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Research project ‘Comparability of sustainability standards for electronic telecommunications infrastructure’

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(Bundesnetzagentur: BNetzA)

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Agenda

1. **Short introduction of Objectives, Scope and Must-Have-Metrics**
2. **Short introduction of methodological approach**
3. **Results on comparability and effort estimation, as well as their conclusions across the 3 categories**
   - **Energy management**
   - **GHG**
   - **Circular economy**

Objectives, Scope, Must-Have-Metrics

- Objectives
  - Examine the comparability and level of specification of selected standards for telecommunications networks in three environmental-relevant sectors: energy management, GHG emissions, circular economy, in terms of Must-Have-Metrics defined in the JRC-Study
  - Estimate the effort required to implement the selected standards
  - Derive recommendations for potential standards that could be used in the context of CoC or other purposes to promote the environmental sustainability of telecommunication networks
- Scope
  - Telecommunications network including network data centers (NDC)
- Must-Have-Metrics (JRC-Study)
  - Energy of network segments in the **real operational** phase: **Energy consumption (e.g MWh); Energy efficiency: data volume in relation to energy consumption; the use of renewable energy**
  - **GHG Scope 1/2/3 Emissions**: organization-related and **network-related** GHG emissions
  - Circular economy: **equipment deployed in network operations**
    - **Weight of e-Waste, Weight of recycled products; Weight of refurbished products; Weight of reused products**

Work Packages (WPs): Overview

- WP 1: Completeness check: reviewing the existing standards at the meta level, in order to identify the most relevant standards

- WP 2: Comparability analysis

  Four evaluation criteria: robustness, reproducibility, credibility, transparency

  - If different users use the same standard, are the results comparable?
  - If comparable standards exist within the same group, are the results comparable?
  - Is there a recommendation for a standard in terms of overall suitability?

Definitions of the 3-level rating model:
- high, visualized as
- medium, visualized as
- Low, visualized as

- WP 3: Effort estimation
  - Semi-quantitative assessment of the effort
  - qualitative assessment based on a narrative evaluation: consultations with some network operators; Market penetration within the regulatory framework, i.e. EU Taxonomy and EU CSRD; and existing findings from other studies

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   - **Energy management**
   - **GHG**
   - **Circular economy**

Energy Management:
Results of Comparability and Effort Estimation

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Comparison of selected 15 energy-related standards in terms of scope and must-have metrics

	Network segment	Standard	Consideration of the supporting infrastructure	Must-have metric 1: energy consumption in absolute value	Must-have metric 2: Energy efficiency = data volume/energy consumption	Must-have metric 3: Renewable energy as a separate metric	Must-have metric 3: no separate metric, however renewable energy in total consumption
RAN	RAN: 2G/3G/4G	ETSI EN 303 472 V1.1.1 (2018-10)	Yes	Yes	Yes	Yes	Yes
RAN	RAN: technology-independent	ETSI ES 203 228 V1.4.1 (2022-04)/ITU-T L.1331	Yes	Yes	Yes	No*	Yes
RAN	RAN: technology-independent	ETSI TR 103 540 V1.1.1 (2018-04)	No	Yes	No	No	Yes
RAN	RAN: technology-independent	ITU-T L.1350 (10/2016)	Yes	Yes	No	No	Yes
RAN	RAN: technology-independent	ITU-T L.1351 (08/2018)	Yes	Yes	No	No	Yes
RAN	RAN: technology-independent	ETSI EN 305 200-2-3 V1.1.1 (2018-06)	Yes	Yes	Yes	Yes	Yes
RAN	RAN: technology-independent	ETSI TS 105 200-2-3 V1.2.1 (2019-12)	Yes	Yes	Yes	Yes	Yes
FAN	FAN: technology-independent	ETSI EN 305 200-2-2 V1.2.1 (2018-08)	Yes	Yes	Yes	Yes	Yes
FAN	FAN: technology-independent	ETSI TS 105 200-2-2 V1.3.1 (2019-12)	Yes	Yes	Yes	Yes	Yes
CAN	CAN: technology-independent	ETSI ES 205 200-2-4 V1.1.1 (2015-06)	No	Yes	Yes	Yes	Yes
5G	5G mobile network: RAN, core network	ETSI TS 128 554 V18.7.0 (2024-10)	No	Yes	Yes	No	not mentioned
Core; entire	ICT-Sites: Core network	ETSI EN 305 200-3-1 V1.1.1 (2018-02)	Yes	Yes	No	Yes	Yes
Core; entire	ICT-Sites: Core network	ETSI TS 105 200-3-1 V1.2.1 (2019-12)	Yes	Yes	No	Yes	Yes
Core; entire	ICT-Sites: entire network	ITU-T L.1332 (01/2018)	Yes	Yes	No	No	Yes
NFV	Entire access network: NFV	ETSI EN 303 471 V1.1.1 (2019-01)	Yes	Yes	Yes	No	Yes

Energy Management: Comparability between different standards within the same group: Example Group 1 RAN

Group 1: RAN	Scope	Robustness	Robustness	Reproducibility	Reproducibility	Reproducibility	Reproducibility	Reproducibility	Credibility	Credibility	Transparency
Evaluation aspects	technical representativeness	Data collection methods: Energy	Data collection methods: other reference units	Measurement period and measurement frequency	Environmental conditions during measurement	Measuring instruments	Measurement points	Allocation rules or delineation of the scope of application	Assessment of Uncertainties	Validation	Reporting
ETSI EN 303 472 V1.1.1 (2018-10)	RAN: 2G/3G/4G	●	●	●	●	●	●	●	●	●	●
ETSI TR 103 540 V1.1.1 (2018-04)	RAN: technology-independent	●	not relevant	●	●	●	●	●	●	●	●
ITU-T L.1350 (10/2016)	RAN: technology-independent	●	not relevant	●	●	●	●	●	●	●	●
ITU-T L.1351 (08/2018)	RAN: technology-independent	●	not relevant	●	●	●	●	●	●	●	●
ETSI EN 305 200-2-3 V1.1.1 (2018-	RAN: technology-independent	●	●	●	●	●	●	●	●	●	●
ETSI TS 105 200-2-3 V1.2.1 (2019-12)	RAN: technology-independent	●	●	●	●	●	●	●	●	●	●
ETSI ES 203 228 V1.4.1 (2022-04)/ITU-T L.1331	RAN: technology-independent	●	●	●	●	●	●	●	●	●	●
ETSI TS 128 554 V18.7.0 (2024-10)	total mobile network: 5G, end-to-end, NFV, Slicing	●	●	●	●	●	●	●	●	●	●
ITU-T L.1332 (01/2018)	Total networks	●	not relevant	●	●	●	●	●	●	●	●
ETSI EN 303 471 V1.1.1 (2019-01)	total access networks: NFV	●	●	●	●	●	●	●	●	●	●

Measurement period: flexibel; 7 days, 30 days, 365 days.

Measurement period:
- default 365 Tage;
- a minimum of 7 days is allowed, if seasonal climate variations are minimal and the period reflects annualized data volume

shared Infrastructure excluded

Allocation: based on energy cost

The commercial agreements or best practices among MNOs

Energy management: summary of comparability and suitability

Netz segment	Standards	Comparability within a standard	Assessment of suitability
RAN: 2G/3G/4G	**ETSI EN 303 472 V1.1.1 (2018-10)**	high	high
RAN: technology-independent	**ETSI ES 203 228 V1.4.1 (2022-04)**/ITU-T L.1331	medium	high
RAN: technology-independent	**ETSI TR 103 540 V1.1.1 (2018-04)**	low	medium
RAN: technology-independent	**ITU-T L.1350 (10/2016)**	low	low
RAN: technology-independent	**ITU-T L.1351 (08/2018)**	low	low
RAN: technology-independent	**ETSI EN 305 200-2-3 V1.1.1 (2018-06)**	medium	medium
RAN: technology-independent	**ETSI TS 105 200-2-3 V1.2.1 (2019-12)**	medium	medium
FAN: technology-independent	**ETSI EN 305 200-2-2 V1.2.1 (2018-08)**	medium	medium
FAN: technology-independent	**ETSI TS 105 200-2-2 V1.3.1 (2019-12)**	medium	medium
CAN: technology-independent	**ETSI ES 205 200-2-4 V1.1.1 (2015-06)**	low	low
5G mobile network: RAN, core network, end-to-end, NFV, slicing	**ETSI TS 128 554 V18.7.0 (2024-10)**	low	low
ICT location: Core network	**ETSI EN 305 200-3-1 V1.1.1 (2018-02)**	medium	medium
ICT location: Core network	**ETSI TS 105 200-3-1 V1.2.1 (2019-12)**	medium	medium
ICT location: entire network	**ITU-T L.1332 (01/2018)**	low	low
Entire access network: NFV	**ETSI EN 303 471 V1.1.1 (2019-01)**	medium	medium

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Energy management: Summary of cost estimates

Network segment	Standards	Semi-quantitative evaluation	Market penetration	Stakeholder survey
RAN: 2G/3G/4G	ETSI EN 303 472 V1.1.1 (2018-10)	medium	- None of these standards are mentioned in the taxonomy or the CSRD. -Survey: Network operators are partially aware of the ETSI standards, but there is no evidence of their practical application -BEREC Studie: standards **ETSI EN 303 472 and ETSI ES 203 228** are used by some network operators.	-Initial expenditure: more than 1% of CAPEX, -Subsequently expected <0.1% CAPEX
RAN: technology-independent	ETSI ES 203 228 V1.4.1 (2022-04)/ITU-T L.1331	low		
RAN: technology-independent	ETSI TR 103 540 V1.1.1 (2018-04)	low		
RAN: technology-independent	ITU-T L.1350 (10/2016)	medium		
RAN: technology-independent	ITU-T L.1351 (08/2018)	medium		
RAN: technology-independent	ETSI EN 305 200-2-3 V1.1.1 (2018-06)	medium		
RAN: technology-independent	ETSI TS 105 200-2-3 V1.2.1 (2019-12)	medium		
FAN: technology-independent	ETSI EN 305 200-2-2 V1.2.1 (2018-08)	medium		
FAN: technology-independent	ETSI TS 105 200-2-2 V1.3.1 (2019-12)	medium		
CAN: technology-independent	ETSI ES 205 200-2-4 V1.1.1 (2015-06)	low		
5G mobile network: RAN, core network, end-to-end, NFV, slicing	ETSI TS 128 554 V18.7.0 (2024-10)	medium		
ICT location: Core network	ETSI EN 305 200-3-1 V1.1.1 (2018-02)	medium		
ICT location: Core network	ETSI TS 105 200-3-1 V1.2.1 (2019-12)	medium		
ICT location: entire network	ITU-T L.1332 (01/2018)	medium		
Entire access network: NFV	ETSI EN 303 471 V1.1.1 (2019-01)	medium		

Recommendation for Code of Conduct (CoC): Energy Management

Standards	Network segment	Strengths	Limitations
ETSI EN 303 472 V1.1.1 (2018-10)	**RAN: 2G/3G/4G**	• Includes three must-have metrics • Includes ICT equipment & infrastructure • Clear definition of the measurement method • Detailed reporting requirements	• Does not support 5G technology • Not considering the shared base station infrastructure
ETSI ES 203 228 V1.4.1 (2022-04) / ITU-T L.1331	**RAN: 2G/3G/4G/5G**	• Coverage 2G to 5G • Includes ICT equipment & infrastructure • Detailed reporting requirements • Provided scaling method • Practicable allocation rule for shared locations	• 2 of the 3 must-have metrics (no explicit disclosure of the metric "renewable energy", but requires disclosure of the percentage of energy from renewable sources used on site). • Flexibility in measuring period and measuring frequency

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Recommendation for Code of Conduct (CoC): Energy Management

Standards	Network segment	Strengths		Limitations
• ETSI EN 305 200-2-3 V1.1.1 (2018-06) • ETSI TS 105 200-2-3 V1.2.1 (2019-12)	RAN	• Includes ICT equipment & infrastructure • Measurement period: standard 365 days, shorter (min. 7 days) possible if representative for the year • **"Global KPIs": potential for future comparisons**	• Includes three must-have metrics	• Different treatment for shared ICT-sites: →EN: Not taking into account the shared base stations →TS: Allocation to the energy costs • Measurement of the data volume: →EN: according to ETSI EN 303 472 normative →TS: informative **An update is required**
• ETSI EN 305 200-2-2 V1.2.1 (2018-08) • ETSI TS 105 200-2-2 V1.3.1 (2019-12)	FAN		• Includes three must-have metrics	• Different treatment for shared ICT-sites: see EN 305-2-3 • TS: if direct measurement is not possible, the maximum consumption of the appliances can be used in accordance with the manufacturer's technical specifications **An update is required**
• ETSI EN 305 200-3-1 V1.1.1 (2018-02) • ETSI TS 105 200-3-1 V1.2.1 (2019-12)	ICT-Sites for core network		• Measuring points are clearly defined	• 2 of the 3 must-have metrics. Energy efficiency metric missing • No allocation rule for shared locations **An update is required**

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Recommendation for Code of Conduct (CoC): Energy Management

Standards	Network segment	Strengths	Limitations
ETSI EN 303 471 V1.1.1 (2019-01)	**NVF for the access networks**	• Holistic approach: Aggregated measurements of the entire NFVI without differentiation at VNF or component level. • As a supplementary standard for RAN and FAN in the NFV application.	• Not considering the shared base stations
ETSI TS 128 554 V18.7.0 (2024-10) / 3GPP TS 28.554 version 18.7.0 suitability: low	**5G end-to-end: RAN & core network**	• Includes both RAN and core network • **Future-orientated**: →5G NFV at component level, network slicing →Extensive performance indicators.	• 2 of the 3 must-have metrics • No requirement for the "renewable energy" metric • No information on measuring method, e.g. measuring period and measuring frequency • Energy consumption of the infrastructure is not mentioned • No report template and report requirements. • No allocation rule for shared locations

Energy: Overview

NFV
extrapolation
same Series

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Total Network (Mobil network und Fixed network)

Total access network (RAN / FAN / CAN)

NVF (Network Function Virtualisation) ETSI EN 303 471 V1.1.1 (2019-01)

Radio access network (RAN)

2G/3G/4G:
ETSI EN 303 472 V1.1.1 (2018-10)

Technology-independent:
ETSI EN 305 200-2-3 V1.1.1 (2018-06)
ETSI TS 105 200-2-3 V1.2.1 (2019-12)

ETSI ES 203 228 V1.4.1 (2022-04) / ITU-T L.1331

Total 5G-Mobil network (incl. NFV, Slicing): ETSI TS 128 554 V18.7.0 (2024-10) / 3GPP 28.554

Fixed access network (FAN)

ETSI EN 305 200-2-2 V1.2.1 (2018-08)
ETSI TS 105 200-2-2 V1.3.1 (2019-12)

Cable access network (CAN)

Total Core network

Technology-independent: ICT Sites

ETSI EN 305 200-3-1 V1.1.1 (2018-02)
ETSI TS 105 200-3-1 V1.2.1 (2019-12)

5G Core network

Recommendation for Code of Conduct (CoC): Energy Management

- A fair comparison of sustainability indicators across different network operators requires: standardized measurement processes, data collection, clear system boundaries, and methodological allocation for shared infrastructure. Additionally, environmental conditions, technology, locations (e.g. urban, rural), network architecture, and load profiles.
- The energy-related standards examined are intended for internal trend analysis of energy consumption, not for comparisons between network operators, as numerous influencing factors remain unconsidered.
- **Future for comparability:** Practical case studies with network operators by using certain standards are recommended to analyze challenges, influencing factors, and network complexity, thereby enabling fair comparisons.

GHG:
Results of Comparability and Effort Estimation

GHG: Overview (4 Standards: 2 Groups)

Group 1: Focus on **Scopes 1 & 2**:

1) GHG Protocol Corporate Accounting and Reporting Standard (2004) + Amendment with Scope 2 Guidance (2015)
2) ITU-T L.1420 (02/2012) Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies in organizations

Group 2: exclusively with a focus on **Scope 3**:

1) GHG Protocol Corporate Accounting and Reporting Standard (2004)
2) ITU-T L.1420 (02/2012)
3) Protocol Corporate (Value Chain) Standard (2011)
4) GSMA/GeSI/ITU: Scope 3 Guidance for Telecommunication Operators (2023)

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GHG: Assessment of standards from Group 1 (GHG Scopes 1&2)

Impact of applying different standards on GHG accounting results

Evaluation criteria	No.	Valuation aspects	GHG Protocol Corporate (2004); extension with Scope 2 Guidance (2015)	ITU-T L.1420 (02/2012)
Robustness	A1.1	Primary data: Recording for Scope 1	🟡	🟡
Robustheit	A1.2	Primary data: Recording for Scope 2	🟡	🟡
Reproducibility	A2.1	Secondary data: Collection for Scope 1 and 2	🟡	🟢
Reproducibility	A2.2	Definition of allocation rules	🔴	🔴
Credibility	A3.1	Evaluation of data quality / uncertainty assessment	🟡	🟢
Credibility	A3.2	Validation	🔴	🔴
Transparency	A4.1	Calculation of Scope 2 emissions	🟢	🔴
Transparency	A4.2	Requirement for calculating the GWP	🔴	🟢
Transparency	A4.3	Definition of organisational system boundaries	🟡	🟡
Transparency	A4.4	Mandatory requirements regarding general information	🟢	🟢
Transparency	A4.5	Mandatory requirements for the metrics	🟢	🔴

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GHG: Assessment of standards from Group 1 (GHG Scope 3)

Impact of applying different standards on GHG accounting results

Evaluation criteria	No.	Valuation aspects	GHG Protocol Corporate (2004); extension with Scope 2 Guidance (2015)	ITU-T L.1420 (02/2012)	GHG Protocol Corporate Value Chain (2011)	GSMA/GeSI/ITU: Scope 3 (2023) and ITU-T L Suppl. 57 (06/2023)
Robustness	A1.1	Requirements regarding the collection and use of activity data for the 15 categories	🔴	🔴	🟡	🟢
Robustness	A1.2	Calculation methods per Scope 3 category, e.g. spend-based method; distance-based method	🔴	🔴	🟡	🟢
Reproducibility	A2.1	Variations with regard to Scope 3 coverage as a sum of Cat 1-15	🔴	🟡	🟡	🟢
Reproducibility	A2.2	Requirements for emission factors; indication of literature sources/databases for emission factors	🔴	🟢	🟡	🟢
Reproducibility	A2.3	Definition of allocation rules	🔴	🔴	🟢	🟡
Reproducibility	A2.4	Definition of materiality criteria for Scope 3	🔴	🔴	🟡	🟡
Credibility	A3.1	Assessment of data quality / uncertainty assessment: - Is an assessment mandatory? - If yes, according to which method? - Are there any guidance documents?	🟡	🟡	🟢	🟢
Credibility	A3.2	Validation: - Is a verification, critical review, etc. required? - If yes, internal or external?	🔴	🔴	🔴	🔴
Transparency	A4.1	Mandatory requirements regarding general information in the report; e.g. operational and organisational system boundaries, emission factors used, etc.	🔴	🟡	🟡	🟢
Transparency	A4.2	Mandatory requirements for the metrics in the report; e.g. differentiation by GHG, extra reporting for biologically stored GHG...	🟡	🟡	🟢	🟡

GHG: Summary of Comparability and Suitability Assessment

Comparability: Influence on the results of metrics and indicators due to different users (Criteria: Robustness & Reproducibility)

Suitability: Additional criteria: Credibility and Transparency

GHG	Standards	Comparability within a standard	Assessment of suitability
Group 1 (Scopes 1&2)	GHG Protocol Corporate Accounting and Reporting Standard (2004) & Scope 2 Guidance	low	medium
	ITU-T L.1420 (02/2012)	medium	medium
Group 2 (Scope 3)	GHG Protocol Corporate Accounting and Reporting Standard (2004) & Scope 2 Guidance	low	low
	ITU-T L.1420 (02/2012)	low	low
	Protocol Corporate (Value Chain) Standard (2011)	medium	low
	Scope 3 Guidance for Telecommunication Operators (2023)	high	high

GHG: Summary of Effort Estimation

Group	Standards	Semi-quantitative evaluation	Market penetration	Stakeholder survey
Group 1 (Scopes 1&2)	GHG Protocol Corporate Accounting and Reporting Standard (2004), Amendment with Scope 2 Guidance (2015)	medium	•**GHG Protocol Corporate:** High due to CSRD requirements and practical application (sustainability reports from network operators). •**ITU 1420 and GSMA:** Used by two network operators.	•**Initial effort:** Approximately 1-5% of CAPEX •**Subsequently:** Expected to be <0.1% of CAPE
	ITU-T L.1420 (02/2012)	**high**		
Group 2 (Scope 3)	GHG Protocol Corporate Accounting and Reporting Standard (2004),	medium		
	ITU-T L.1420 (02/2012)	**high**		
	Protocol Corporate (Value Chain) Standard (2011)	medium		
	GSMA/GeSI/ITU: Scope 3 Guidance for Telecommunication Operators (2023)	medium		

Conclusions and recommendations on CoC: GHG Scope 1 & Scope 2

Focus on Scopes 1 & 2:

- GHG Protocol Corporate Accounting and Reporting Standard (2004) + Amendment with Scope 2 Guidance (2015)

Advantages: High market penetration and broad acceptance among companies, stakeholders, and governmental bodies. Low additional effort. Transparency.

Limitations: Low comparability of results

CoC:

- Separate reporting of telecommunication network-related Scope 1/2 emissions and transparent documentation of the methodological approach.
- Clear Definition of the activities considered, e.g., maintenance trips using the company's own fleet.

Conclusions and recommendations on CoC: GHG Scope 3

Focus on Scopes 3:

- GSMA/GeSI/ITU: Scope 3 Guidance for Telecommunication Operators (2023)

Advantages: Detailed guidance and prioritization with a specific focus on the unique characteristics of the telecommunications sector, resulting in high comparability of Scope 3 results.

Limitations: High effort required (typical for Scope 3); Comparability depends on how the methods are applied in practice.

Conclusions and recommendations on CoC: GHG Scope 3

CoC:

- Focus on the most significant categories: "Purchased goods and services" used in the network segment (Category 1), "Capital goods" used in the network segment (Category 2), fuel and energy-related activities associated with network, e.g., maintenance trips by external service providers (Category 3), and, if applicable, activities associated with network in investments (Category 15); Upstream/Downstream leased assets (categories 8/13)
- Transparent documentation of the methodology used for categorization, the boundaries of the categories considered, and the source of emission factors.

Future for comparability: The goal is to facilitate the calculation of comprehensive Scope 3 categories while improving the harmonization and comparability of results. To achieve this, it is helpful to collectively record sector-specific but average CO2e emission factors for upstream and downstream processes, such as the production chain of network components, in a centralized database platform.

Circular Economy:
Results of Comparability and Effort Estimation

Circular economy: Overview (6 Standards: 2 Groups)

- **Group 1: Pre-Use**
  - ETSI TR 103 476 V1.1.2 (2018-02): Environmental Engineering (EE); Circular Economy (CE) in Information and Communication Technology (ICT); Definition of approaches, concepts and metrics
  - DIN EN 45556: General method for assessing the proportion of reused components in energy-related products;
  - DIN EN 45557: General method for assessing the proportion of recycled material content in energy-related products
- **Group 2: EoL (End-of-Life)**
  - GRI 306: Waste 2020
  - ETSI EN 305 174-8 V1.1.1 (2018-01): Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Lifecycle Resource Management; Part 8: Management of end of life of ICT equipment (ICT waste/end of life)
  - ETSI TS 105 174-8 V1.2.1 (2019-12): Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Lifecycle Resource Management; Part 8: Implementation of WEEE practices for ICT equipment during maintenance and at end-of-life

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Circular Economy: Assessment of Standards

Group 1: Pre-Use

Evaluation criteria	No.	Valuation aspects	ETSI TR 103 476 V1.1.2 (2018-02)	DIN EN 45556 (2020)	DIN EN 45557 (2020)
Robustness	A1	Data collection methods of input parameters			
Reproducibility	A2.1	Data collection methods: sources of input parameters			
Reproducibility	A2.2	Data collection methods: time coverage of data			
Credibility	A3.1	Assessment of Uncertainties			
Credibility	A3.2	Validation			
Transparency	A4	Reporting			

Group 2: EoL

Evaluation criteria	Nr.	Valuation aspects	GRI 306	ETSI EN 305 174-8 V1.1.1 (2018-01)	ETSI TS 105 174-8 V1.2.1 (2019-12)
Robustness	A1	Data collection methods of input parameters			
Reproducibility	A2.1	Data collection methods: sources of input parameters			
Reproducibility	A2.2	Data collection methods: time coverage of data			
Credibility	A3.1	Assessment of Uncertainties			
Credibility	A3.2	Validation			
Transparency	A4	Reporting			

Circular Economy: Summary of Comparability and Suitability Assessment

Comparability: Influence on the results of metrics and indicators due to different users (Criteria: Robustness & Reproducibility)

Suitability: Additional criteria: Credibility and Transparency

Group	Standards	Comparability within a standard	Assessment of suitability
Pre-Use	ETSI TR 103 476 V1.1.2 (2018-02)	low	low
	DIN EN 45556 (2020)	medium	medium
	DIN EN 45557 (2020)	medium	medium
End-of-Life	GRI 306 (2020)	medium	low
	ETSI EN 305 174-8 V1.1.1 (2018-01)	medium	low
	ETSI TS 105 174-8 V1.2.1 (2019-12)	medium	medium

Circular Economy: Summary of Effort Estimation

Group	Standards	Semi-quantitative evaluation	Market penetration	Stakeholder survey
Pre-use	ETSI TR 103 476 V1.1.2 (2018-02)	medium	• No normative references • Standards are largely unknown • Hardly applied in practice (exception: GRI 306)	Effort currently not quantifiable
	DIN EN 45556 (2020)	medium		
	DIN EN 45557 (2020)	medium		
End-of-Life	GRI 306 (2020)	low		
	ETSI EN 305 174-8 V1.1.1 (2018-01)	low		
	ETSI TS 105 174-8 V1.2.1 (2019-12)	low		

Conclusions and recommendations on CoC: Circular economy

- The standards analyzed in both groups are not specific to network infrastructure.
- The standards in the "pre-use" group are not suitable for determining the (product-related) must-have metrics of the JRC study, but they do provide a good introduction and overview of the topics of "Circular Economy" and "Resource Efficiency" to some extent.
- The standards in the "end-of-life" group are suitable for determining some must-have metrics (e.g., weight of e-waste, weight of recycled products/materials); however, their comparability within a standard as well as their overall suitability is rated as relatively low (low to medium).
- The analyzed standards require a low to medium level of effort.
- The result of the effort estimation could neither be confirmed nor disproved by the stakeholder survey, as the analyzed standards were not known to the network operators surveyed.
- Given the low suitability of the standards and their limited comparability within the standards, there is a particular need for the development of specific standards in the "pre-use" group.

Conclusions and recommendations on CoC: Circular economy

CoC:

- Metric “E-waste” in the "End-of-Life" group, GRI 306 provides an indicator for determining e-waste quantities, however not for comparability. Note: ITU-T L.1050 standard (no metrics) but offers a list of network and infrastructure equipment within network segments (access, backhaul, backbone), which can be used to systematically record e-waste in the network domain.
- Other metrics: “Distribution or utilisation of recycled/ refurbished/ reused **products**” in both groups (“pre-use” and “EoL”) -> No suitable standards have been found.

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Thank you for your attention!

Do you have any questions?

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