**1 Description of the Use Case**

**1.1 Name of Use Case: Microgrid Unscheduled Islanding**

|  |  |  |
| --- | --- | --- |
| ***Use Case Identification*** | | |
| ***ID*** | ***Domain(s)/ Zone(s)*** | ***Name of Use Case*** |
|  |  | Microgrid Unscheduled Islanding |

**1.2 Version Management**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Version Management*** | | | | |
| ***Version No.*** | ***Date*** | ***Name of Author(s)*** | ***Changes*** | ***Approval Status*** |
| 20161123a | 20161123 |  | 20161107 UML |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**1.3 Scope and Objectives of Use Case**

|  |  |
| --- | --- |
| ***Scope and Objectives of Use Case*** | |
| ***Scope*** | Unscheduled transition of microgrid from grid-connected to islanded |
| ***Objective(s)*** | Seamlessly island a low-inertia microgrid upon loss of grid power |
| ***Related business case(s)*** | Circuit Segment Optimization  Microgrid Reconnection |

**1.4 Narrative of Use Case**

|  |
| --- |
| ***Narrative of Use Case*** |
| ***Short description*** |
| The business objective of this Microgrid Unscheduled Islanding use case is to seamlessly transition a low-inertia microgrid from grid-connected to islanded mode. The microgrid PCC Coordination Service creates device schedules considering the status and capabilities of circuit segment actors over appropriate timeframes. These schedules maintain proper voltage, frequency, and power factor for safe, reliable operation, including switching the Primary Energy Storage System to voltage source inverter (VSI) isosynchronous (ISO) mode upon loss of grid power at the Point of Common Coupling (PCC). |
| ***Complete description*** |
| The business objective of this Microgrid Unscheduled Islanding use case is to seamlessly transition a low-inertia microgrid from grid-connected to islanded mode. Figure 1 shows the microgrid connected to a feeder and substation. The microgrid Point of Common Coupling (PCC), which is a motor operated switch, isolates the microgrid from the feeder and delineates two separate but coordinated, self-optimized layers, each with its own Coordination Service. The microgrid includes PV, multiple Energy Storage Systems, as well as controllable and uncontrollable loads. Within this OpenFMB reference implementation, the microgrid has the ability to independently seamlessly island and reconnect without interruption.    Figure 1: Microgrid Unscheduled Islanding Use Case Single Line Diagram  Considering the status and capabilities of circuit segment actors over appropriate timeframes, schedules created by the microgrid PCC Coordination Service maintain proper voltage, frequency, and power factor for safe, reliable operation. Depending upon local conditions and objectives, multiple algorithms may satisfy local needs. This use case is agnostic to such differing algorithms and only addresses interactions between the use case actors. The microgrid PCC Coordination Service may also consider objectives such as:   * Import or export schedules * Economic dispatch * Solar smoothing to reduce circuit segment volatility * Volt-VAr for power factor optimization * Peak demand management by shaving / shifting   For a microgrid, such as shown in Figure 1, the general event-driven flow of information for seamless low-inertia islanding is:   1. PCC Motor Operated Switch detects grid power has been lost considering any applicable ride-through, opens, and publishes anomaly event 2. Co-located PCC Coordination Service module subscribes to anomaly event from PCC Motor Operated Switch 3. Co-located PCC Coordination Service develops new schedules for unscheduled islanding 4. Co-located PCC Coordination Service publishes schedules 5. Primary ESS subscribes to and executes the schedule to change to VSI ISO mode 6. Other microgrid devices subscribe to and execute updated schedules from PCC Coordination Service |

**1.5 General Remarks**

|  |
| --- |
| ***General Remarks*** |
| Not Applicable |

**2 Diagrams of Use Case**

|  |
| --- |
| ***Diagram(s) of Use Case*** |

|  |
| --- |
| Figure 2: Microgrid Unscheduled Islanding Use Case |

**3 Technical Details**

**3.1 Actors**

|  |  |  |  |
| --- | --- | --- | --- |
| ***Actors*** | | | |
| ***Grouping*** *(e.g. domains, zones)* | | ***Group Description*** | |
|  | |  | |
| ***Actor Name***  *see Actor List* | ***Actor Type***  *see Actor List* | ***Actor Description***  *see Actor List* | ***Further info*** |
| Devices | | | |
| Controllable Load | Device | Electrical components whose power consumption can be adjusted by a specified entity. |  |
| Energy Storage System | Device | Device that stores energy at one time to discharge it at a later time. Commonly includes power control system inverter / rectifier converting alternating current to or from battery direct current. |  |
| Load | Device | Electrical components whose power consumption is not under the control of the entity of concern. |  |
| Motor Operated Switch | Device | A switch which can be operated by activating its motor. |  |
| PCC | Device | Point of common coupling where a portion of the electrical grid under separate administration can disconnect from or reconnect to a portion of the larger electrical grid. |  |
| Solar Inverter | Device | Inverter providing AC current from photovoltaic panels. |  |
| Services | | | |
| PCC Coordination Service | Service | A system service that coordinates actions of devices on a portion of the grid under separate administration. Coordinates with POI Coordination Service. |  |
| PCC Optimizer | Service | Publishes requested schedule for a service provider defined period of time with time intervals ranging from minutes to several hours. |  |

**3.2 Triggering Event, Preconditions, Assumptions**

|  |  |  |  |
| --- | --- | --- | --- |
| ***Use Case Conditions*** | | | |
| ***Actor/System/Information/Contract*** | ***Triggering Event*** | ***Pre-conditions*** | ***Assumption*** |
| PCC Motor Operated Switch | PCC Motor Operated Switch detects grid power has been lost | PCC Motor Operated Switch operating |  |
| PCC Coordination Service | Coordination Service publishes planned islanded mode schedules | PCC Coordination Service operating |  |
| Other devices and Optimizer | Other devices and Optimizer respond to new schedules | Other devices and Optimizer operating |  |

**3.3 References**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***References*** | | | | | | |
| ***No.*** | ***References Type*** | ***Reference*** | ***Status*** | ***Impact on Use Case*** | ***Originator / Organisation*** | ***Link*** |
| 1 | IEC | 62559-2 |  | Utilized use-case narrative template | Omnetric, Jim Waight |  |

**3.4 Further Information to the Use Case for Classification / Mapping**

|  |
| --- |
| ***Classification Information*** |
| ***Relation to Other Use Cases*** |
| This use case is precipitated by some scenarios of the DER Circuit Segment Management use case |
| ***Level of Depth*** |
| Mid level |
| ***Prioritization*** |
| High |
| ***Generic, Regional or National Relation*** |
| Will be applied in a generic test at Duke test bed. |
| ***Viewpoint*** |
| Technical |
| ***Further Keywords for Classification*** |
|  |

**4 Step by Step Analysis of Use Case**

**4.1 Steps – Scenario Name**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Scenario Conditions** | | | | | |
| **No.** | **Scenario Name** | **Primary Actor** | **Triggering Event** | **Pre-Condition** | **Post-Condition** |
| 1 | Microgrid Unscheduled Islanding | PCC Coordination Service | PCC Motor Operated Switch detects grid power has been lost | PCC Coordination Service, PCC Optimizer, and devices operating | Devices executing schedules in islanded mode  PCC Optimizer responds to schedule |

**4.2 Steps – Scenarios**

**4.2.1 Steps – Microgrid Unscheduled Islanding**



Figure 3: Microgrid Unscheduled Islanding Activity Diagram

**5 Information Exchanged**

See logical models designed based on the IEC CIM. Physical XSDs and IDLs are generated from the logical models listed below.

|  |
| --- |
| ***Name of Information and Description of Information Exchanged*** |
| **BreakerEventProfile** |
| **BreakerReadingProfile** |
| **BreakerStatusProfile** |
| **ESSControlProfile** |
| **ESSControlScheduleProfile** |
| **ESSEventProfile** |
| **ESSReadingProfile** |
| **ESSStatusProfile** |
| **GenerationControlProfile** |
| **GenerationControlScheduleProfile** |
| **GenerationEventProfile** |
| **GenerationForecastProfile** |
| **GenerationReadingProfile** |
| **GenerationStatusProfile** |
| **InterchangeScheduleProfile** |
| **PlannedInterconnectionScheduleProfile** |
| **RequestedInterconnectionScheduleProfile** |
| **LoadControlProfile** |
| **LoadControlScheduleProfile** |
| **LoadForecastProfile** |
| **LoadReadingProfile** |
| **LoadStatusProfile** |
| **MotorOperatedSwitchControlProfile** |
| **MotorOperatedSwitchControlScheduleProfile** |
| **MotorOperatedSwitchEventProfile** |
| **MotorOperatedSwitchReadingProfile** |
| **MotorOperatedSwitchStatusProfile** |
| **PlannedOptimizerScheduleProfile** |
| **RequestedOptimizerScheduleProfile** |
| **RecloserControlProfile** |
| **RecloserEventProfile** |
| **RecloserReadingProfile** |
| **RecloserStatusProfile** |
| **RegulatorControlScheduleProfile** |
| **RegulatorEventProfile** |
| **RegulatorReadingProfile** |
| **RegulatorStatusProfile** |
| **ResourceReadingProfile** |
| **ResourceStatusProfile** |
| **SecurityEventProfile** |
| **ShuntControlProfile** |
| **ShuntControlScheduleProfile** |
| **ShuntReadingProfile** |
| **ShuntStatusProfile** |
| **SolarCapabilityProfile** |
| **SolarControlProfile** |
| **SolarControlScheduleProfile** |
| **SolarEventProfile** |
| **SolarForecastProfile** |
| **SolarReadingProfile** |
| **SolarStatusProfile** |
| **WeatherDataProfile** |

**6 Requirements (optional)**

|  |  |
| --- | --- |
| **Requirements (optional)** | |
| **Categories for Requirements** | **Category Description** |
| NA |  |
| **Requirement ID** | **Requirement Description** |
| NA |  |
|  |  |

**7 Common Terms and Definitions**

|  |  |
| --- | --- |
| **Common Terms and Definitions** | |
| **Term** | **Definition** |
| NA |  |

**8 Custom Information (optional)**

|  |  |  |
| --- | --- | --- |
| ***Custom Information (optional)*** | | |
| ***Key*** | ***Value*** | ***Refers to Section*** |
| NA |  |  |