ETSI IoT Week 2022

NCIe a Carbon Emission KPI for any Network Type

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11/10/2022

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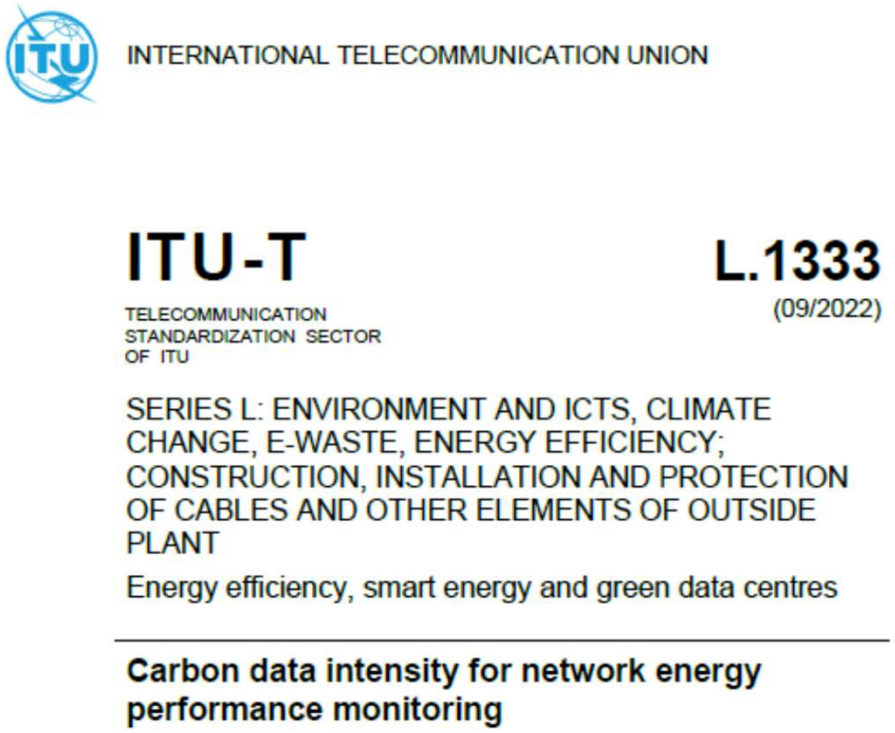
  - THE NCIe concept
- Future activities

ITU-T L.1333* (NCIe) Current status

- The standard Recommendation ITU-T L.1333 was consented (first step of approval) by ITU-T SG5 on 1 July 2022.
- The document it is finally approved on September 2022.
- Finally Published end of October, Actually available only for ITU member



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T **L.1333**

(09/2022)

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

SERIES L: ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

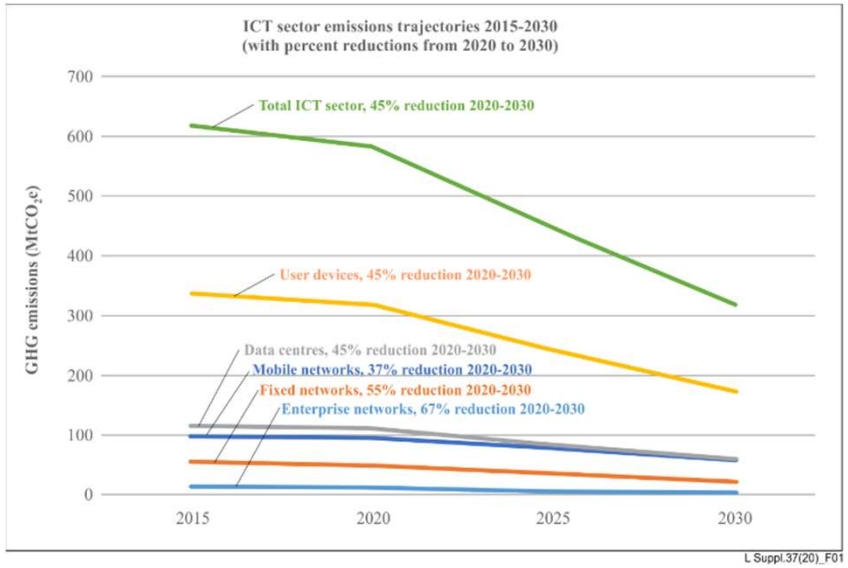
Energy efficiency, smart energy and green data centres

Carbon data intensity for network energy performance monitoring

* https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=15028

Why a new Indicator

Actual trend is to reduce GHG emissions from network as proposed by GESI, GSMA, ITU and SBTi



- Data traffic from cellular and fixed broadband networks will grow at a 29% compound annual growth rate (CAGR) from 2018 to 2024. his due also to the spread of IOT technologies
- So, the amount of traffic will significantly increase, and it is necessary to define an indicator to show how the increase efficiency in term of GHG of a network linking the amount of GHG emitted to the services provided by the network.
- Actually, some operators use internal indicator to evaluate their network emission and give an indication on how they are reducing the contribution of network at their emission.(*)
- A common indicator is needed to measure the carbon intensities in network infrastructure, such as Public Telecom Network (PTN), Non-Public Network (NPN)

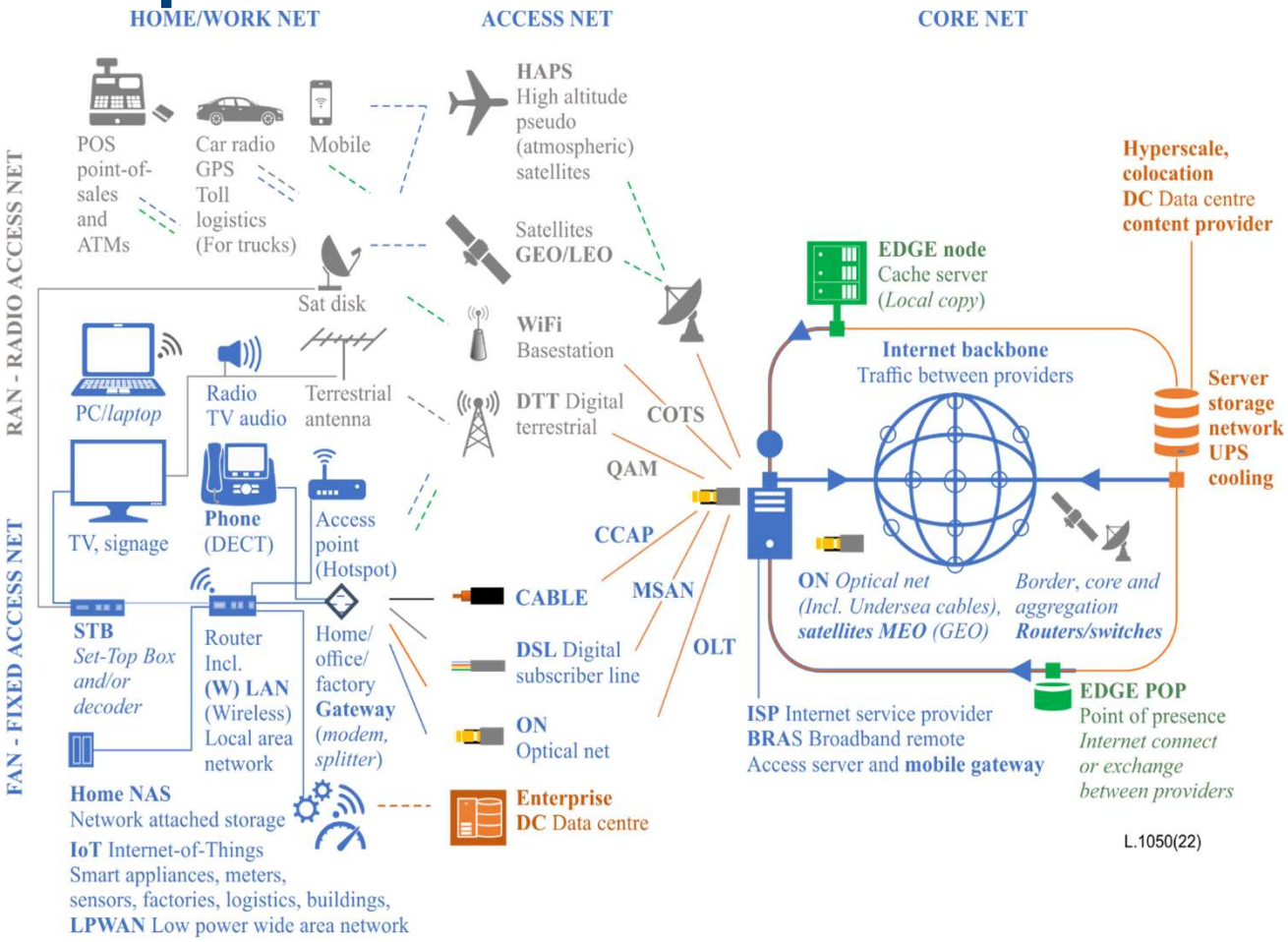
* informa tech: "*The Path to Net Zero for ICT Requires Technology Innovation*"

ITU-T L.1333 (NCIe) proposal

- A metric/KPI to evaluate Network performance
- Applicable to the green decarbonization performance of network facilities.
- Not suitable for a horizontal comparison between different types of network facilities,
- It is suitable for comparisons between similar network facilities in different regions.
- However, it is a suitable benchmark to track over time for a particular operator the evolution of network functionality.
- The benefit:
  - A tool to see how infrastructure network evolve in terms of GHG emissions.
  - Network Owner can control in a simple way network performance controlling the volume(traffic) of data (deriving from monitoring system) the amount and the source of energy used by their network.

ITU-T L.1333 (NCIe) assumptions

- NCIe is focused only on use/operation phase no other LCA assessment phases are considered; considering a standard LCA assessment scope 2 and minor part of cope 1 and 3 are considered.
- The network infrastructure under consideration can be any network infrastructure such as PTN, NPN and enterprise network.
- This mind any type of network: public network (operator) but also Non-Public Network
- All equipment energy consumption in a site will be considered:
  - ICT
  - Facilities
  - Terminal are excluded



ITU-T L.1333 (NCIe): NCIe definition

- $$NCIe\ \left(\frac{kgCO_2e}{TB}\right) = \frac{Total\ Carbon\ Emission\ of\ network\ operation}{Total\ Data\ traffic}$$

- NOTE: The unit TB refers to Terabytes and is equivalent at 2^{40} bytes or 8 * 2^{40} bits.

- The KPI is calculated as below formula considering the total energy consumption of network divided by the amount of data traffic managed by the network:

- $$NCIe = \frac{E_{total}}{Total\ Data\ traffic} * EF = \frac{\sum E_j * EF_j}{\sum Data\ traffic_j}$$

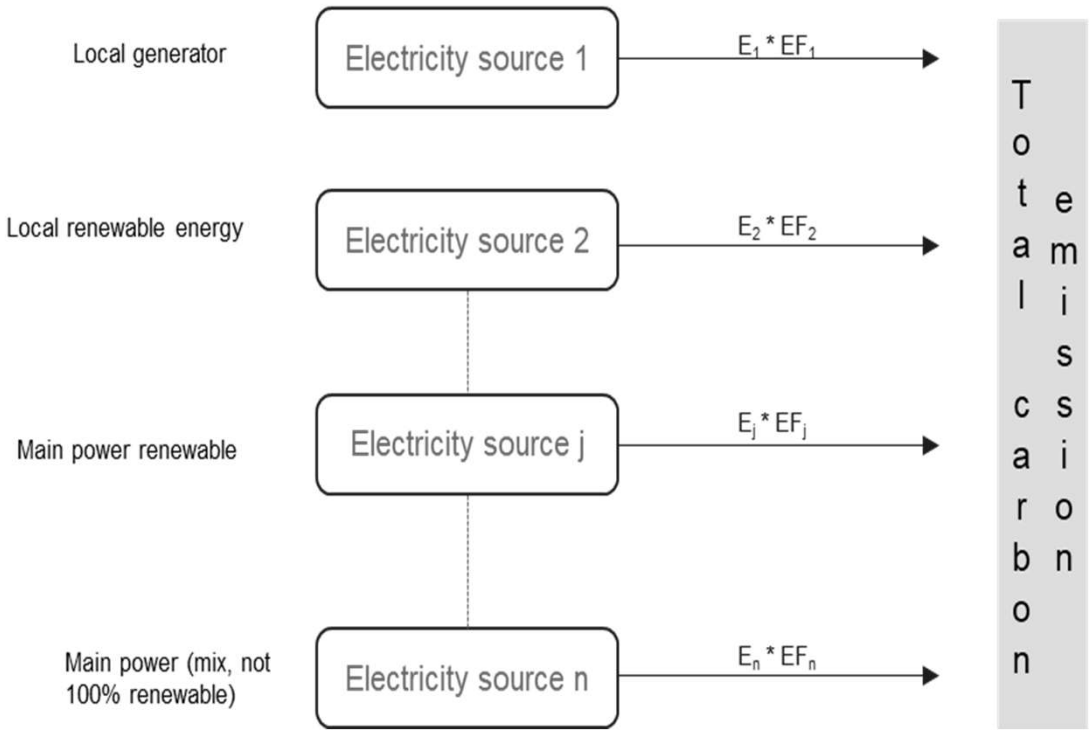
- Total data traffic is the total traffic/volume of network under consideration in TeraBytes (TB)

- EF (kg CO¬2e/kWh) is the emission factor represented by the mass of carbon emitted per kWh of electricity. In line with [ITU-T L.1450*] the emission factor shall be sourced from recognized public sources and consider the energy supply chain and distribution losses. Different emissions factors apply for different energy supplies e.g. grid electricity, and local sources like for example diesel and solar.

* https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13581

ITU-T L.1333 (NCIe) Energy type considered

- Three type of energy sources are generally considered:
  - Grid electricity: Most of the energy consumed comes from local grid electricity.
  - Backup energy: A small proportion of energy comes from backup diesel, or other types, generators such as e.g. solar panels.
  - Local generate energy: energy provideds by local generators not used for backup functionality, e.g. Solar, wind generator.
- E_{Total} is the total electrical energy from grid or local generators consumed by the network system during the same period., To distinguish green energy (wind, hydro, solar, etc.) from traditional energy in terms of carbon intensity, the numerator of the ETotal can be extended as follows considering different sources and different generation types



ITU-T L.1333 (NCIe): Emission factor consideration

The emission factor for all three types of energy shall consider the electricity supply chain.

The value of EFj depends on the electrical energy characteristics utilized. EFj value shall be derived by existing national statistical data available in the country where the network is located or from international data like what available by IPCC, IEA or other.

If network owner purchases renewable electricity the emission factor shall be referred to market-based for this share of EF, requiring source/supplier of electrical energy the specific emission factors for the electricity purchased.

Calculate emissions according to both location-based and market-based methods. In line with GHG protocol.

In case of renewable or mixed energy purchased in the market consideration shall be done on the losses occurred during electricity transport and distribution, which also need be considered in the calculation of emission factor.

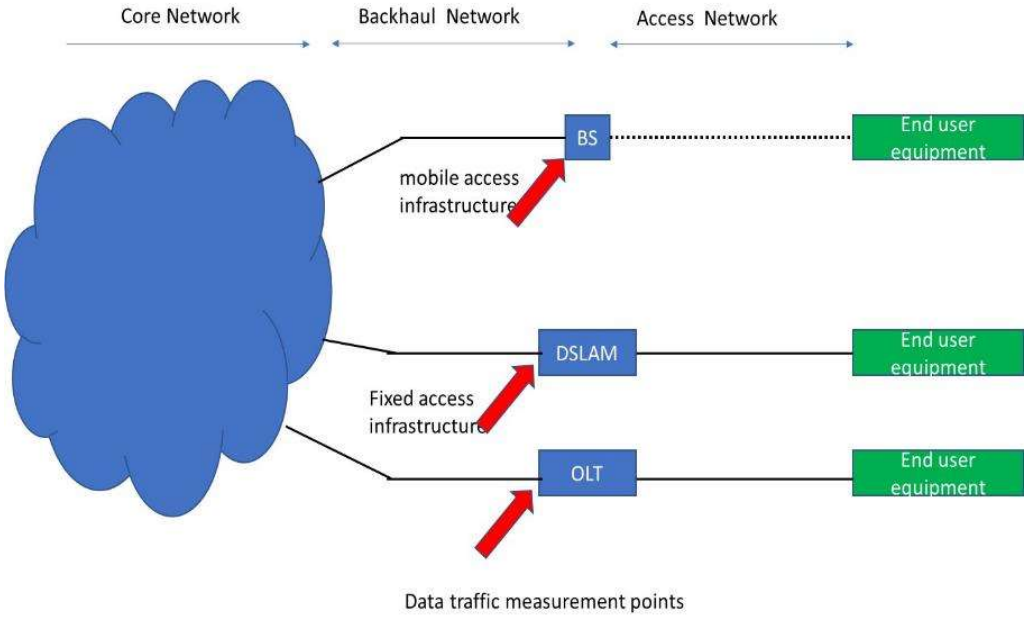
In the case of renewable energy produced locally in site the related EF shall be equal to zero considering that losses in power distribution are negligible.

ITU-T L.1333 (NCIe) KPI calculation

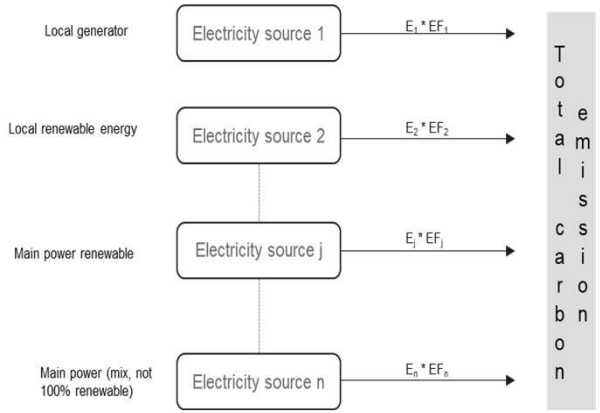
- The KPI calculation period should be 1 year. (it is possible use also shorter period: 1 month, 1 week)
- Data derived by monitoring system
- The network traffic will be measured at aggregated point of user interface
- In case of mobile network only, it is possible to derive the KPI starting from the Mobile network data energy efficiency (EEMN,DV) defined in [ETSI ES 203 228] or [ITU-T L.1331], this is the ratio between the data volume (DVMN) and the energy consumption (ECMN) when assessed during the same time period.

$$NCIe\left(\frac{kgCO2e}{TB}\right) = \frac{1}{EE_{MN,DV}} * EF * \frac{8 * 2^{40}}{3.6 * 10^{6}}$$

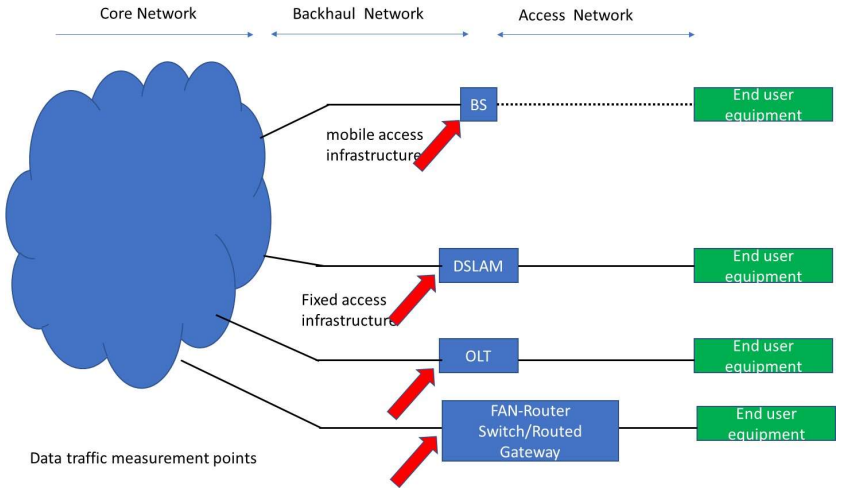
- In fixed network
  - the total traffic can be measured at DSLAM or OLT equipment level, depending on type of user connection.
- enterprise network same approach can be used, collecting the traffic at Gateway/Router/Switch level



ITU-T L.1333 (NCIe) How to apply.



Measure energy consumption and define the Emission Factor based on energy sources



Calculate the KPI

Network infrastructure examples, based on ITU-T L.1333

- $$NCIe\left(\frac{kgCO_2e}{TB}\right) = \frac{E_{total}}{Total\ Data\ traffic} * EF = \frac{\sum E_j * EF_j}{\sum Data\ traffic_j}$$

Measure data traffic

Possible next step

- Identify possible synergies between ITU-T and ETSI on L.1333 implementation and evolution.
- Provide additions to L.1333 specification by incorporating guidelines to apply the NCIe approach to enterprise network and industrial network (industry 4.0 scenario)
- Work on guidelines on how to pass from NCI at network level to actual KPI at site level like, i.e., Site Energy Efficiency (SSE).
- Collect and publish L.1333 use case applications.
- Progress on L.GHG intensities: a next step to have a more complex indicator that include all emission scope: 1, 2 and 3 and using maybe not only data traffic as quality factor for network.