**3GPP TSG-SA1 Meeting # *S1-23xxxx***

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [*HE**LP*](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network | **X** |

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| ***Title:***  | Energy Efficiency as a Service Criteria requirements update with agreed CPRs |
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| ***Source to WG:*** | China Mobile, Nokia, Nokia Shanghai Bell, Samsung |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | EnergyServ |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | CPR 6.1-6, 6.1-7, 6.3-4, 6.4-3, 6.4-4, 6.4-5, 6.6-1 were agreed last meeting and need to considered adding into 6.15a.  |
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| ***Summary of change:*** | Add CPR 6.1-6, 6.1-7, 6.3-4, 6.4-3, 6.4-4, 6.4-5, 6.6-1 to existing section1) 6.15a.2.2 adding 6.1-6, 6.1-72) 6.15a.4.2 adding 6.3-43) 6.15a.5.2 adding 6.4-3, 6.4-4, 6.4-54) add CPR 6.6-1 as new section 6.15a.x |
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| ***Consequences if not approved:*** | Requirement of energy efficiency as service criteria will be missed in TS 22.261 |
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| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | 6.15a, 6.15a.2.2, 6.15a.4.2, 6.15a.5.2 |
|  |  |
| ***This CR's revision history:*** |  |

## 6.15a Energy Efficiency as a Service Criteria

### 6.15a.1 Description

Climate change and the rising consumption of energy motivate increased energy efficiency. Energy efficiency is a strategic priority for telecom operators around the world.

Energy efficiency as a service criteria allows services to be delivered with diverse energy efficiency and energy consumption policies. Energy consumption and efficiency information and network energy states can be exposed to third parties and energy consumption can be constrained.

Energy consumption information can include ratio of renewable energy and carbon emission information when available. Calculation of ratio of renewable energy as described in the following requirements is done by means of averaging or applying a statistical model. The requirements do not imply that some form of 'real time' monitoring is required.

### 6.15a.2 Energy related information as a service criteria

#### 6.15a.2.1 Description

Energy consumption can be monitored and considered through O&M as part of network operations [47], as well as a service criteria.

For best-effort traffic, that is, without QoS criteria, policies can be defined to limit energy use for services. This is not in conflict with the principle that performance policies will not be traded off for energy efficiency, since best-effort service has no performance guarantees.

Specifically, best-effort traffic can be subject to a policy that limits the maximum energy consumption over time, or further constrained by location (so that the energy consumption limit only applies when used in a specified service area.)

Additionally, policies can be defined with a maximum energy credit limit, e.g. for best-effort services to limit the total amount of energy consumption. These policies expand the options of subscription policies to control energy consumption in the 5G system.

#### 6.15a.2.2 Requirements

Subject to operator’s policy, the 5G system shall support subscription policies that define a maximum energy credit limit for services without QoS criteria.

Subject to operator’s policy, the 5G system shall support a means to associate energy consumption information with charging information based on subscription policies for services without QoS criteria.

Subject to operator’s policy, the 5G system shall support a mechanism to perform energy consumption credit limit control for services without QoS criteria.

NOTE 1: The result of the credit control is not specified by this requirement.

NOTE 2: Credit control [49] compares against a credit control limit. It is assumed charging events are assigned a corresponding energy consumption and this is compared against a policy of energy credit limit. It is assumed there can be a new policy to limit energy consumption allowed.

Subject to operator’s policy, the 5G system shall support a means to define subscription policies and means to enforce the policy that define a maximum energy consumption (i.e. quantity of energy for a specified period of time) for services without QoS criteria.

NOTE 3: The granularity of the subscription policies can either apply to the subscriber (all services), or to particular services.

The 5G system shall provide a mechanism to include the ratio of renewable energy as part of charging information.

Subject to operator policy and agreement with 3rd party, the 5G system shall provide a mechanism to support the selection of an application server based on energy consumption information associated with a set of application servers.

### 6.15a.3 Support of different energy states

#### 6.15a.3.1 Description

Different energy states is beneficial for verticals and operators to save energy according to different working status of telecommunication equipment and manufacturing.

#### 6.15a.3.2 Requirements

The 5G system shall support different energy states of network elements and network functions.

5G system shall support dynamic changes of energy states of network elements and network functions.

NOTE: This requirement also includes the condition when providing network elements or functions to an authorised 3rd party, the dynamic changes can be based on pre-configured policy (the time of changing energy states, which energy state map to which level of load, etc.)

The 5G system shall support different charging mechanisms based on the different energy states of network elements and network functions.

### 6.15a.4 Monitoring and measurement

#### 6.15a.4.1 Description

Different levels of monitoring and measurement related to energy consumption and efficiency bring more support in energy efficiency and energy saving. In this section, monitoring and measurement related to energy consumption and efficiency include network functions under NPN condition and also all kinds of NG-RAN deployment scenarios.

#### 6.15a.4.2 Requirements

Subject to operator's policy, the 5G network shall support energy consumption monitoring at per network slice and per subscriber granularity.

NOTE 1: Energy consumption monitoring as described in the preceding requirement is done by means of averaging or applying a statistical model. The requirement does not imply that some form of 'real time' monitoring is required. The granularity of the subscription policies can either apply to the subscriber (all services), or to particular services.

Subject to operator’s policy and agreement with 3rd party, the 5G system shall be able to monitor energy consumption for serving this 3rd party.

NOTE 2: The granularity of energy consumption measurement could vary according to different situations, for example, when several services share a same network slice, etc.

NOTE 3: The energy consumption information can be related to the network resources of network slice, NPNs, etc.

Subject to operator policy and regulatory requirements, the 5G system shall be able to monitor the energy consumption for serving the 3rd party, together with the network performance statistic information for the services provided by that network, through same update rate e.g. hourly or daily.

NOTE 4: The network performance statistic information could be the data rate, packet delay and packet loss, etc.

### 6.15a.5 Information exposure

#### 6.15a.5.1 Description

Information related to energy consumption and efficiency is not only necessary for network internal optimization, but also will benefit the service adjustment for 3rd party.

#### 6.15a.5.2 Requirements

Subject to operator’s policy and agreement with 3rd party, the 5G system shall be able to expose information on energy consumption for serving this 3rd party.

NOTE 8: Energy consumption information can include ratio of renewable energy and carbon emission information when available. The reporting period could be set, e.g., on monthly or yearly basis and can vary based on location.

NOTE 9: The energy consumption information can be related to the network resources of network slice, NPNs, etc.

Subject to operator’s policy, the 5G system shall support a means to expose energy consumption to authorized third parties for services, including energy consumption information related to the condition of energy credit limit (e.g. when the energy consumption is reaching the energy credit limit).

Subject to operator policy, the 5G system shall provide means for the trusted 3rd party, to configure which network performance statistic information (e.g. the data rate, packet delay and packet loss) for the communication service provided to the 3rd party, needs to be exposed along with the information on energy consumption for serving this 3rd party.

Based on operator’s policy and agreement with 3rd party, the 5G system shall be able to expose energy consumption information and prediction on energy consumption of the 5G network per application service to the 3rd party.

Subject to operator’s policy and agreement with 3rd party, the 5G system shall support a mechanism for the 3rd party to provide current or predicted energy consumption information over a specific period of time.

### 6.15a.6 Network actions leveraging energy efficiency as a service criteria

#### 6.15a.6.1 Description

This clause addresses requirements to the 5G system that leverage energy-related information (e.g., energy consumption, energy efficiency), amongst others (e.g., network load), as criteria for network internal optimization actions targeting energy savings, within and across operators in a localized (i.e., geographically bound) and/or temporal (i.e., time bound) manner.

One of the strategies to save energy within mobile networks is to shut down some RAN nodes at times of low usage.

Eventually only one communication service could be used on a local basis among operators at times of low usage, as further energy saving gain to be exploited. Agreements could be put in place between operators so that in the low load periods (e.g., night time) only one of multiple mobile networks may be active in an area and will provide communication service to the subscribers of all networks, whereas the other networks can apply cell shutdown of their own infrastructure to obtain network energy savings.

Alternatively, based on risks of power outage nation-wide/region-wide, regulators could ask operators to “optimize” their coverage e.g., shutdown some nodes in overlapping coverage areas during energy peak hours and/or in specific geographical areas, whilst still guaranteeing minimum coverage/service (in particular emergency calls).

This can also apply between NPN operators and/or with PLMN operators.

#### 6.15a.6.2 Requirements

Subject to regulatory requirements and operators’ policies, the 5G system shall enable an operator to temporarily serve UEs of other operators within a geographical area for the purpose of saving energy of the other operators.

NOTE 1: The other operators are assumed to stop providing communication service over their own network infrastructure within the same geographical area to save energy during that time.

NOTE 2: Policies may include predefined times/locations, energy consumption/efficiency thresholds, etc.

NOTE 3: It is assumed that the 5G system can collect charging information associated with serving UEs of other operators.