SmartConnect Use Case:

D6 - Distribution Operator Controls the Distribution System Using AMI Data

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Document History

Revision History

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Approvals

This document requires following approvals.

Name	Title
Bryan Lambird	Project Manager, Edison SmartConnect
Greg M. Smith	Manager TDBU, Grid Operations Northwest Division
Robert Yinger	Consulting Engineer, TDBU Engineering Advancement

Contents

1. Use Case Description

1.1 Use Case Title

Distribution Operator Controls Distribution System Using AMI Data

1.2 Use Case Summary

This use case describes several scenarios in which the operator of the distribution network uses SmartConnect data to make decisions about how to reconfigure the network. These are not long-term planning scenarios, but situations affecting reliability that require immediate decision-making to prevent various types of outages. This use case also covers the use of additional SmartConnect provided information in the planned outage preparation process. The primary benefits of involving the SmartConnect system in these scenarios are:

- The SmartConnect system can provide a detailed load history to the Outage Management System (OMS), Energy Management System (EMS) or Distribution Management System (DMS) to automatically calculate loading estimates to help improve the reliability of load predictions that depend considerably on the experience of the operator.
- The SmartConnect system can provide more accurate and geographically pinpointed load information than presently available through SCADA systems that at best only provide details at the distribution circuit level. With better data, operators can make load affecting decisions more quickly. This ability is also supports load switching to reduce the number of affected customers in planned outages.
- The SmartConnect system can provide distribution operators with demand response (DR) as an option for reducing load when reconfiguration of the network is no longer an option. Using voluntary DR in this way can reduce the need for rotating blackouts or brownouts on a feeder basis.
- The SmartConnect system can provide a network for communicating with distributed energy providers eliminating the need to build additional communications networks and reducing the cost of entry for distributed energy resources (DER). Communication with and control of DER gives distribution operators an additional tool for improving distribution grid reliability.

1.3 Use Case Detailed Narrative

This use case includes the following scenarios:

1. **System operator uses historical metering measurements to reconfigure feeders.** This scenario illustrates how the OMS communicates with the SmartConnect system to increase the speed and reliability of a system operator's reaction to a circuit overload

alarm. This scenario focuses on data provided by the SmartConnect system and does not include the DR capabilities covered in Scenario 2.

Each day, the SmartConnect system gathers load profile data and peak load information about individual distribution transformers and switches, by aggregating data from customer meters. When a circuit threshold alarm occurs, the OMS collects and presents an appropriate subset of this information to the operator along with present and historical loading information gathered at the circuit level by the SCADA system. The OMS uses this data to calculate and estimate a load for all the transformers and switches in the circuit that raise the alarm and on adjacent circuits as well. Note that while the OMS calculates load estimates in real-time, the metering data the estimates are based on, are historical data collected the previous day by the SmartConnect system.

With the help of these estimates and supporting data, the operator makes a decision to move some portion of the load to other circuits. This decision can be made faster and more reliably because the operator is using historical load profile data that has been:

- Collected the previous day – removing the effect of seasons and recent network changes.
- Gathered from the specific area where the problem is actually occurring – not averaged or idealized from similar circuits.
- Aggregated for each particular segment or transformer point – not the circuit as a whole.

Following the load transfer, the operator can verify the revised load using SCADA data or choose to query current SmartConnect data for the particular circuit or segment.

The SmartConnect application gathering this information for the OMS could be the Transformer Load Calculating Engine discussed in Use Case D7. As noted in that use case, the topology mapping between customer and transformers or switches must be accurately defined in order to aggregate meter data correctly and provide accurate load estimates.

2. **System operator uses SmartConnect data for localized load reduction to relieve circuit or bank overloading.** As in the first scenario, Scenario 2 begins with a circuit or transformer bank overload alarm. After attempting to shift load to adjacent circuits, the operator may be required to further reduce load using the SmartConnect system to initiate DR reductions.

   The Demand Response Analysis and Control System (DRAACS) provides the operator with an estimate of how much load may be available for reduction and how quickly customers can be expected to respond. In cases such as this, the operator receives information on the DR enrollment groups associated with individual circuits, circuit segments and transformers from the DRAACS.

   Whether the operator chooses to use the DR option to resolve the overload depends on how quickly the DR can be achieved. This scenario only discusses voluntary programs, which means the response could be delayed by human involvement. This would require the operator to make choices other than using DR, such as blackouts at the circuit level, opening strategic circuit switches, or disconnecting groups of individual premises through the use of the SmartConnect meter's remote disconnect switch.

3. **System operator uses SmartConnect technology to perform planned switching operation.** The only way this scenario differs from the first is the absence of an initial alarm. Instead, the operator performs load switching not in reaction to system conditions, but according to scheduled activities planned for a given distribution grid location (construction work orders, maintenance and inspection work, etc.). Like the first scenario, the as-is process for planned switching is supplemented with the aid of historical information from the SmartConnect system. The switching operation is improved by the availability of more accurate loading data. This scenario is not discussed in detail because it places the same requirements on the OMS and SmartConnect system as Scenario 1.

4. **Grid Control Center (GCC) directs the system operator to control DER for planned islanding and reconnection to the grid**. This scenario illustrates how the system operator can use the SmartConnect communications network to determine the appropriate action to take in an islanding situation. It assumes there is a regulatory environment permitting DER and islanding to take place. The DER infrastructure must be compatible with the SmartConnect communications protocols. Groups of customers will only be islanded if voltage and frequency can be maintained in a manner that prevents damage to customer equipment and ensures safe operations.

   As in the other scenarios, the load profile information provided by the SmartConnect system permits the operator to make better decisions such as switching operations that balance the capacity of the DER with the load of the surrounding island.

   The SmartConnect system also serves as the communications network for acquiring periodic status information from the DER and sending connect and disconnect commands for the generation itself. For smaller DERs (under 200kW), the operator can control the integrated meter disconnect switch for the DER customer. For larger resources, the operator sends a command through the meter to control synchronization equipment at the customer site.

1.4 Business Rules and Assumptions

- Circuit topology and connectivity from the substation breaker to the transformer is recognized by the SmartConnect system with a high level of accuracy. (circuit – transformer – meter connectivity models are up-to-date and correct).
- Increased granularity of circuit loading information is used for planned and unplanned switching operations.
- The system operator is able to control DR resources at the substation, circuit, and lower level.
- To manage DER using SmartConnect data and communications network, assume that:
    - The DER in question has met all required criteria for an Authorized Alternative energy Source (AAS).
    - The DER has excess generation available.
    - The DER has an automatic control system on-site, or is located behind a SmartConnect meter with a disconnect switch.
    - The DER has the capability to match generation to load.
    - The DER customer is stand-alone and does not require extra equipment.
    - The SmartConnect Meter for a DER customer can be configured from other SmartConnect Meters.
    - Technology for automatic switching with synchronization capability is available.
    - A portable synchronization check is in place at the DER site.
    - Regulations allow for “retail wheeling” for circumstances where an island supported by DER extends beyond the premises supplying the DER (school campus, community distributed generation, etc.).
    - Protective equipment is in place including reserve capacity for changes in load such as disconnect, load break, and ride-through capability.

2. Actors

Describe the primary and secondary actors involved in the use case. This might include all the people (their job), systems, databases, organizations, and devices involved in or affected by the function (e.g. operators, system administrators, customers, end users, service personnel, executives, meters, real-time databases, ISOs, power systems). Actors listed for this use case should be copied from the global actors list to ensure consistency across all use cases.

Actor Name	Actor Type (person, device, system etc.)	Actor Description
System Operator	Person	Monitors the OMS and controls distribution switches using the DCMS to avoid overload conditions, recover from outages and respond to other situations affecting reliability.
Outage Management System (OMS)	System	A distribution management system that uses an analysis engine to identify the location of outages. Using information from the Geographic Information Services, CSS, SCADA, and SmartConnect systems it correlates to end-point outages and infers root causes by identifying common failure points grouped upstream. Helps reduce outage duration and assists with restoration plans. Determination of outage locations is based on the system's knowledge of the power system topology.
Meter	Device	Advanced electric revenue meter capable of two-way communications with the utility. Can receive, record, display, and transmit data (energy data for billing and operations, power quality data, customer data, tariff data, etc.) to and from authorized systems and provides other advanced utility functions.
Grid Control Center (GCC)	System	Location that customers call when they want to report an electrical system outage. This call center forwards information from customer calls to the OMS for analysis.
Distribution Control Management System (DCMS)	System	Used by the system operator to control automated switches at SCE. Provides measurements and switch state information to the OMS to update and provide a current picture of connectivity and loading on the power network. The DCMS and OMS may be replaced in the future by an integrated Distribution Management System (DMS).
Energy Management System (EMS)	System	A customer supplied system for monitoring and managing energy use at their residence or business. It includes human interface displays for interacting with the system and allows the customer to program functions, control loads, and display energy costs, usage, and related information. It can be programmed to take action based upon price inputs or event messages from the utility, or changes to customer's load. Interfaces with HAN devices and the SmartConnect meter.

Actor Name	Actor Type (person, device, system etc.)	Actor Description
SmartConnect Network Management System (NMS)	System	The utility's back-office system responsible for two-way communications with SmartConnect Meters to retrieve data and execute commands. Balances load on the communications network resulting from scheduled meter reads. It retries meters during communications failures and monitors the health of the advanced metering infrastructure. Remotely manages and implements firmware updates, configuration changes, provisioning functions, control and diagnostics.
Transformer Load Calculating Engine	System	A software application that gathers raw customer usage data from the Meter Data Management System (MDMS) to periodically calculate odometer-like readings, load profiles, statistics, and remaining-life estimates for each transformer and circuit segment.
Transformer Load Management (TLM) Database	System	Stores two primary types of information: 1) connectivity data describing which customers are connected to which transformers, switches, segments, circuit breakers, feeders or other elements of the distribution system; and 2) historical loading data, capturing how much load is on any of these elements at a given time. Utilizes software applications to generate analyses and reports (periodically or on request) from the collected data.
Meter Data Warehouse	System	Responsible for long-term storage of meter data including energy usage, demand, generation, events, logs, and other time-related information measured by the meter or calculated from that data. Does not contain information on the configuration, management, diagnostics, and maintenance of the meters themselves. Includes certain software applications responsible for filtering, analyzing, and reporting meter data.
Demand Response Analysis and Control System (DRAACS)	System	Sends demand response event notifications to meters and load control devices through the SmartConnect system. Provides demand response options to operators, market traders, etc. based on predefined groupings of customers and statistical analysis of how those customers have responded in the past.
Distributed Energy Resource (DER)	System	A customer with generation capabilities that can be used to provide support to the distribution system, or potentially support loads other than the customer itself (referred to as an island).
Program Writer	Person	Individual who determines the switching steps necessary to perform an operation such as planned switching or islanding.

Actor Name	Actor Type (person, device, system etc.)	Actor Description
Authorized Alternative Source (AAS) Controller	System	An electrical source equal to a host parallel point on the electrical system; a place to pick up load. DER authorized to provide support to the distribution system. The automated system at the AAS that communicates with the SmartConnect system for system monitoring and control purposes.

3. Step-by-Step Analysis of Each Scenario

Describe steps that implement the scenario. The first scenario should be classified as either a Primary Scenario or an Alternate Scenario by starting the title of the scenario with either the word "Primary" or "Alternate". A scenario that successfully completes without exception or relying heavily on steps from another scenario should be classified as Primary; all other scenarios should be classified as "Alternate. If there is more than one relevant scenario (set of steps) make a copy of the following section (all of 3.1, including 3.1.1 and tables) and fill out the additional scenarios.

3.1 Primary Scenario: system operator uses historical metering measurements to reconfigure feeders

This scenario describes how the OMS communicates SmartConnect system data to the system operator during a circuit overload alarm. The SmartConnect system data gives the system operator a better understanding of the distribution system and increases the speed and reliability with which a system operator can react during a circuit overload alarm by reconfiguring feeders. This scenario focuses on the data provided by the SmartConnect system and does not include demand response capabilities (covered in Scenario 2).

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
Identify the name of the event that initiates the scenario	*Identify the actor whose point-of-view is primarily used to describe the steps*	*Identify any pre-conditions or actor states necessary for the scenario to start*	*Identify the post-conditions or significant results required to complete the scenario*
Circuit reaches a threshold of greater than 80% load and the EMS raises a circuit overload alarm.	System Operator	MDMS performs nightly read of all meters and stores hourly interval data for each customer in the Meter Data Warehouse. Transformer Load Calculation Engine aggregates interval data for all customers to calculate loading on individual transformers and switches and stores the resulting load profiles in the TLM Database. Transformer-to-customer and switch-to-customer mapping must be up-to-date in the TLM Database.	Circuit is re-configured to balance load on all affected circuits.

3.1.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

Step #	Actor	Description of the Step	Additional Notes
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.*
1	EMS	Detects a circuit overload alarm threshold and alerts the System Operator.	SCADA data is used to measure the circuit load.
2	System Operator	Acknowledges the circuit overload alarm.	
3	OMS	Acquires aggregated load profiles and peak averages for each transformer and switch on the affected circuit and surrounding circuits from the TLM Database. Gathers real-time and historical load information for the affected circuits from the SCADA system. Calculates an estimated load profile and peak load for each affected circuit, circuit segment, transformer, and switch based on this data.	See pre-conditions required for the data to be in the TLM Database. This task is likely to be performed by the DMS in the future.
4	System Operator	Evaluates the situation to determine whether action is necessary, considering: • Time of day • Whether entering or exiting a peak period • Peak averages • Real-time load • *Estimated* load profile and peak load at specific locations from the OMS model described in the previous step • Whether it is an abnormal occurrence	

Step #	Actor	Description of the Step	Additional Notes
5	System Operator	If action is necessary, examines the circuit map and makes an assessment where to move load. Determines the best and easiest place to move load where there is the most capacity, based on the estimates shown by the OMS/DMS.	
6	System Operator	Moves load, either using automated devices or manually directing switching to accomplish the load swap and re-configure the network.	
7	System Operator	Validates loads on affected circuits by viewing the real-time substation and circuit load to confirm the amperes have moved.	OMS/DMS is continuously updated with real-time data via SCADA.

3.2 Primary Scenario: Utility uses SmartConnect data for localized load reduction to relieve circuit or bank overloading

This scenario begins with a circuit or transformer bank overload alarm, as in the first scenario. In this scenario transferring load is insufficient or not an option and the system operator attempts to reduce load by using the SmartConnect system to initiate DR reductions.

Triggering Event	*Primary Actor*	*Pre-Condition*	*Post-Condition*
Identify the name of the event that initiates the scenario	*Identify the actor whose point-of-view is primarily used to describe the steps*	*Identify any pre-conditions or actor states necessary for the scenario to start*	*Identify the post-conditions or significant results required to complete the scenario*
EMS detects a circuit overload and an alarm is activated.	System Operator	Circuit or bank overload has occurred and no alternate circuit is appropriate for load transfer; load reduction is required. Customers are enrolled in a DR program. DRAACS can group and call on DR enrolled customers based on their electrical connectivity.	Circuit re-configuration has balanced circuit or bank overload with advanced AMI load control.

3.2.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

Step #	*Actor*	*Description of the Step*	*Additional Notes*
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.*

Step #	Actor	Description of the Step	Additional Notes
1	EMS	Detects a circuit overload alarm threshold and alerts the system operator.	SCADA data is used to measure the circuit load.
2	System Operator	Acknowledges the circuit overload alarm.	
3	OMS	Acquires aggregated load profiles and peak averages for each transformer and switch on the affected circuit and surrounding circuits from the TLM Database. Gathers real-time and historical load information for the affected circuits from the SCADA system. Calculates an estimated load profile and peak load for each affected circuit, circuit segment, transformer, and switch based on this data.	See pre-conditions required for the data to be in the TLM Database. This task is likely to be performed by the DMS in the future.
4	System Operator	Evaluates the situation to determine whether action is necessary, considering: • Time of day • Whether entering or exiting a peak period • Peak averages • Real-time load • *Estimated* load profile and peak load at specific locations from the OMS model described in the previous step • Whether it is an abnormal occurrence	
5	System Operator	Action is deemed necessary. The system operator examines the circuit map and makes an assessment where to move load.	
6	System Operator	Determines that load transfer is not the solution (i.e. load transfer options are not available or have been exhausted). Queries SmartConnect system (likely the DRAACS) for possible DR options.	See Scenario 1 for load transfer.

Step #	Actor	Description of the Step	Additional Notes
7	DRAACS	Provides a list of DR options for the particular circuit and/or segment that the operator is concerned about, showing an estimate of the load reduction and the likely amount of time required to achieve the response.	
8	System Operator	Performs criticality analysis based on the time available to address the overload and chooses to either: a. If the event is time-critical the load is dropped using automated devices on the circuit; or b. If the event is not time-critical, deploy DR resources to achieve the required load reduction.	
9	DRAACS	Sends DR event messages to enrolled customers on the affected circuit.	May need to use long-duration DR events to ensure the load stays reduced after being moved to the new circuit.
10	DR Customers	Receives DR event messages and automatically or manually reduces load as directed.	
11	System Operator	Validates loads on the circuit by viewing the real-time substation and circuit load to confirm the load reduction.	May query either the SCADA or SmartConnect systems.

3.3 Primary Scenario: System Operator uses SmartConnect technology to perform planned switching operation

This scenario differs from the first scenario only in that there is no initial alarm. Instead, the System Operator performs load switching as a planned, routine operating procedure, again with the aid of historical information from the SmartConnect system. This scenario is not discussed in detail because it places the same requirements on the OMS and SmartConnect systems as scenario 1.

Triggering Event	*Primary Actor*	*Pre-Condition*	*Post-Condition*
Identify the name of the event that initiates the scenario	*Identify the actor whose point-of-view is primarily used to describe the steps*	*Identify any pre-conditions or actor states necessary for the scenario to start*	*Identify the post-conditions or significant results required to complete the scenario*

3.4 Primary Scenario: Grid Control Center directs the system operator to control Distributed Energy Resources (DER) for planned islanding and reconnection to grid

This scenario illustrates how the system operator can use SmartConnect data to determine the appropriate action to take in an islanding situation. It assumes there is a regulatory environment permitting DER and islanding to take place along with the other assumptions discussed in section 1.4.

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
Identify the name of the event that initiates the scenario	*Identify the actor whose point-of-view is primarily used to describe the steps*	*Identify any pre-conditions or actor states necessary for the scenario to start*	*Identify the post-conditions or significant results required to complete the scenario*
GCC directs the system operator to control DER during a widespread outage for the purpose of creating stable islands.	GCC	The maintenance of grid equipment leading to an outage affects one or more substations. Circuit load is greater than generation. MDMS performs nightly read of all meters and stores hourly interval data for each customer in the Meter Data Warehouse. Transformer Load Calculation Engine aggregates interval data for all customers located on the same transformer or switch and stores the resulting load profiles in the TLM Database. Transformer-to-customer and switch-to-customer mapping must be up-to-date in the TLM Database. Controllers for AAS (DER) send periodic updates of status to the OMS via the SmartConnect system.	GCC directs the system operator to reconnect the island to the grid.

3.4.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

Step #	Actor	Description of the Step	Additional Notes
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.*
1	GCC	Directs the system operator to control DER to form islands.	
2	System Operator	Identifies section of the circuit to be islanded.	
3	OMS	Displays availability and capacity of AAS associated with the section to be islanded to the system operator.	OMS receives periodic updates of AAS availability and capacity.
4	OMS	Acquires aggregated load profiles and peak averages for each transformer and switch on the affected circuit and surrounding circuits from the TLM Database. Gathers real-time and historical load information for the affected circuits from the SCADA system. Calculates an estimated load profile and peak load for each affected circuit, circuit segment, transformer, and switch based on this data.	

Step #	Actor	Description of the Step	Additional Notes
5	System Operator	Compares available capacity of AAS with expected load in the footprint of the planned island from the OMS • Balance, $P_{gen} = P_{load}$, permissible • If $P_{gen} > P_{load}$, permissible • If $P_{load} > P_{gen}$, then reduce the load by: o Shrinking the island size o Shedding load in the island using existing use cases	
5	System Operator	Identifies steps necessary to isolate circuit segment for islanding.	
6	System Operator	Executes load switching to disconnect island.	
7	OMS	Displays location of the island and AAS on geographic displays.	
8	AAS Controller	Sends periodic updates of status to the OMS through the SmartConnect system during the islanding event.	
9	OMS	Re-calculates estimated load profile and peak load data for the section of the distribution network under islanding, based on updated information received from AAS controllers and EMS/SCADA.	
10	System Operator	Uses OMS information to monitor generation provided in comparison to load requirements during the islanding event and makes adjustments as necessary.	
11	GCC	Directs the system operator to reconnect after the event.	

Step #	Actor	Description of the Step	Additional Notes
12	System Operator	After emergency has passed, reconnects island in one of two ways: 1. Dropping and picking up load by: • Disconnecting AAS from the island using: o Meter disconnect for 200 amps or less o Signaling AAS Controller to disconnect • Closing disconnected circuit segment 2. Synchronize and re-insert Island by: • Enabling automatic synchronization functionality • Activating synchronization	
13	OMS/DMS	Sends necessary reconnection commands to AAS Controller through the SmartConnect network.	Meters receive commands to disconnect as needed.

4. Requirements

Detail the Functional, Non-Functional and Business Requirements generated from the workshop in the tables below. If applicable list the associated use case scenario and step.

4.1 Functional Requirements

Functional Requirements	Associated Scenario # (if applicable)	Associated Step # (if applicable)
The OMS/DMS shall make the following data available to the system operator: • Real-time amperes from SCADA for each circuit • Historical ampere data from the SmartConnect system, aggregated for each circuit/circuit segment, transformer and switch collected on the previous day's meter reading cycle • Historical amperes from SCADA for each circuit (load profile and peak load) • Year-to-date peak, last five-day peak and yesterday's peak data from the SmartConnect system for each circuit/circuit segment, transformer and switch.	1 2	3 3
The Transformer Load Calculating Engine shall aggregate historical amperes and year-to-date peak, five-day peak, and last day peak amperes for each circuit/circuit segment, transformer and switch in the distribution network and store them in the TLM Database.	1 2	Pre-condition Pre-condition
The Transformer Load Calculating Engine shall time and synchronize all aggregation of interval data so all customers are measured over the same interval and the data from each customer includes the same time stamps.	1 2	Pre-condition Pre-condition
The Transformer Load Calculating Engine shall aggregate load data not only from SmartConnect customers, but also from large commercial and industrial (C&I) customers not yet equipped with SmartConnect meters.	1 2	Pre-condition Pre-condition
The OMS/DMS system shall calculate and display a load estimate for each circuit, transformer and switch based on the data it gathers from the SCADA system and TLM Database. The OMS shall re-calculate the estimate each time it is requested based on new real-time SCADA data and the same load history, as well as anytime the load history information is updated.	1 2	3 3

Functional Requirements	Associated Scenario # (if applicable)	Associated Step # (if applicable)
The OMS/DMS shall adjust its load estimates based on seasonal changes and economic fluctuations.	1 2	3 3
The OMS/DMS shall present the system operator with an estimated system impact for a planned load switching operation.	1	5
The OMS/DMS shall permit the System Operator to query the SmartConnect system for an on-demand read of the aggregated load on any circuit segment. SmartConnect components involved may include the Transformer Load Calculation Engine, the SmartConnect NMS and Meter.	1 2	7 10
DRAACS shall provide to the OMS/DMS the predicted DR resources available from any given circuit, switch or transformer in the distribution network including the expected load reduction and the expected time to reach that amount of reduction.	2	7
DRAACS shall provide to the OMS/DMS the predicted DR resources available for a circuit, switch or transformer segregated by DR program type and indicate expected responses for DR programs that have variable event signals (price levels).	2	7
The OMS/DMS and DRAACS shall allow a system operator to initiate a DR event for the enrolled customers on any given circuit, switch or transformer of the distribution network from the OMS console.	2	8
The OMS/DMS and DRAACS shall allow a system operator to select load reduction by program type, number of participants and variable event signals.	2	8
The SmartConnect Meter and SmartConnect NMS shall permit the AAS Controller to periodically report the status of the AAS (DER resources) to the OMS over the SmartConnect network. The status report shall include: • The health of the AAS • The percent capacity and/or amperes available from the AAS • The estimated duration of time the output level will be available	4	3
The OMS/DMS shall display the availability and capacity of the AAS associated with a circuit section that is islanded or under consideration for islanding.	4	4
The SmartConnect meter and SmartConnect NMS shall permit the AAS Controller to spontaneously report its status to the OMS as an event whenever its generation reaches a pre-configured threshold based on its capacity.	4 4	3 8

Functional Requirements	Associated Scenario # (if applicable)	Associated Step # (if applicable)
The OMS/DMS shall be able to send commands to the AAS Controller though the SmartConnect NMS and SmartConnect Meter to control islanding operations (starting and stopping generation, synchronization, connection/disconnection).	4 4	6 12
The OMS/DMS shall provide the system operator with an interface to calculate and plan islanding options based on AAS availability, historical and measured circuit loads.	4	5
The AAS Controller shall send periodic status updates to the OMS/DMS during an island operation.		

4.2 Non-Functional Requirements

Non-Functional Requirements	Associated Scenario # (if applicable)	Associated Step # (if applicable)
The historical aggregate load data provided in the TLM Database shall be no older than 24 hours.	1 2	pre-condition pre-condition
The load estimates calculated by the OMS based on SCADA real-time data and SmartConnect historical data shall have a 10 % error margin or less.	1 2	3 3
The SmartConnect HAN, Meter, Network and NMS shall permit AAS Controllers to report status to the OMS every 4 seconds.	4	3
The Transformer Load Calculating Engine, SmartConnect NMS, and Meter shall permit the OMS to read the aggregate load of a circuit segment between 1-15 minutes.	1 2	7 10
The OMS/DMS load shifting prediction process shall be timely enough to support real-time operations.	1 2 4	4 4 5

4.3 Business Requirements

Business Requirement	Associated Scenario # (if applicable)	Associated Step # (if applicable)
The utility shall put a contract in place with each AAS allowing the utility to monitor and control the AAS. The AAS must commit to following load up to pre-agreed limits.	4	4

5. Use Case Models (optional)

This section is used by the architecture team to detail information exchange, actor interactions and sequence diagrams.

5.1 Information Exchange

This section was updated at by the 2008 workshop.

For each scenario detail the information exchanged in each step.

Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
#	Name of the step for this scenario.	What actors are primarily responsible for Producing the information?	What actors are primarily responsible for Receiving the information?	Describe the information being exchanged
1	1	EMS	System Operator	Circuit overload alarm
1	2	System Operator	EMS	Alarm acknowledgement
1	3	TLM Database	OMS/DMS	Per circuit and transformer aggregated load profiles
1	3	TLM Database	OMS/DMS	Per circuit and transformer load peak averages
1	3	SCADA	OMS/DMS	Per circuit and transformer real-time load data
1	3	SCADA	OMS/DMS	Per circuit and transformer historical load data
1	6	System Operator	OMS/DMS	Load shifting commands
1	6	OMS/DMS	Distribution Switches	Switching commands
1	7	SCADA	OMS/DMS	Per circuit and transformer real-time load data
2	1	EMS	System Operator	Circuit overload alarm

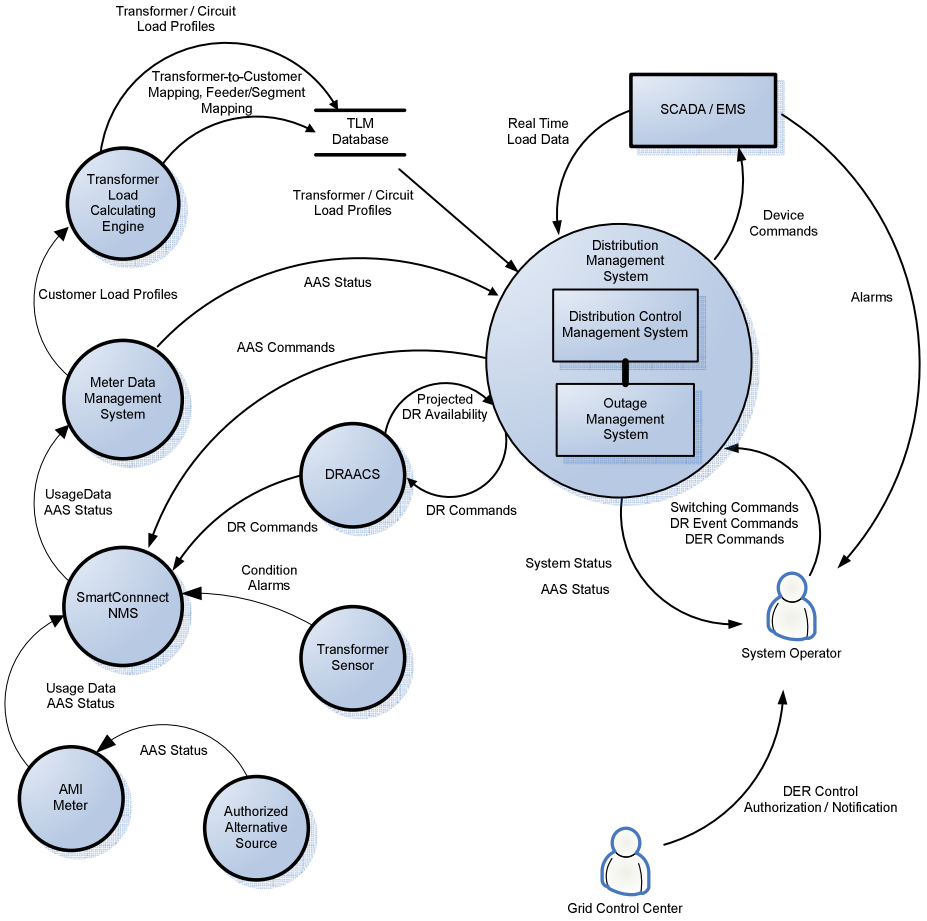
Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
2	2	System Operator	EMS	Alarm acknowledgement
2	3	TLM Database	OMS/DMS	Per circuit and transformer aggregated load profiles
2	3	TLM Database	OMS/DMS	Per circuit and transformer load peak averages
2	3	SCADA	OMS/DMS	Per circuit and transformer real-time load data
2	3	SCADA	OMS/DMS	Per circuit and transformer historical load data
2	6	OMS/DMS	DRAACS	Query for DR data based on a specified circuit or transformer.
2	7	DRAACS	OMS/DMS	DR analysis for a specific circuit or transformer. Expected DR including • Involved DR programs • Available DR levels
2	9	DRAACS	SmartConnect NMS	DR event messages
2	9	SmartConnect NMS	SmartConnect Meters	DR event messages
2	9	SmartConnect Meters	HAN devices	DR event messages
2	11	SCADA	OMS/DMS	Per circuit and transformer real-time load data
4	Pre-condition	AAS	OMS/DMS	AAS status data
4	1	GCC	System Operator (OMS/DMS?)	Notification to control DER and form islands
4	3	OMS/DMS	System Operator	AAS availability and capacity for selected circuit(s)

Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
4	4	TLM Database	OMS/DMS	Per circuit and transformer aggregated load profiles
4	4	TLM Database	OMS/DMS	Per circuit and transformer load peak averages
4	4	SCADA	OMS/DMS	Per circuit and transformer real-time load data
4	6	System Operator	OMS/DMS	Island creation switching commands and DER commands
4	6	OMS/DMS	Distribution Switches	Island creation switching commands
4	6	OMS/DMS	AAS Controllers	DER commands to support island creation
4	8	AAS Controller	OMS/DMS	AAS status data
4	9	SCADA	OMS/DMS	Per circuit and transformer real time load data
4	10	System Operator	OMS/DMS	Switching commands and DER commands to maintain island
4	10	OMS/DMS	Distribution Switches	Switching commands to maintain island
4	10	OMS/DMS	AAS Controllers	DER commands to maintain island
4	11	GCC	System Operator (OMS/DMS?)	Notification to reconnect islands to grid
4	13	OMS/DMS	SmartConnect Meters	Meter disconnect commands for AAS without remote control
4	13	OMS/DMS	AAS Controllers	DER disconnect command
4	13	OMS/DMS	Distribution Switches	Circuit reconnection commands

Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
4	13	OMS/DMS	AAS Controllers	DER synchronization command

5.2 Diagrams

The architecture team shall use this section to develop an interaction diagram that graphically describes the step-by-step actor-system interactions for all scenarios. The diagrams shall use standard UML notation. Additionally, sequence diagrams may be developed to help describe complex event flows.



6. Use Case Issues

Capture any issues with the use case. Specifically, those unresolved to help the use case reader understand the constraints or unresolved factors that have an impact of the use case scenarios and their realization.

Issue
Describe the issue as well as any potential impacts to the use case.
Threshold of the alarm of 80 % load was discussed, but other possible values should be discussed.
Tariff Process and Serve (TS&P) to discuss coverage for emergency situations.
Enhancement to energy theft detection may be possible using the load forecasts based on SmartConnect data.
Further discussion required for the AMI system to have the capability of different modes, (safe, storm, etc.). Discussions at CalTech were related to earthquake scenarios, a means to indicate to the meters to stop communicating for a period of time while; either by storing the information or disconnecting.
Using the meter disconnect switch to achieve localized load reduction should be investigated.
Need to reconcile D6, D7 and D8 (others?) actors and functions: • Transformer Load Calculating Engine (D6) vs. Segment Load Calculating Process (D8) • Transformer Load Management Database (D6, D7, D8) vs. Meter Data Warehouse (D6) – where is the aggregated data to be stored?
Connectivity model for aggregation seems to be relatively static. Transformer/circuit/segment loading calculations should consider operational switching. D7's daily bottom up approach from meters doesn't appear to capture the connectivity changes that would occur in Scenario 1 of this use case.
Need to determine the functionality of the Segment Load Calculation Process (D8), Planning Data Warehouse (D8), Transformer Load Calculation Engine (D6, D7) and TLM)Database (D6, D7, D8) and unify interfaces, calculation processes and data storage as possible.

7. Glossary

Insert the terms and definitions relevant to this use case. Please ensure that any glossary item added to this list should be included in the global glossary to ensure consistency between use cases.

Glossary	
Term	**Definition**
Grid Control Center (GCC)	Location that customers call when they want to report an electrical system outage. This call center forwards information from customer calls to the OMS for analysis.
Distribution Control Management System (DCMS)	Used by the system operator to control automated switches at SCE. Provides measurements and switch state information to the OMS to update and provide a current picture of connectivity and loading on the power network. The DCMS and OMS may be replaced in the future by an integrated Distribution Management System (DMS).
Energy Management System (EMS)	A customer supplied system for monitoring and managing energy use at their residence or business. It includes human interface displays for interacting with the system and allows the customer to program functions, control loads, and display energy costs, usage, and related information. It can be programmed to take action based upon price inputs or event messages from the utility, or changes to customer's load. Interfaces with HAN devices and the SmartConnect meter.
Tariff Process and Service (TP&S)	Utility group that develops the processes and procedures to ensure business requirements around load control are implemented correctly.
Distributed Energy Resource DER	A customer with generation capabilities that can be used to provide support to the distribution system, or potentially support loads other than the customer itself. Referred to as an island.
Supervisory Control and Data Acquisition (SCADA)	The computer, communications system and remote devices that monitor and control the distribution network. Information from the SCADA network is usually updated every 2 to 4 seconds.

8. References

Reference any prior work (intellectual property of companies or individuals) used in the preparation of this use case.

9. Bibliography (optional)

Provide a list of related reading, standards, etc. that the use case reader may find helpful.