# SmartConnect Use Case:

# D9 - Utility Manages Utility-Owned Distributed Generation

## December 23, 2008

# Document History

## Revision History

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## Approvals

This document requires following approvals.

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# 1. Use Case Description

## 1.1 Use Case Title

Utility Manages Utility-Owned Distributed Generation

## 1.2 Use Case Summary

The SmartConnect system with its extensive footprint and advanced metrology capabilities can provide mechanisms that enable utility owned distributed generation to be deployed with greater safety and enhanced overall system reliability. This use case describes how the utility applies SmartConnect for distributed generation. It covers the following scenarios:

- Utility uses SmartConnect or Energy Control Network (ECN) to meter utility owned distributed generation (DG).
- Utility uses SmartConnect to exchange information to utility-owned distributed generation (DG) for command and control.

## 1.3 Use Case Detailed Narrative

For many years distributed generation (DG) has had a relatively small impact on utility operations. Traditionally electricity is generated as a by-product of the manufacturing process to serve as a primary energy source or emergency back-up for business applications that place a premium on reliability and power quality. Stricter renewable portfolio standards (RPS) and end-users needing abundant, cheap and reliable energy have accelerated the growing demand for renewable energy resources resulting in a higher market penetration of intermittent renewable power generation. Due to new and evolving policies regarding climate change issues, government agencies are instituting rewards programs as an incentive for utilities to use and leverage greater amounts of renewable generation. To meet these more ambitious goals, utilities must find ways to effectively manage and optimize intermittent wind and photovoltaic (PV) power generation. This requires gathering information, conducting tests, and using tools specifically developed to determine how distributed generation employing renewable fuels and energy storage can support utility green initiatives. The Smart Connect Advanced Metering Infrastructure (AMI) program has the potential for providing more efficient wind penetration and market integration, and leveraging increased penetration of end-user PV power systems and renewable fuels to help meet utility RPS in the most cost-effective manner.

Solar, geothermal and wind power now offer consumers the opportunity to reduce their utility bill and meet some or all of their power requirements using environmentally friendly alternatives. Spurred by California’s increasingly stringent requirements for meeting renewable energy portfolios, and abetted by new technologies, a number of manufacturers are developing large-scale generators and implementing new technologies to meet the electricity requirements for large amounts of customer loads, either in part or for entire distribution circuits.

Utilities can benefit greatly from distributed generation. DG can reduce peak loading on the grid and support line voltage at the end of long distribution circuits. A utility can install generation to supplement or defer grid upgrades where space, economics and other constraints prevent expansion of substations or building new distribution lines. For example, the utility could install DG to improve service near isolated loads supplied by a long transmission line.

Distribution automation (DA) provides the operating and control functionality necessary to coordinate distribution devices with PV systems. These systems include switching and reactive power control capabilities for managing high levels of generation on distribution feeders. DA systems could also include communications platforms that enable high-speed communication between the utility and PV systems, an important consideration due to the fact that it is essential that distributed PV as DA be located outside the substation fence on primary distribution.

The Smart Connect system with its extensive footprint and advanced metrology capabilities can provide mechanisms that enable utility owned DG to be deployed with greater safety and overall system reliability. SmartConnect can employ enhanced metering and monitoring functions for use by many stakeholders. This use case explores the use of utility-owned DG for advanced distribution applications such as supporting voltage and reactive power requirements on the distribution system.

In the first scenario of this use case the utility uses SmartConnect or the Energy Control Network (ECN) to meter utility-owned DG to deliver status and production information to a group of users. The potential users include the Independent System Operators (ISO) with Automatic Gain Control (AGC) and SCE's Grid Control Center (GCC), Distribution Operations, Energy Procurement (Market Operations) and Power Procurement System (PPS), Resource Forecasting and Planning, Meter Data Management System (MDMS), and Meter Data Warehouse.

The next scenario describes a situation in which the utility needs to exchange system information and commands with the utility-owned DG and does so using the SmartConnect infrastructure. Utility-owned DG provides real-time control, data acquisition and system information to the MDMS via the SmartConnect to monitor and analyze system/component status and performance, power quality, metrology data, command and control status, system and component failure alarm notifications, and logged data from an on-site data historian. Utility organization may execute control functions for utility-owned DG using MDMS functions such as command and control for volt/VAR control, ancillary services, and on-site energy storage control.

A DG-ready SmartConnect system provides many benefits for the utility such as reduced power requirements from the grid during high-cost periods and in the key areas of operating efficiency, asset efficiency, and societal benefits. The advantages realized by the utility are:

Greater operating efficiency for:

- Dispatching and monitoring customer DG
- Lowering DG meter read costs
- Increasing output accuracy
- Eliminating the manual commissioning process by leveraging the SmartConnect/HAN communications network
- Reducing manual processes and administration costs for calculating DG incentives, and preparing and mailing manual incentive checks
- Providing services for customer owned DG such as: remote monitoring, performance optimization and performance reporting

- Detecting unauthorized DG in the service territory thereby increasing worker safety
- Creating lower cost alternatives for volt-VAR support, peak shaving, and ancillary services such as AGC, load following and frequency control
- Reducing outages for fewer no-power and maintenance requests to the call center
- Increasing worker safety by allowing control of start/stop monitoring for feeder maintenance

Greater asset efficiency for:

- Increased participation in load management programs
- Elimination (in some cases) of requirements for two independent sets of meters
- A communication pathway from the utility to the load management devices (broadly includes on-site generation)
- Reduced equipment and installation costs for systems and facilities that enable customer-provided DG and increase DG participation rates
- Deployment of DG in wide and targeted areas to mitigate future peak generation citing, construction and greenhouse gas (GHG) costs associated with high-efficiency DG
- Improvements in grid management and system reliability for more efficient response to distribution reliability concerns to reduce local and system-wide outages
- Combining DG with energy storage capabilities allowing integration and management of wide-scale renewable energy production from intermittent and varying sources such as wind and solar whenever a local area experiences cloud cover or the local winds die down
- Greater understanding of off-peak versus on-peak usage to optimize system performance and avoid new distribution assets (if possible)

Greater benefits to society by:

- Allowing solar use during outages to supplement customer power demands
- Avoiding safety issues associated with energizing the grid
- Making the public more aware of system performance and energy generation sources and the correlation between societal behaviors and rising energy costs
- Enabling the utility to measure and take advantage of Western Renewable Energy Generation Information System (WREGIS) credits from solar environmental activities
- Helping society to reach renewable goals at a much faster pace

## 1.4 Business Rules and Assumptions

- For this use case the utility has a distributed generation grid connection > 200 kW.
- The meter collects energy flows at the metering point.
- As detailed in use case D2 - distribution engineering or operations can optimize the network based on data collected by the SmartConnect system from the meter. The meter can collect power quality measurements at the metering point.
- Utility-owned DG equipment (inverter, solar panel, switch position, etc.) are able to communicate status and energy information to the meter (IEEE 1547.3 specified DG communication).
- The utility has the ability to dispatch utility owned DG units to the ISO.
- Communications between the meter and DG devices are operational during power outages.
- Advanced PV systems have been tightly integrated into the broader SmartConnect context, enhancing the value of PV even further.
- The enhanced capability of the PV inverter/controllers enable distributed PV to become a distributed grid resource.
- Weather events, concerns over an aging infrastructure, and a greater dependence on electricity highlight the need for energy reliability
- The ability to reduce distribution loads are essential for dealing with power fluctuations from PV, including those caused by daily solar cycles and cloud transients.

# 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, customer, end users, service personnel, executives, meters, real-time databases, ISO, 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 |
|---|---|---|
| Utility-Owned Distributed Generation | Device | A generation resource owned by the utility, connected to the distribution grid and authorized to supply energy. |
| SmartConnect | System | SCE's system name for their Advanced Metering Infrastructure (AMI) implementation. A combination of communications infrastructure and computer applications that provide for remote access to customer meters and advanced applications such as time-of-day metering, remote connect/disconnect, outage information, and demand response. |
| Data Processing Gateway (DPG) | Device | Network access device between a grid connected resource and Energy Control Network. |
| Energy Control Network (ENC) | Network | A real-time communications network providing access to information exchange between generation, transmission, distribution, and grid control system resources. Supports 4-second update rates among resources for efficient grid operation and reliability. |
| Independent System Operator (ISO) | Organization | Also referred to as a Regional Transmission Organization. Responsible for the economic and reliable operation of the transmission grid. Creates a functioning market for energy, capacity, and ancillary services. The ISO is responsible for compliance with federal and state rules and regulations. |
| 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. |
| Energy Procurement (Market Operations) | Organization | A generic term for those actors within the normal process flow of data for Electricity Supply and Markets (ES&M). The actors include the load forecast group, planning group, day-ahead energy traders, the schedulers, and real-time operations. |

| Actor Name | Actor Type (person, device, system etc.) | Actor Description |
|---|---|---|
| Power Procurement System (PPS) | System | Maintains the system resource stack of available supply and demand resources and their price parameters. Energy traders use the PPS to select resources for bids to the ISO. The stack of resources, generally considered supply resources, listed from cheapest to most expensive allows traders to balance supply with forecasted system load. In this use case, the amount of demand response available for any given market window is considered a resource in the stack. |
| Resource Forecasting | System | Part of Energy Procurement (Market Operations). Responsible for rolling system demand forecasts for the next day, 7 days, 30 days, 90 days, 6 months, or 1 year. |
| Resource Planning | System | Part of Energy Procurement (Market Operations). Responsible for rolling system supply resource forecasts for the next day, 7 days, 30 days, 90 days, 6 months, or 1 year. |
| Meter - ISO | Device | An electric revenue meter that meets the utility, ISO, and state metering standards. Having two-way communications using a standards-based protocol, the meter can record and transmit data (e.g. energy data for billing and operations) to authorized systems. |
| Meter – Utility (SmartConnect Meter) | Device | An advanced electric revenue meter capable of two-way communications with the utility. Serves as a gateway between the utility, customer site, and customer's load controllers. Measures, records, displays, and transmits data such as energy usage, generation, text messages, event logs, etc. to authorized systems (i.e., the SmartConnect NMS) and provides other advanced utility functions. |
| Meter Data Management System (MDMS) | System | Gathers, validates, estimates and permits editing of meter data such as energy usage, generation, and meter logs. Stores this data for a limited amount of time before it goes to a data warehouse and makes this data available to authorized systems. |
| 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. |
| Utility Organization | Organization | Any group inside a utility that requires access to utility-owned distributed generation metering, control, or system information. |

# 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 work "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 are more than one relevant scenarios (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: Utility uses SmartConnect or Energy Control Network infrastructure to meter power generated by utility-owned distributed generation

Utility uses SmartConnect or ECN to meter utility-owned DG for delivery status and production information to a group of users. Potential users are ISO including AGC, the GCC, the MDMS, Meter Data Warehouse, and Energy Procurement (Market Operations) utilizing PPS, Resource Forecasting, and Resource Planning.

Procurement (Market Operations) including Resource Forecasting and Planning require real-time energy production data to correctly forecast utility-owned DG. The information is used to prepare real-time billing for Power Procurement Finance to perform settlements. Energy utilities and environmental regulators need this data to validate delivery of renewable energy that counts toward RPS and WREGIS credits. Real-time and historical data can be used by market operations to adjust utility-owned DG energy production to minimize ISO Uninstructed Deviation penalties.

| 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 star* | *Identify the post-conditions or significant results required to complete the scenario* |
| *Utility-owned DG is connected to the distribution grid* | *Meter-ISO*<br>*Meter-Utility* | *Utility-owned DG receives authorization to supply energy to the distribution grid.* | *Metering information related to utility-owned DG s successfully delivered to users.* |

| 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 | Meter - ISO | Provides real-time data to ISO, PPS, GCC, and Distribution Operations Center by way of Data Processing Gateway (DPG) over the ECN<br>Energy information in real-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) | |
| 2 | ISO | Polls Meter-ISO for billing information once a day:<br>• kWh in<br>• kWh out<br>• kVARh in<br>• KVARh out | |
| 3 | Meter-ISO | Returns billing information to ISO, PPS and GCC:<br>• KWh in<br>• KWh out<br>• KVARh in<br>• KVARh out | |

| Step | Actor | Description of the Step | Additional Notes |
|---|---|---|---|
| 4 | Meter-Utility (SmartConnect Meter) | Provides metering information to MDMS<br>Energy information in real-time:<br>• kW in<br>• kW out<br>• kVAr in<br>• kVAr out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) | |
| 5 | MDMS | Provides meter-utility data to the Meter Data Warehouse<br>Energy information in real-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) | |

| Step | Actor | Description of the Step | Additional Notes |
|---|---|---|---|
| 6 | Utility organizations including:<br>Generation Business Unit<br>T&D Business Unit<br>Customer Service System<br>Corporate Communications<br>Resource Forecasting<br>Resource Planning | Requests utility-owned DG metering information from the Meter Data Warehouse | |
| 7 | Meter Data Warehouse | Provides utility-owned DG information to Utility Organization including metering, system performance and status, power quality, and metrology. | |

## 3.2 Primary Scenario: Utility uses SmartConnect infrastructure to communicate with utility-owned distributed generation for control, status, performance metrics, etc.

This scenario covers the situation where the utility exchanges system information and commands with the utility-owned DG using the SmartConnect infrastructure. Utility-owned DG provides real-time control and data acquisition system information to MDMS via SmartConnect for items such as system and component status and performance, power quality (PQ) monitoring, metrology data, command and control status, system and component failure alarm notification, and logged data from an on-site data historian. The utility organization executes control functions for utility-owned DG via MDMS including command and control for volt/VAR control, ancillary services, and on-site energy storage control.

| 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 star* | *Identify the post-conditions or significant results required to complete the scenario* |
| *Utility-owned DG is connected to the distribution grid.* | *Real- time control and data acquisition system.* | *Utility-owned DG has received authorization to supply energy to the distribution grid.* | *Control and system information related to utility-owned DG is successfully delivered to users.* |

| 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 | Utility-owned DG | Provides the MDMS with real-time control and data acquisition system information over SmartConnect for the following:<br>• Status, performance, and PQ monitoring<br>• Metrology data<br>• Command and control status<br>• System and component failure alarm notification<br>In addition, utility-owned DG supplies on-site historical data. | |
| 2 | MDMS | Provides the Meter Data Warehouse utility-owned DG with real-time control and data acquisition system information for the following:<br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification<br>In addition, utility-owned DG supplies on-site historical data. | |

| Step # | Actor | Description of the Step | Additional Notes |
|---|---|---|---|
| 3 | Utility organizations including:<br>Generation Business Unit<br>T&D Business Unit | Requests utility-owned DG control and system information from Meter Data Warehouse for the following:<br><br>• Status, performance, and PQ monitoring<br>    ○ inverter status and performance<br>    ○ solar panel strings monitoring<br>    ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification<br><br>In addition, utility-owned DG supplies on-site historical data. | |
| 4 | Meter Data Warehouse | Provides utility-owned DG control and system information to utility organization.<br><br>• Status, performance, and PQ monitoring<br>    ○ inverter status and performance<br>    ○ solar panel strings monitoring<br>    ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage control status<br>• System and component failure alarm notification<br><br>In addition, utility-owned DG supplies on-site historical data. | |
| 5 | Utility organizations including:<br>Generation Business Unit<br>T&D Business Unit | Executes control function for utility-owned DG via MDMS for the following:<br><br>• Command and control<br>• Volt/VAR control<br>• Ancillary service<br>• On-site energy storage control | Note: This capability requires dropping U.L. rating for inverter to allow for external control by utility. |

| Step # | Actor | Description of the Step | Additional Notes |
|---|---|---|---|
| 6 | MDMS | Transfers request to utility-owned DG by utility organization to execute control function for the following:<br><br>• Command and Control<br>• Volt/VAR control<br>• Ancillary service<br>• On-site energy storage control | |
| 7 | Utility-Owned DG | Executes requested control function | |
| 8 | Utility-Owned DG | Sends confirmation message to MDMS that the control function has been executed. | |
| 9 | MDMS | Sends utility organization a message confirming the requested control function has been executed. | |

# 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)* |
|---|---|---|
| Meter-ISO shall be capable of providing real-time data to the ISO, PPS, GCC, and Distribution Operations Center by way of the DPG via the ECN.<br><br>Energy information in real-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) | 3.1 | 1 |
| Meter-ISO shall be capable of recording energy based on a user's selectable interval. | 3.1 | 1 |
| Meter-ISO shall be capable of reporting recorded interval energy when requested. | 3.1 | 1 |
| ISO shall poll the Meter-ISO for billing information once a day:<br>• kWh in<br>• kWh out<br>• kVARh in<br>• kVARh out | 3.1 | 2 |

| *Functional Requirements* | *Associated Scenario # (if applicable)* | *Associated Step # (if applicable)* |
|---|---|---|
| Meter-ISO shall return billing information to the ISO, PPS and GCC:<br>• kWh in<br>• kWh out<br>• kVARh in<br>• kVARh out | 3.1 | 3 |
| Meter-ISO shall provide billing metering information directly to ISO | 3.1 | 3 |
| FR7: Meter-Utility shall be capable of providing metering information to MDMS.<br>Energy information in real-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) | 3.1 | 4 |

<table>
<tr><th>Functional Requirements</th><th>Associated Scenario # (if applicable)</th><th>Associated Step # (if applicable)</th></tr>
<tr><td>MDMS shall be capable of providing Meter-Utility information to the Meter Data Warehouse.<br><br>Energy Information in real-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points)</td><td>3.1</td><td>5</td></tr>
<tr><td>Utility Organization shall be capable of requesting utility-owned DG metering information from the Meter Data Warehouse.</td><td>3.1</td><td>6</td></tr>
<tr><td>The Utility Organization requesting utility-owned DG information shall be authorized to access metering information. All authorizations shall comply with applicable utility, state and federal standards including NERC-CIP Authentication Requirements.</td><td>3.1</td><td>6</td></tr>
<tr><td>Meter Data Warehouse shall be capable of providing utility-owned DG metering information to the utility organization that requested it.</td><td>3.1.</td><td>7</td></tr>
<tr><td>Utility-owned DG shall be capable of providing the MDMS with real-time control and data acquisition system information over SmartConnect for the following:<br><br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification<br>• On-site historical data</td><td>3.2</td><td>1</td></tr>
</table>

| *Functional Requirements* | *Associated Scenario # (if applicable)* | *Associated Step # (if applicable)* |
|---|---|---|
| MDMS shall be capable of providing to the Meter Data Warehouse utility-owned DG real-time control and data acquisition system information for the following:<br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage control status<br>• System and component failure alarm notification<br>• On-site historical data | 3.2 | 2 |
| Utility organization shall be capable of requesting utility-owned DG control and system information from the Meter Data Warehouse for the following:<br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification<br>• On-site historical data | 3.2 | 3 |
| Meter Data Warehouse shall be capable of providing utility-owned DG control and system information to the Utility Organization.<br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification<br>• On-site historical data | 3.2 | 4 |

| *Functional Requirements* | *Associated Scenario # (if applicable)* | *Associated Step # (if applicable)* |
|---|---|---|
| Utility Organization shall be capable of executing control functions for utility-owned DG via MDMS for the following:<br>• Command and Control<br>• Volt/VAR control<br>• Ancillary service<br>• On-site energy storage control | 3.2 | 5 |
| MDMS shall be capable of passing on requests by the Utility Organization to utility-owned DG to execute control functions for the following:<br>• Command and Control<br>• Volt/VAR control<br>• Ancillary service<br>• On-site energy storage control | 3.2 | 6 |
| Utility-owned DG shall be capable of executing the requested control function. | 3.2 | 7 |
| Utility-owned DG shall be capable of sending to the MDMS a confirmation message that the requested control function has been executed. | 3.2 | 8 |
| MDMS shall be capable of sending to the Utility Organization a confirmation message that the requested control function has been executed. | 3.2 | 9 |

## 4.2 Non-Functional Requirements

| *Non-Functional Requirements* | *Associated Scenario # (if applicable)* | *Associated Step # (if applicable)* |
|---|---|---|
| Meter-ISO shall be capable of supplying updated utility-owned DG energy, status, and metrology data with data updated every 4 seconds. | 3.1 | 1 |
| Meter-ISO shall be capable of supplying the utility-owned DG with updated data that has an 99.7% uptime availability. | 3.1 | 1 |

| Non-Functional Requirements | Associated Scenario # (if applicable) | Associated Step # (if applicable) |
|---|---|---|
| Meter-ISO shall be capable of recording energy information in intervals of 5 minutes or more. | 3.1 | 1 |
| Meter-ISO shall require communications in recorded time-series intervals using ISO specified metering standards and security per NERC CIP rules. | 3.1 | 1 |
| ECN shall be capable of handling metering information from at least 150 utility-owned DG sites. | 3.1 | 1 |
| Meter-ISO shall be capable of transmitting energy information upon request at least once a day. | 3.1 | 2 |
| SmartConnect shall be capable of handling metering information from at least 150 utility-owned DG sites. | 3.1 | 2 |
| SmartConnect shall be capable of handling metering information from at least 400 data points for each utility-owned DG site. | 3.1 | 2 |
| Utility-owned DG real-time control and data acquisition shall be performed using either SmartConnect or a NERC CIP compliant VPN, not through external (non-secure) access methods. | 3.1 | 2 |

## 4.3 Business Requirements

| Business Requirement | Associated Scenario # (if applicable) | Associated Step # (if applicable) |
|---|---|---|
| | | |

# 5. Use Case Models (optional)

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

## 5.1 Information Exchange

*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.* |
| 3.1 | 1 | Meter-ISO | ISO (including AGC)<br>PPS and GCC<br>Distribution Operations Center | • kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker or inverter status |
| 3.1 | 2 | ISO | Meter-ISO | Request for daily billing information |
| 3.2 | 3 | Meter-ISO | ISO | Daily billing information in 5 minute intervals<br>• kWh in<br>• kWh out<br>• kVARh in<br>• kVARh out |

| Scenario # | Step #, Step Name | Information Producer | Information Receiver | Name of information exchanged |
|---|---|---|---|---|
| 3.1. | 4 | Meter-Utility | MDMS | Energy Information inreal-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) |
| 3.1. | 5 | MDMS | Meter Data Warehouse | Energy Information in real-time:<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) |

| Scenario # | Step #, Step Name | Information Producer | Information Receiver | Name of information exchanged |
|---|---|---|---|---|
| 3.1 | | Utility Organization | Meter Data Warehouse | Requested information –<br>• kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) |
| 3.1 | 3 | Meter Data Warehouse | Utility Organization | • kW in<br>• kW out<br>• kVAR in<br>• kVAR out<br>• PQ , sag, swell, flicker, harmonics<br>• wind speed<br>• wind direction<br>• ambient temperature<br>• global horizontal radiance<br>• direct radiance<br>• panel temperature<br>• breaker status (no breaker – providing inverter status instead – 4 points) |
| 3.2 | 1 | Utility-Owned DG | MDMS | Utility-owned DG control and system information including:<br>• Status, performance, and PQ monitoring<br>• Metrology data<br>• Command and control status<br>• System and component failure alarm notification<br>• Historical data |

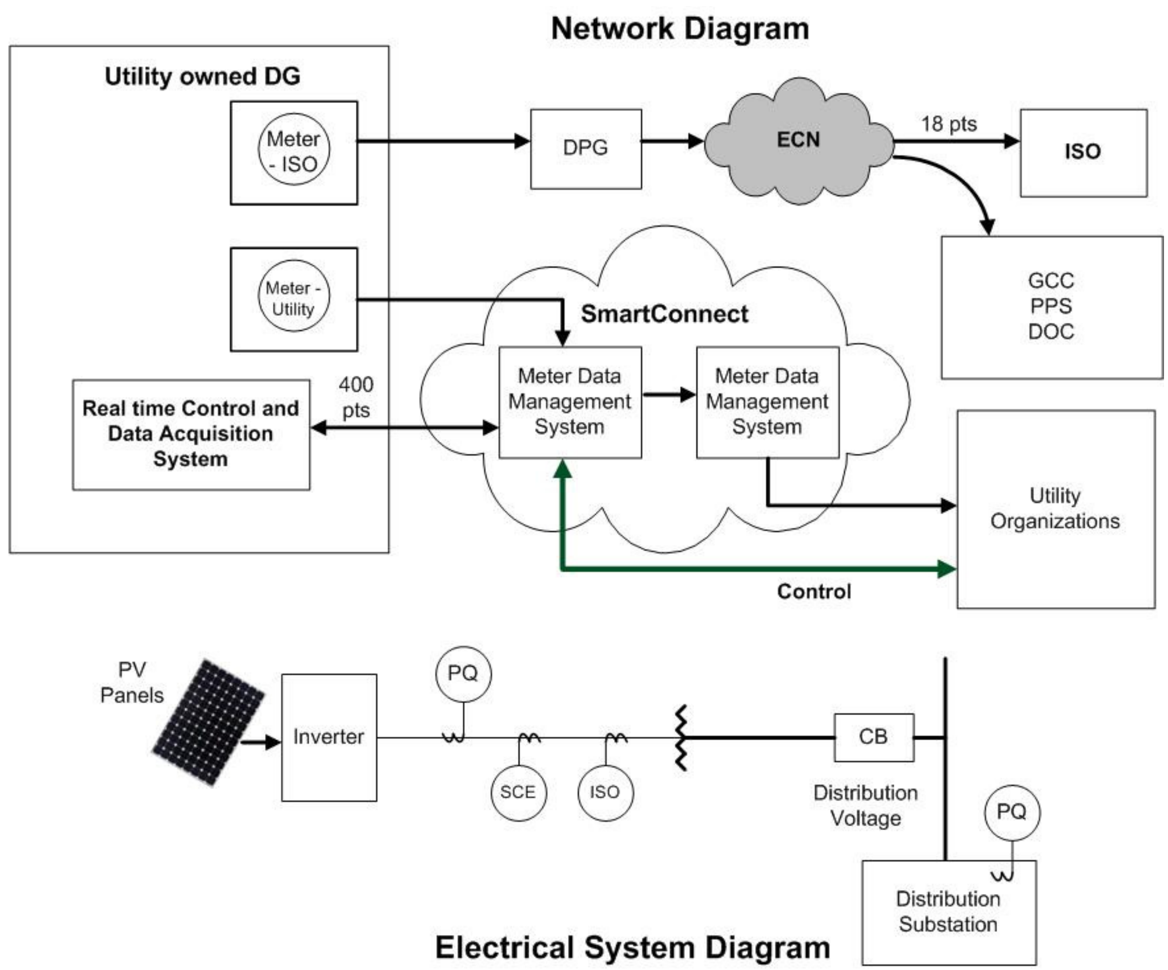
| Scenario # | Step #, Step Name | Information Producer | Information Receiver | Name of information exchanged |
|---|---|---|---|---|
| 3.2 | 2 | MDMS | Meter Data Warehouse | Utility-owned DG control and system information including:<br>• Status, performance, and PQ monitoring<br>• Metrology data<br>• Command and control status<br>• System and component failure alarm notification<br>• Historical data |
| 3.2 | 3 | Utility Organization | Meter Data Warehouse | Request for utility-owned DG control and system information including:<br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification |
| 3.2 | 4 | Meter Data Warehouse | Utility Organization | Utility-owned DG control and system information including:<br>• Status, performance, and PQ monitoring<br>  ○ inverter status and performance<br>  ○ solar panel strings monitoring<br>  ○ switchgear status<br>• Metrology data<br>• Command and control status<br>• On-site energy storage status<br>• System and component failure alarm notification |
| 3.2 | 5 | Utility Organization | MDMS | Utility-owned DG control message<br>• Command and control<br>• Volt/VAR control<br>• Ancillary service<br>• On-site energy storage control |

| Scenario # | Step #, Step Name | Information Producer | Information Receiver | Name of information exchanged |
|---|---|---|---|---|
| 3.2 | 6 | MDMS | Utility-Owned DG | Utility-owned DG control message including:<br>• Command and control<br>• Volt/VAR control<br>• Ancillary service<br>• On-site energy storage control |
| 3.2 | 8 | Utility-Owned DG | MDMS | Confirmation utility-owned DG control message has been executed. |
| 3.2 | 9 | MDMS | Utility Organization | Confirmation utility-owned DG control message has been executed. |

## 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.*

### 5.2.1 Electrical System Diagram:



# 6. Use Case Issues

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

| ***Issue*** |
| --- |
| *Describe the issue as well as any potential impacts to the use case.* |
| Two additional scenarios could be added to this use case:<br>• SmartConnect's metering and monitoring functions could be enhanced to provide information to the many stakeholders that use the system.<br>• This use case could explore utility use of utility-owned DG for advanced distribution applications such as supporting voltage and reactive power requirements on the distribution system. |

# 7. Glossary

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

| Glossary | |
|---|---|
| **Term** | **Definition** |
| SmartConnect | SCE's system name for their Advanced Metering Infrastructure (AMI) implementation. A combination of communications infrastructure and computer applications that provide for remote access to customer meters and advanced applications such as time-of-day metering, remote connect/disconnect, outage information, and demand response. |
| Distributed Generation (DG) | Local generation resource connected to distribution grid. |
| Advanced Metering Infrastructure (AMI) | System of communications infrastructure and computer applications that allow remote access to customer meters providing advanced applications such as time-of-day metering, remote connect/disconnect, outage information and demand response. |
| Automatic Gain Control (AGC) | The instantaneous regulation of electricity used to maintain frequency on the system within time and frequency parameters. AGC is monitored every 4 seconds and the frequency is limited to +- 0.08 hertz of 60 hertz. |

# 8. References

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

## SCE's Circuit of the Future will enable real-world testing of emerging Smart Grid concepts.

| Southern California Edison Avanti: Circuit of the Future | | |
|---|---|---|
| Characteristics | **Initiator/ Utility** | Southern California Edison |
| | **Size** | 1,420 residential and business customers |
| | **Location** | Anaheim, CA |
| | **Technology** | Multiple Smart Grid |
| Location |  | |
| Description | • Technologies envisioned include advanced sensors, distribution automation, AMI, distributed energy resources, fault current limiters and modular hybrid poles<br>• Multiple communications platforms will be tested including fiber optic and broadband over power line, along with SCE's mesh radio network | |
| Objectives | • The goal is to develop a test platform for incorporating new technologies and methods that increase reliability and safety while controlling customer costs. SCE engineers see a need to increase circuit performance, reduce life cycle costs and incorporate new technologies as they become available. | |
| **Strategic Significance** | | |
| The circuit of the future will become a working Smart Grid platform and test bed serving customers to test new technologies and operating strategies as they develop. | | |

# 9. Bibliography (optional)

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