**3GPP TSG-WG SA2 Meeting #162 *S2-2404005r1***

**15 - 19 April, 2024, Changsha, China**

**Source: China Mobile**

**Title: New Solution: Network energy saving with UPF relocation and release**

**Document for: Approval**

**Agenda Item: 19.4**

**Work Item / Release: FS\_EnergySys / Rel-19**

*Abstract of the contribution: Propose a solution on KI#3: Network energy saving with UPF relocation and release.*

# 1 Discussion

This paper is to propose a new solution on KI#3.

This solution aims to achieve energy savings through a new NF, Energy Efficiency Control Function (EECF) by optimizing the energy utilization of UPF(s), which powered by either renewable or non-renewable energy sources. The EECF leverages collected energy related UE subscription information, resource information of UPF(s) from OAM and network energy related information from UPF(s) by SMF to reduce the energy consumption such as UPF re-selection, relocation and release.

By incorporating UPFs that utilize renewable energy sources, the solution enhances its environmental benefits, contributing to a reduced carbon footprint and promoting sustainable network operations. The EECF can request the OAM to adjust the working mode of the UPFs, such as transitioning to an energy-saving state during off-peak periods,

Additionally, the EECF can trigger policy adjustments to the SMF to determine the target DNAI and change the UPFs for established PDU session(s). This allows for the aggregation of PDU session(s) into fewer UPFs, prioritizing those powered by renewable energy when possible and in line with user preferences and service quality requirements.

The system prioritizes the use of renewable energy-powered UPFs in two scenarios:

1. User preference for green/renewable networks: UE allows to used green/renewable network powered by renewable energy or the user is willing to accept lower performance communication in order to reduce energy consumption.
2. Network Energy Saving: The system aims to prioritize UPFs powered by renewable energy while ensuring that the QoS for users is not compromised. This approach maintains user experience while aligning with sustainability goals.

In summary, the EECF's role in optimizing UPF energy utilization, with a focus on integrating renewable energy sources, represents a proactive step towards more energy-efficient and environmentally friendly network operations.

# 2 Proposal

It is proposed to include the below changes into TR 23.700-66 v0.4.0.

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*FIRST CHANGE (all the text is new)*

6.0 Mapping of Solutions to Key Issues

**Table 6.0-1: Mapping of Solutions to Key Issues**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Solutions** | **Key Issues** | | | |
|  | **1** | **2** | **3** | **...** |
| **Solution x: Network energy saving with UPF relocation and release** |  |  | X |  |
|  |  |  |  |  |
| **…** |  |  |  |  |

*NEXT CHANGE (all the text is new)*

## 6.x Solution #X: Network energy saving with UPF relocation

### 6.x.1 Key Issue mapping

This solution addresses the following issues of KI#3.

### 6.x.2 Functional Description

This solution aims to achieve energy saving through optimizing the energy utilization of UPF(s), which powered by either renewable energy or normal energy. The EECF(Energy Efficiency Control Function) leverages resource information of UPF(s) from OAM and network energy related information from UPF(s) through SMF, to reduce the energy consumption in UPF with the following approach:

- Triggering the UPF re-selection (i.e. relocated into UPF which is powered by renewable energy)

### 6.x.3 Procedures

EECF

OAM

PCF

AF

NEF

SMF

UPF-1

UPF-2

1b. Trigger based on local operator policy

3a. Obtain energy related information from OAM

UPF-N

3b. Obtain energy related information from UPF(s)

6.Steps 3-5 of Figure 4.16.5.2-1 of TS 23.502

5. Trigger to update the policy information to PCF/SMF

7.SMF reconfigure the User plane of the PDU Session

1a Nnef\_EnergySaving

1a Neecf\_EnergySaving

UDM

2. Obtain energy related UE subscription information from UDM

4. UE energy consumption calculation

**Figure 6.x.3-1: Procedure for Network energy saving for UPF**

1a. The AF creates a request for energy saving, including UE identifier(s), UE address(es), S-NSSAI, DNN, and UE energy consumption threshold at network slice/DNN/APP ID granularity, and sends the request to NEF. The NEF invokes Neecf\_EnergySaving to send the information provided by AF to EECF.

1b. The EECF is triggered to execute UPF(s) energy saving and energy related information collection based on local operator policy.

2. The EECF obtains energy related UE subscription information from UDM. The collected energy related UE subscription information can indicate whether the use of renewable energy is allowed, whether the UPF relocation is allowedto achieve the low energy consumption.

3a. The EECF obtains energy related information of the UPF(s) through OAM, including , renewable energy information of UPF(s), etc.

3b. The EECF interacts with SMF to request energy related information of UPF(s) from SMF with Nsmf\_UPF\_EnergyInfoCollect Request. SMF requests energy consumption related information of UPF with Nupf\_EnergyInfoCollect Request. UPF(s) collect parameters e.g. data volume, bit rate. UPF(s) response the collected parameters to SMF with Nupf\_EnergyInfoCollect Response. SMF responses energy consumption related information of UPF(s) to EECF with Nsmf\_UPF\_EnergyInfoCollect Response.

4. The EECF calculates the current energy consumption of UE based on the information from 3b.

5. If the energy consumption threshold of UE is exceed, EECF sends this information to the PCF together with the renewable resource information of UPF(s) through Npcf\_PolicyAuthorization Create/Update service, indicating the PCF may update PCC rules accordingly. .

6. The PCF reuses the steps 3-5 of the SM policy association modification process specified in TS 23.502 [3], to update SM policy based on the policy information sent by EECF, including renewable resource information of UPF(s), UE address, PDU session ID, and one or more DNAI information.

7. When receives the updated PCC rules from PCF, the SMF reconfigure the user plane of the PDU session to a UPF with renewable energy resource. The SMF determines target DNAI and change the UPF(s) for an established PDU session.In the case of changing the PSA UPF of a PDU session, procedures described in clause 4.3.5 of TS 23.502 [3] are used to update the PDU session.

### 6.x.4 Impacts on existing services, entities and interfaces

EECF: New NF. Functionalities are as description of clause 6.x.2.

NEF: New service operation Nnef\_EnergySaving.

PCF: Updating SM policy based on the policy information received from EECF.

UPF: Reporting the network energy related information based on EECF request through SMF.

UDM: Energy related subscription information.

*End of CHANGE*