**3GPP TSG-SA5 Meeting #150 S5-235zzz**

**Goteborg, Sweden, August 21-25, 2023 was S5-235zzz**

**Source: Samsung, ...**

**Title: Rel-18 pCR 28.318 5.X** **Coordinated service recovery without redundent topology**

**Document for: Approval**

**Agenda Item: 6.6.4.3 (NSOEU\_WoP#3) Support energy system recovery through communication of management information between the energy utility service operator and site operator**

# 1 Decision/action requested

***The group is asked to discuss and approve the proposals.***

# 2 References

[1] 3GPP TR 28.829 "Study on network and service operations for energy utilities".

[2] SP-230632, "Network and Service Operations for Energy Utilities", NSOEU WID approved at SA#100.

# 3 Rationale

This pCR provides a normative clause of the requirements agreed in [1] with respect to coordination of energy system recovery, and pursues the objectives in the agreed WID [2].

# 4 Detailed proposal

It is proposed to agree to the following change to TS 28.318, 0.0.0.

|  |
| --- |
| **Begin Change** |

## 5.Y Energy utility and telecommunications coordinated recovery without redundant topology

### 5.Y.1 Description

The motivation for the functionality whose requirements are specified in clause 5.Y.2 is described in clause 4.4.

This use case is a variation of the use case described in clause 5.Z, where a redundant topology offers the opportunity to adjust the switching of medium voltage lines for energy distribution. When there is a failure of one of these lines, it is possible to adjust the topology to re-establish energy supply to all distribution substations. This possibility exists only if there is a redundant topology.

This clause, 5.Y, describes the scenario in which there is no redundant topology, either because a substation is remotely located or because the redundant topology is sufficiently damaged that a sufficient network cannot be re-established. This use case addresses these situations.

In this use case, it is necessary to restore the energy supply between distribution substations where interrupted in order to restore supply; all substations are supplied **in serial** and there is no redundancy in the topology. Manual intervention to restart service will require substantially more time than automated response, and this is a slow process, e.g. requiring an hour or more.

At the point when the distribution is again possible, it is necessary to resume service at distribution substations ,as described in clause 5.Z, where energy supply is 'switched on and off.' The difference between the use case described in this clause and the use case in clause 5.Z is that significant time will elapse between the service outage and the energy restoration process. It is quite likely that the UPS capacity of sites will be exhausted by the time energy service can be restoered. If mobile network sites (including base stations) have no remaining reserve energy capacity, no smart energy automated operations to control distribution substations will be possible. This will necessitate further manual intervention to restart the energy service in a coordinated manner, further delaying both the resumption of energy service distribution and mobile telecommunication service (at the sites without any UPS capacity remaining.)

For this reason, this use case defines a capability to achieve rapid coordinated recovery. In this approach the DSO informs the site operators about its automated energy recovery requirements to MNO (or site operator) so that the later could reserve sufficient UPS capacity in certain sites, so that it will be possible to resume telecom operationssubsequent to the resumption of energy distribution service. If energy distribution service does not resume, after the UPS capacity becomes exhausted, telecom services will become impossible.The use case supported is one that has two actors.

- The management service consumer, the authorized third party, is operated by the DSO.

- The management service producer, which selectively exposes specific functionality of the 3GPP managmeent system. This producer exposes interfaces to interact with the site operator's network operations centre.

In this use case, the management service consumer requests, subscribes to and provides information. Responses and notifications are provided as described below.

Preconditions:

The purpose of the following description is to explain the scenario in which the energy utility operates a network by means of diverse accesses. It is important to mention that other access systems are used to access the energy utility site networks as well, but only access via the mobile telecommunication system is in of scope of this use case.

An energy utility maintains many energy distribution substations. Each is an energy utility infrastructure site that is responsible for distribution of energy to customer sites. This energy utility infrastructure site's operation requires smart energy services. The smart energy services are used to manage and control DSO equipment. This equipment is present on a local area network in the energy utility infrastructure site, which is accessed (e.g. as a VLAN) over any access. In this use case, the access that is used is 3GPP access. A UE is used effectively to carry DSO energy utility infrastructure site communication opaquely (that is, as encrypted traffic) to the Utility Service Provider Network.

The DSO can obtain information from each UE that is used to provide access to the DSO networks. The DSO is, by means of this information obtained from UEs in the DSO network, aware of the Base station ID of the serving base station for each UE.

On a regular basis, e.g. daily, the DSO-MS reads information by the exposed interface of the Site Operator’s (MNO’s) 3GPP management system. The DSO-MS is aware which base stations each of the DSO's UE camp on. The DSO-MS is also aware of which mobile network sites (e.g. base stations) rely on which Distribution Substation.

Service Flow:



Figure 5.Y.1-1: Timeline for Restoration of a Distribution Substation

Editor's Note: Replace this figure with an editable version.

1. At some time (T0) there is an outage incident either a planned or unplanned incident.

2. The DSO-MS uses the standardized mechanism to request information from the MNO-MS, to identify the UPS capacity, including remaining time of operation, of the base stations in the vicinity of the outage, where the distribution substations will need to be switched on and off.

This request may be done repeatedly, over time, so that the DSO-MS can track the status of the MNO-MS. The MNO-MS may inform the DSO-MS of the current UPS status for a specific Energy Supply ID.

3. At some subsequent time (T1), the energy utility begins restoration of energy transmission feeder lines or other affected infrastructure.

4. The period of time that will elapse before the restoration of energy transmission service for some set of distribution substations will be longer than the UPS capacity of the mobile infrastructure sites. That is, T2 occurs after the UPS capacity is exhausted in the sites affected by the energy outage. This use case assumes that the MNO knows or can estimate the remaining time of operation after T0 given the UPS capacity of different mobile infrastructure sites, as received in step 2, shown as a, b, c, d in Figure 5.Y.1-1. This use case assumes that the DSO knows or can estimate time at which energy transmission service can resume, shown as T2 in figure 5.Y.1-1. This may not be the exact time at which energy transmission service can resume, which is shown as T3. T2 is an estimate when the energy transmission feeder will have recovered, while T3 represents the time at which energy transmission feeder service resumes and restoration of distribution services is possible thereafter.

5. The energy feeder for one or more energy distribution substations is now complete. At this point, it will be possible to start restoring energy distribution service. However, operations are required at the distribution substation. This can be performed by smart energy services remotely if there is network coverage. The starting time, when the MNO provides service with remaining UPS capacity, is shown in Figure 5.Y.1-1 as T3. The point in time when the smart energy services restore energy distribution services to all customers, including the MNO, using MNO rapid intervention, is shown as T4.

There are two alternatives for how the restoration can occur. Manually, as described in 6a, or with remote intervention, as described in 6b.

6a. Without prior arrangement, there will be no UPS capacity remaining in the infrastructure that serves the distribution substations that have restored power. They will not be able to perform automated recovery, as explained in use case C.4. In this case, manual intervention is required to restore energy distribution. This will be complete after a substantial period of time (T5).

6b. Alternatively, prior arrangement can be made so UPS capacity will remain in the infrastructure at the time it is needed to restore energy distribution service. This prior arrangement is described in the steps below, and consists of set of information and operations shared between the DSO-MS and MNO-MS.

 This is to enable the situation that, at time (T3), the MNO is able to use remaining UPS capacity to offer telecommunication service at the time at which the DSO will perform remote operations by means of data communications to restore distribution service in the sites affected by the outage, and operates them until the outage concludes.

6.b.1. In this use case, the DSO-MS communicates to the MNO-MS:

- the affected sites (identified by the associated Energy Supply IDs) by the outage

- the time X after which recovery is possible

- the time Y (that is a certain interval of time after X) that the recovery is expected to complete (a small number of minutes)

 The site operator, knowing this, has the opportunity to manage the use of the UPS in the affected sites so that they do not exhaust at time (a, b, c, d, etc.). Rather, capacity sufficient for operation of the base station between time X and Y is reserved.

6.b.2. The DSO, after time (T3), employs smart energy services such as distribution automation or specific SCADA operations to restore service to customers rapidly, including the site operator.

6.b.3. The incident concludes (T4). Energy distribution service has been restored to the MNO site(s) as well as other energy service customers.

6.b.4 The DSO-MS notifies the MNO-MS that the restore operation is complete.

Service flow result

T4 occurs before manual uncoordinated recovery of service would be successful (T5 in Figure 5.Y.1-1.) Thus, alternative 6.b is superior to 6.a for both the site operator and the DSO.

Service is restored to distribution substation 3 and 4 at T4, within minutes of the restoration of the medium voltage transmission line between distribution substation 2 and 3 i.e. T3. This is substantially faster than service could be restored if a technician had to visit distribution substation 2 and 3 - represented on Figure 5.Y.1-1 as T5. As a result, service is restored to the MNO sites affected more rapidly than in an uncoordinated incident.

### 5.Y.2 Requirements

The following requirements, if supported, enable the site operator to voluntarily discontinue service, retain UPS capacity, and wait until an opportune time to restore service. This is subject to operator policy, contractual obligations and regulatory restrictions.

For all the requirements below, supported interaction is described between the DSO and the MNO (or site operator). The reason for this term 'site operator' is that in network sharing scenarios, the base station and/or cell site may be operated by a third party. In active network sharing scenarios the DSO can communicate with an site operator that operates the site, but can be distinct from the serving site operator. The interaction described is really between the DSO and the management services of the entity that operates the site essential for telecommunication service, identified by the energy supply ID.

|  |  |  |
| --- | --- | --- |
| Requirement label | Description | Related use cases |
| REQ-5.Y-1 | The 3GPP management system should expose management services, subject to operator policy, to enable the DSO to provide the MNO (or site operator) with information concerning the expected restoration time of its distribution services for site operator for effected sites. | 5.Z [NOTE 1] |
| REQ-5.Y-2 | The 3GPP management system should support, subject to operator policy, the capability to enable the DSO to provide the MNO (or site operator) with information concerning the time when DSO restores its Energy "transmission" service. At this time the DSO needs the MNO's (or site operator's) communication services to be able to use its automated energy services for rapid remote recovery of energy distribution services. | 5.Z |
| REQ-5.Y-3 | The 3GPP management system should support, subject to operator policy, the capability to enable the DSO to provide the MNO (or site operator) with information concerning the time duration for which DSO expects to require MNO's (or site operator's) communication services to achieve coordinated recovery for being able to use smart energy services to restore its energy distribution services. The time that the DSO provides to the MNO (or site operator) can be adjusted as new information becomes available. The time estimate specifically applies to sites (e.g. base stations) that are needed for the remote recovery operations. | 5.Z |
| REQ-5.Y-4 | The 3GPP management system should support, subject to operator policy, the capability to enable the DSO to provide the MNO (or site operator) with information concerning the locations where for example DSO substations need to restore distribution services on priority. Location information expressing where restoration will occur could be expressed in terms such as latitude-longitude pairs or Energy Supply Id. | 5.Z |
| REQ-5.Y-5 | The 3GPP management system should support, subject to operator policy, the capability to enable the site operator to provide the DSO with information concerning the time at which MNO (or site operator) should actually be able to provide communication services to achieve coordinated recovery to DSO for a particular region. | 5.Z |
| REQ-5.Y-6 | The 3GPP management system should support, subject to operator policy and other conditions, the capability to enable the MNO (or site operator) to provide the DSO with information concerning the time duration for which site operator would actually be able to provide communication services to achieve coordinated recovery of DSO's energy distribution services for a particular region. | 5.Z |
| REQ-5.Y-7 | Authentication of the consumer (third party) by the producer (3GPP management system) shall be possible. | 5.Z |
| REQ-5.Y-8 | Authentication of the producer (3GPP management system) by the consumer (3rd party) shall be possible. | 5.Z |
| REQ-5.Y-9 | Authorization of the consumer (third party) by the producer (3GPP management system) shall be possible. | 5.Z |
| REQ-5.Y-10 | Communication between the consumer (third party) and the producer (3GPP management system) shall be confidentially protected. | 5.Z |
| REQ-5.Y-11 | Communication between the consumer (third party) and the producer (3GPP management system) shall be integrity protected. | 5.Z |
| REQ-5.Y-12 | The 3GPP management system should support, subject to operator policy, the capability to enable the site operator to provide the DSO with information about locations where MNO (or site operator) will actually be able to provide dedicated communications services to achieve coordinated recovery of DSO's energy distribution services. | 5.Z |
| [NOTE 1] The relation between the use case in clause 5.Y and clause 5.Z is that both support recovery procedures between DSO and MNO, and have similar aspects, especially regarding security requirements. Clause 5.Y specifies coordination procedures in a scenario in which the energy supply does not have a redundant topology and therefore could entail significant delays before service recovery is possible. Clause 5.Z specifies coordination procedures in a scenario in which the energy supply has a redundant topology and can be restored relatively rapidly.  |

|  |
| --- |
| **End of Changes** |