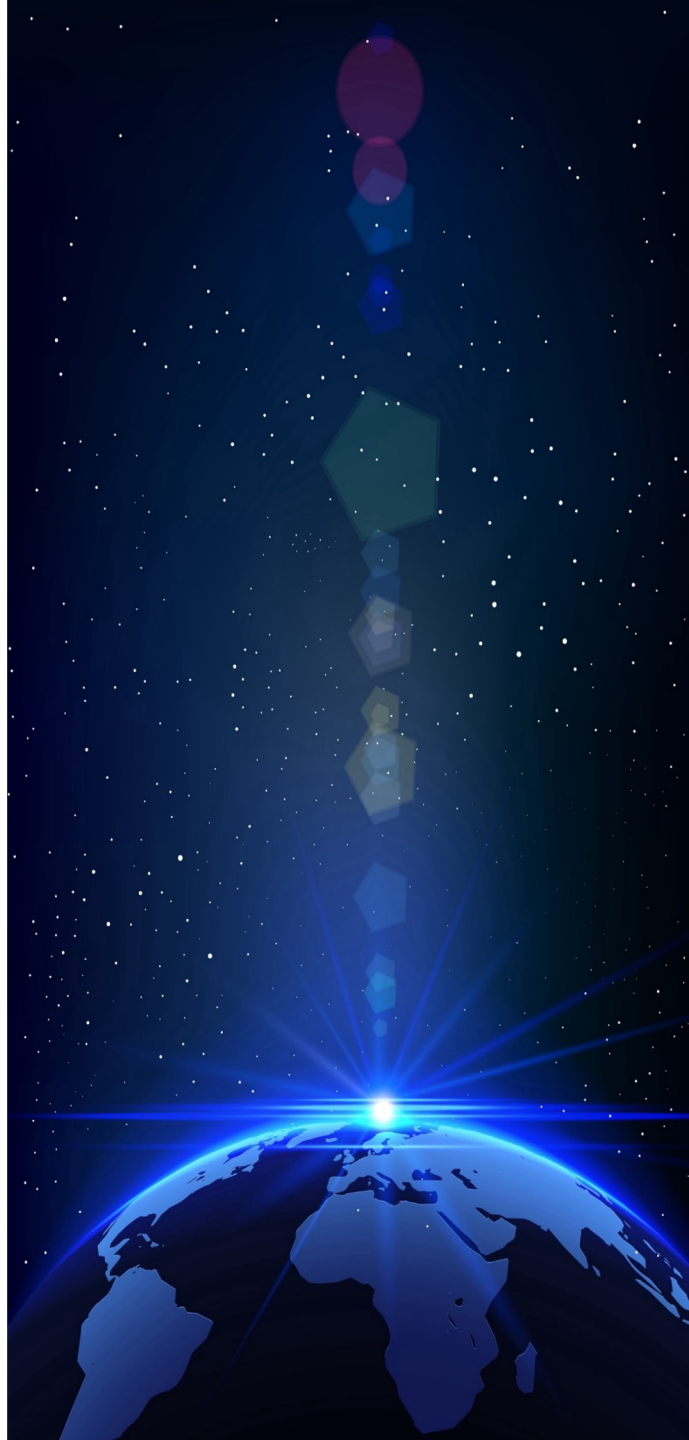


Strengthening Collaboration and Implementation of Standards

- Africa SG5RG-AFR
- Arab Region SG5RG-ARB
- Asia & the Pacific SG5RG-AP
- Latin America SG5RG-LATAM

Collaboration Across UN Agencies

Collaboration with other SDOs and Organizations



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Thank you.

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SG5: Environment, climate change and circular economy