**3GPP SA4 131** **S4-250043r02**

**Geneva, February 17th 2025 – February 21th 2025**

**Source: Orange**

**Title: Pseudo-CR on Proposed Conclusions**

**Spec: 3GPP TR 26.942 v1.0.2**

**Agenda item: 8.8 – FS\_MediaEnergyGREEN (Study on Media enerGy consumption exposuRE and EvaluatioN framework)**

**Document for:** **Agreement**

**1. Introduction**

The goal of this pCR is to progress on clause 8 Conclusions and proposed next steps. More solutions will be probably added during SA4#131. The goal of this document is to propose a basis which will be modified/complemented during the meeting to complete the Technical Report at the end of the meeting as expected.

**2. Reason for Change**

Conclusions and proposed next steps are missing.

**3. Conclusions**

Without this pCR, no instructions will be provided for next steps.

**4. Proposal**

It is proposed to agree the following changes to 3GPP TR 26.942 v1.0.2.

\* \* \* First Change \* \* \* \*

# 2 References

[22883] 3GPP TR 22.883: "Feasibility Study on Energy Efficiency as service criteria Phase 2".\* \* \* Next Change \* \* \* \*
(all new text)

# 8 Conclusions

## 8.1 General

The present document highlights ongoing challenges in accurately estimating and reporting energy consumption of media delivery in the 5G System, including mobile network as well as end-user devices. The main difficulties are:

**-** *Data accuracy:* Difficulty in obtaining precise power data at the hardware level and in reporting these data preserving privacy.

**-** *Energy attribution:* Challenges in assigning energy usage to specific data throughput across multiple stakeholders as expected by regulators and protocols, complicated by non-linear relationships between energy and data.

**-** *Regulatory pressures:* Legal requirements for net zero emissions necessitate clear energy allocation strategies, which can lead to disputes among network operators, service providers and consumers.

**-** *Measurement boundaries:* Defining system boundaries for energy measurements affects responsibility and accountability.

Current assessments of energy use are often too coarse for effective policymaking or system design, and do not meet reporting standards set by the Greenhouse Gas Protocol (see clause 4.2.5) and regulatory bodies (see, for example, clause 4.2.8). The present document suggests that collecting fine-grained energy consumption data in real time could address these challenges and proposes a framework for future measurements.

## 8.2 Conclusion for Key Issue #1 (Energy-related information exposure)

Two alternative Candidate Solutions addressing this Key Issue are documented:

- Solution #4 in clause 7.5 proposes to extend the UE data collection, reporting and event exposure architecture defined in TS 26.531 [21] such that the Direct Data Collection Client additionally collects and reports per-application UE energy-related information to the Data Collection AF.

- Solution #5 in clause 7.6 proposes a new architecture and related procedures allowing energy-related information from the device and the network (including the AS) to be provided to a UE application during media consumption for exposure to the user with the definition of two new components, the *Energy Information AF* and the *Energy Information Collector*.

The following aspects are concluded:

- For exposure of end-to-end energy-related information to the network, the Direct Data Collection Client and Data Collection AF specified in TS 26.532 [22] would need to be extended to take into consideration UE energy-related information in addition of their existing data.

- For exposure of end-to-end energy-related information to UE applications, two new entities and their associated interfaces would be required to provide energy-related information from the device, the network and other components of the Media Delivery system to a UE application: The Energy Information AF and the Energy Information Collector.

There is consensus to address the above principles by the following normative work:

1. Create a new stage-2 TS defining an energy architecture using energy information available on Energy Information Function (EIF) allowing end-to-end energy-related information to be exposed to UE applications and extend TS 26.501 [23] and TS 26.506 [59] to instantiate this architecture in the media context.

2. Address the relevant stage-3 aspects based on stage-2 work.

No consensus has been found on UE energy information exposed to the network. Hence, it is not recommended to pursue Solution #4 in clause 7.5 with normative work.

## 8.3 Conclusion for Key Issue #2 (Energy-related monitoring and measurement)

Two solutions addressing this Key Issue are documented:

- Solution #3 in clause 7.4 describes how UE Operating Systems provide tools to assess the energy footprint of applications using system-wide metrics but lists some major limitations (information not publicly available on all UE OS, not limited to media consumption and with uncertain accuracy).

- Solution #6 in clause 7.7 proposes a method leveraging energy consumption information to monitor and measure the way the media content is handled and delivered to the users, and to provide better Quality of Experience (QoE) for users.

The following aspects are concluded:

- On the device side, there is no consensus on defining a UE entity in the 5G System to manage the measurement of UE energy-related information. UE energy-related information can still be used on some UE Operating Systems providing these kinds of metrics, but because the metrics differ from one UE OS to another, there will not be normative work on UE energy-related information collection and metrics.

- On the network side, the Energy Information Function (EIF) is defined in TS 23.501 [72] to collect UE-related Energy Consumption information from Network Functions in the 5G Core, to calculate the Energy Consumption information at the granularity of UE, PDU Session and/or QoS Flow, and to expose the Energy Consumption information to the authorized consumer NF(s) (AF/NEF or another 5GC NF). No additional information has been identified at this time in the context of media delivery or consumption.

In conclusion, there is no consensus at this time to initiate normative work addressing this Key Issue.

## 8.4 Conclusion for Key Issue #3 (Evaluation framework)

Two different solutions addressing this Key Issue are documented:

- Solution #1 in clause 7.2, based on work done by the French regulator, indicates how APIs available on some UE Operating Systems can be used to evaluate the impact of the use of some technologies on energy efficiency on devices in a lab.

- Solution #2 proposes a method to evaluate the energy efficiency of the entire UE as a whole device, which is UE implementation-specific.

The following aspects are concluded:

* No methodology has yet been identified allowing evaluation of the energy usage/savings of multimedia standards features and proposals, following best practices from these earlier characterization frameworks. The main difficulties are the lack of common UE metrics related to media consumption available on all mobile Operating Systems, and the lack of implementation of 5G network entities allowing to provide energy-related information from the network with sufficiently fine granularity.
* It seems that Energy Information Function implementations are needed before being able to evaluate the energy usage/savings of a multimedia standards feature on a specific device in a lab.

In conclusion, there is no consensus at this time to initiate normative work addressing this Key Issue.

# 9 Proposed next steps

The current conclusions of the present document recommend normative work addressing Key Issue #1 (Energy-related information exposure). This normative work is based on the new availability in the 5G System of the Energy Information Function (EIF) as defined in TS 23.501 [72]. Because the capabilities and interfaces of the Energy Information Function (EIF) are not yet fully defined, it seems premature to initiate a new normative Work Item addressing Key Issue #1 before the full definition of the EIF is available.

This study also raised several questions not addressed by any of the Key Issues already defined. For example:

1. How does an Application Service Provider provision an *Information Exposure Specification* in the Energy Information AF?

- Interaction with the PCF and/or the NIF may be required.

2. Is the concept of an *Energy Policy* needed to allow Application Service Provider to specify how the 5GMS System should react to energy-related information about its services shared with the Energy Information AF instantiated in 5GMS AF?

3. How might the 5GMS AS and/or the 5GMS Client (and equivalent functions of the RTC System) react to energy-related information shared with them by the network via the Energy Information AF instantiated in the 5GMS AF and/or the Energy Information Collector instantiated in the Media Session Handler?

- This could involve notification from and/or renegotiation with the PCF, potentially influenced by the Energy Policy mentioned above.

- It could also involve modifications to the behaviour of the 5GMS AS and Media Stream Handler (downlink Media Player or uplink Media Streamer) and/or Dynamic Policy re-instantiation by the Media Session Handler.

A second phase of study seems relevant to complement the work already done, addressing the new questions above and providing more details on the use of new 5G System functionsto provide energy-related information.

This second phase could also allow work done in TR 22.883 [22883] – which was not available during the first study phase – to be addressed, listing new use cases and potential requirements on the following aspects regarding enhancements on energy as service criteria:

* Information exposure of energy-related characteristics of the network for the communication service (i.e. energy consumption, energy supply mix, carbon footprint, energy capacity and availability conditions) to authorized users or authorized third parties.
* Potential dynamic adjustments of the delivered communication service from a 5G System perspective (including service performance adjustments) resulting from the changes of energy-related characteristics of this service. Dynamic adjustments can be based on criteria such as network decision, user preference or agreement between authorised third parties and the network.
* Other aspects including security, charging and privacy for the scenarios above.

The recommendation of the present document is to:

1. Wait for the full definition of the Energy Information Function (EIF) and the completion of TR 22.883 [22883].

2. Then, update the present document with:

a. More details on the interaction with the Energy Information Function (EIF).

b. New Key Issues addressing questions not yet addressed.

c. New Key Issues addressing new relevant use cases and requirements defined in TR 22.883 [22883].

3. Then, initiate normative work normative work including:

a. Normative work already proposed for addressing Key Issue #1 (Energy-related information exposure) in clause 8.2.

b. Potential other work identified in the second phase of the study.