Draft new Recommendation ITU-T Y.IMT2020-EE-CFW

Requirements and capability framework of IMT-2020 networks and beyond from the energy efficiency perspective

1. Scope

Energy efficiency (EE) is the relation between the useful output and the energy/power consumption. This Recommendation focuses on the requirements and capability framework of IMT-2020 networks and beyond from the energy efficiency perspective. It addresses the following topics of IMT-2020 networks and beyond from the energy efficiency perspective:

- Requirements, including the general requirements and requirements on UE, access network, core network, data network and services and applications, and also the network capability group of IMT-2020 networks and beyond from the energy efficiency perspective.
- Capability framework, including the network capabilities and information related to the potential support of new enabling technologies.
- Procedures, including the interactions among network capability group of IMT-2020 networks and beyond from the energy efficiency perspective, UE, access network, core network, data network and services and applications

Editor's note: The network capability group of IMT-2020 networks and beyond from the energy efficiency perspective is the group of capabilities of IMT-2020 networks and beyond to support the end-to-end communication system energy efficiency with the cooperation among UE, access network, core network, data network and services and applications. This network capability group will be further elaborated.

2. References

Editor's note: This clause is for future update according to the progress of the Recommendation.

[ITU-T Y.3100] Recommendation ITU-T Y.3100 (2017), Terms and definitions for IMT-2020 network.

[ITU-T Y.3101] Recommendation ITU-T Y.3101 (2018), Requirements of the IMT-2020 network.

[ITU-T Y.3102] Recommendation ITU-T Y.3102 (formerly Y.IMT2020-frame): Framework of the IMT-2020 network.

[ITU-T Y.3104] Recommendation ITU-T Y.3104 (2018), Architecture of the IMT-2020 network.

[ITU-T Y.3200] Recommendation ITU-T Y.3200 (2022), *Fixed, mobile and satellite convergence – Requirements for IMT-2020 networks and beyond.*

[ITU-T L.1316] Recommendation ITU-T L.1316 (2019), *Energy efficiency framework.*

[ITU-T L.1330] Recommendation ITU-T L.1330 (2015), *Energy efficiency measurement and metrics for telecommunication networks.*

[ITU-T L.1331] Recommendation ITU-T L.1331 (2022), *Assessment of mobile network energy efficiency.*

[ETSI DGR/NFV-EVE021] *Network Functions Virtualisation (NFV) Release 5; Evolution and Ecosystem; Report on energy efficiency aspects for NFV*

[3GPP TR 21.866] TR 21.866, *Study on Energy Efficiency Aspects of 3GPP Standards*

[3GPP TS 28.310] TS 28.310, *Management and orchestration; Energy efficiency of 5G*

[3GPP TR 28.813] TR 28.813, *Management and orchestration; Study on new aspects of Energy Efficiency (EE) for 5G*

[3GPP TR 38.864] TR 38.864, *Study on network energy savings for NR*

[3GPP TR 22.882] TR 22.882, *Study on Energy Efficiency as a service criteria*

[3GPP FS_CNEES] XXX, *Study on Energy Efficiency and Energy Saving*

3. Definitions

3.1. Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 energy efficiency (EE) [ITU-T L.1330]: The relation between the useful output and energy/power consumption.

3.1.2 fixed, mobile and satellite convergence (FMSC) [ITU-T Y.3200]: The capabilities that provide services and applications to end users regardless of the fixed, mobile or satellite access technologies being used and independently of the users' location.

3.1.3 IMT-2020 [ITU-T Y.3100]: Systems, system components, and related technologies that provide far more enhanced capabilities than those described in [b-ITU-R M.1645].

NOTE – [b-ITU-R M.1645] defines the framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000 for the radio access network.

3.1.4 power consumption [ITU-T L.1330]: The power consumed by a device needed to achieve an intended application performance.

3.2. Terms defined in this Recommendation

This Recommendation defines the following terms:

Editor's note: Terms will be added according to further update of the text

4. Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

EE	Energy Efficiency
FMSC	Fixed, Mobile and Satellite Convergence
UE	User Equipment

5. Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's

implementation must provide the option, and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Recommendation.

6. Introduction

[Editor's Note] This clause will provide the introduction of IMT-2020 networks and beyond. from the energy efficiency perspective.
TBD

7. Requirements of IMT-2020 networks and beyond from the energy efficiency perspective

[Editor's Note] This clause will provide the requirements of IMT-2020 networks and beyond from the energy efficiency perspective, including the general requirements and requirements on UE, access network, core network, data network and services and applications, and also the network capability group of IMT-2020 networks and beyond from the energy efficiency perspective.

8. Capability framework of IMT-2020 networks and beyond from the energy efficiency perspective

[Editor's Note] This clause will describe the capabilities and the capability framework of IMT-2020 networks and beyond from the energy efficiency perspective, based on the requirements defined in clause 7. It will also provide information related to the potential support of new enabling technologies, including with respect to, but not limited to, the network capability of energy efficiency information acquisition, the network capability of energy efficiency information analysis, and the network capability of energy efficiency policy enforcement. Fig 8.1 is the initial input for the capability framework, for further consideration.

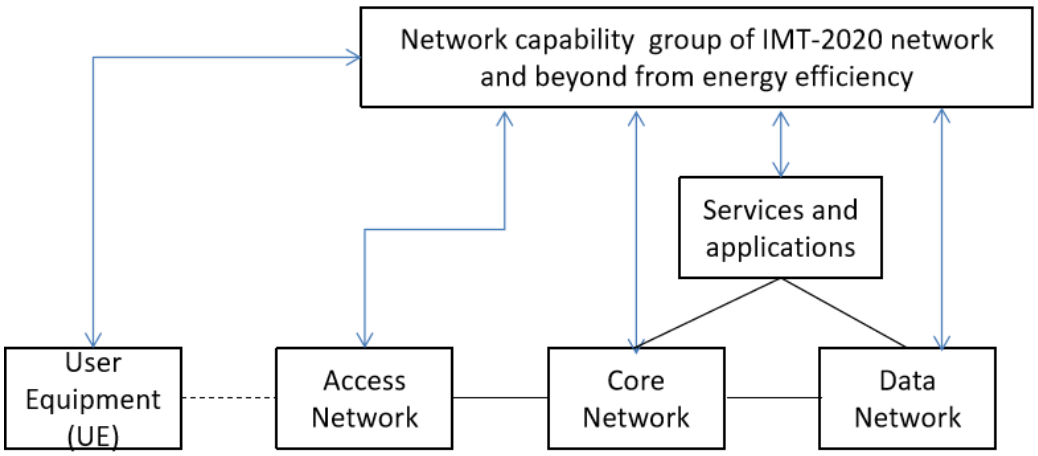

Fig 8.1 Overview of capability framework of IMT-2020 networks and beyond from the energy efficiency perspective

TBD

9. Procedures of IMT-2020 networks and beyond from the energy efficiency perspective

Editor's note: This clause will describe the interactions among the network capability group of IMT-2020 networks and beyond from the energy efficiency perspective, UE, access network, core

network, data network and services and applications in the context of the capability framework from the energy efficiency perspective.
TBD

10. Security Considerations

Editor's note: This clause will describe the security considerations on capability framework, and procedures of IMT-2020 networks and beyond from the energy efficiency perspective.

TBD

Appendix I

Editor's note: the effective usage (and the specific content to be considered) of this temporary appendix in the final version of this draft Recommendation is for further discussion.

Standardization landscape of network studies from the energy efficiency perspective for IMT-2020 and beyond

(This appendix does not form an integral part of this Recommendation.)

In recent years, the energy efficiency aspect of networks has become a hot topic in ITU-T, 3GPP, ETSI and other SDOs.

In March 2023 Q20/13 meeting, liaisons were sent to SG5, 3GPP SA5 and ETSI, to provide information and request advices on the SG13 plan to initiate the new work item at the 23 Oct-3 Nov 2023 meeting. The received replies to these SG13 advice requests are presented in the following.

As for SG5, the advice is that if this planned Recommendation is more focused on potential enhancements towards network functions considering energy efficiency, ITU-T SG5 would like to propose changing the title accordingly, as well as the scope of this new work item. ITU-T SG5 would be very happy to collaborate with SG13 if this planned new work item is effectively created in SG13 in order to provide feedback on energy efficiency.

In 3GPP, energy efficiency has been studied in SA, SA5 and RAN.
Specifically, SA has studied system requirements and principles and provided an Energy Efficiency Control Framework, including the core network and the radio access network [TR 21.866].
SA5 has specified concepts, use cases, requirements and solutions for energy efficiency assessment and optimization for energy saving, as well as Energy Efficiency (EE) KPIs [TS 28.310] [TS 28.813].
RAN study has concentrated on the definition of network energy consumption models, evaluation methodology and KPIs, and has also identified techniques on the gNB and UE sides to improve network energy savings in terms of both BS transmission and reception [TR 38.864]. As for 3GPP SA5, since energy efficiency is currently considered in many standard groups and specifications, 3GPP SA5 would like to collaborate with ITU-T SG13 on such topic from different perspectives and complement each other's work, and would like to be kept informed of the progress of the SG13 planned new work item on "Requirements and framework of network function enhancements of IMT-2020 networks and beyond from the energy efficiency perspective".

NOTE - The standardization work of 3GPP focuses on core network and RAN, and considers the energy efficiency issue in each network. But from the energy efficiency perspective, the end-to-end energy efficiency monitoring and control in communication system is essential, leveraging cooperation among UE, access network, core network, data network and services and applications, which is the target for this new work item, and could be a good complementary work to 3GPP work (with the radio part out of scope of this new work item). For example, the load volume in the communication network usually fluctuates periodically, with high load during busy time and low load during idle time: through collaborative energy saving solutions in each part of the network, it can be realized dynamic adaptation of energy supply according to the network load, and this can effectively improve the energy efficiency of IMT-2020 networks and beyond.

As for ETSI, ETSI ISG NFV kindly requested ITU-T SG13 to consider appropriate ETSI standardization information for the development of the planned new work item (e.g., potential to reference the ETSI NFV's work, and/or complement the ETSI NFV's work with other use cases beyond the ones documented in the DGR/NFV-EVE021). In addition, the ETSI ISG NFV kindly asked ITU-T SG13 to be kept informed about the progress of the planned new work item.

IETF has some drafts discussing the necessities to consider the energy issue at the protocol level in order to improve the efficiency of the whole data center, and they don't touch the telecom operator network, including core network, fixed network and also cloud computing aspects.

To the best of the SG13 knowledge, a network capability framework of IMT-2020 networks and beyond for the energy efficiency perspective has not been addressed in other SDOs.

Therefore, the current IMT-2020 networks and beyond energy efficiency perspective study has not been implemented on the end-to-end (E2E) communications system. There exists an urgent need to study the requirements and capability framework of IMT-2020 networks and beyond from the energy efficiency perspective.

Bibliography

[b-ITU-R M.1645] Recommendation ITU-R M.1645 (2003), *Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000*.

Attachment 1

A.1 justification for proposed draft new ITU-T Y.IMT2020-EE-CFW "Requirements and capability framework of IMT-2020 networks and beyond from the energy efficiency perspective"

Question:	20/13	**Proposed new ITU-T Recommendation**	Geneva, 23 Oct -3 Nov 2023	
Reference and title:	ITU-T Y.IMT2020-EE-CFW "Requirements and capability framework of IMT-2020 networks and beyond from the energy efficiency perspective"			
Base text:	SG13-TDxxx/WP1		**Timing:**	2025-10
Editor(s):	Yuexia Fu, China Mobile, Email: fuyuexia@chinamobile.com Lulu, China Mobile, E-mail:lulu@chinamobile.com;		**Approval process:**	AAP

Scope (defines the intent or object of the Recommendation and the aspects covered, thereby indicating the limits of its applicability):

Energy efficiency (EE) is the relation between the useful output and the energy/power consumption. This Recommendation focuses on the requirements and capability framework of IMT-2020 networks and beyond from the energy efficiency perspective. It addresses the following topics of IMT-2020 networks and beyond from energy efficiency perspective:

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- Capability framework, including the network capabilities and information related to the potential support of new enabling technologies.
- Procedures, including the interactions among network capability group of IMT-2020 networks and beyond from the energy efficiency perspective, UE, access network, core network, data network and services and applications

Summary (provides a brief overview of the purpose and contents of the Recommendation, thus permitting readers to judge its usefulness for their work):

The network capabilities of IMT-2020 network and beyond from the energy efficiency perspective are essential and are required to adapt to the new trend of requirements of low carbon.

In order to better guide the construction of an end-to-end communication system from the energy efficiency perspective and help to reach consensus and unified understanding, it is worth considering how to obtain the energy efficiency information of IMT2020 network and beyond, and how to cooperate among UE, access network, core network, data network and services and applications to improve and optimize the end-to-end communication system energy efficiency.

This Recommendation focuses on requirements, capability framework and procedures of IMT-2020 networks and beyond from the energy efficiency perspective.

Relations to ITU-T Recommendations or to other standards (approved or under development)**:**

ITU-T Y.3100, ITU-T Y.3101, ITU-T Y.3102, ITU-T Y.3104, ITU-T Y.3200, ITU-T L.1316, ITU-T L.1330, ITU-T L.1331, ETSI DGR/NFV-EVE021, 3GPP TR 21.866, 3GPP TS 28.310, 3GPP TR 28.813, 3GPP TR 38.864, 3GPP TR 22.882, 3GPP FS CNEES

Liaisons with other study groups or with other standards bodies:

ITU-T SG5, ITU-T SG11, ITU-R, 3GPP, ETSI, IETF, NGMN

Supporting members that are committing to contributing actively to the work item:

China Mobile, China Unicom, Huawei Technologies, ZTE