AMI Use Case:

D3 - Customer Provides Distributed Generation

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Document History

Revision History

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Approvals

This document requires following approvals.

Name	Title
Robert Yinger	Mega Team Lead
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Contents

1. Use Case Description

1.1 Use Case Title

Please insert the title of the use case.

D3 – Customer Provides Distributed Generation.

1.2 Use Case Summary

Describe briefly the scope, objectives, and rationale of the Use Case

For many years distributed generation(DG) has had a relatively small impact on utility operations, Traditionally, distributed generation has served as a primary or emergency back-up energy source for business applications that place a premium on reliability and power quality or it has resulted from manufacturing processes that are able to produce electricity as a by product. Additionally, solar, geothermal and wind power have offered consumers the opportunity to reduce their utility bill and meet some or all of their power requirements with environmentally friendly alternatives, Spurred by the volatility in the energy marketplace, and abetted by new technologies, a number of manufacturers in recent years have brought or are bringing to market small-scale generators and other resources that can economically wholly or partially provide the electricity requirements of a single home, business or even a neighborhood. The availability of these systems coupled with increasing concern about the nation's energy infrastructure is encouraging legislation that will facilitate even more penetration of distributed generation in utility grids.

Utilities stand to benefit from distributed generation as well. Distributed generation can reduce the peak loading on the grid. It can also help support line voltage at the end of long distribution circuits. The utility could also install generation to supplement or defer grid upgrades where space, economics, or other constraints prevent the expansion of substations or the building of new distribution lines. An example of this would be installing distributed generation to improve service near isolated loads currently supplied by a long transmission line. That said, under current technological and fuel cost assumptions the number of applications where DG can substitute for distribution is likely to be limited.

An AMI system with its extensive footprint and advanced metrology capabilities can provide mechanisms that enable distributed generation to be deployed with greater safety and enhanced overall system reliability. Basic scenarios that detail typical distributed generation scenarios prevalent today are covered with opportunities for AMI to enhance installation coordination, metering and address safety issues. Further requirements specific to DG and safety are also addressed in Use Case D4 Scenarios. This Use Case will walk through customer enrollment in a utility-sponsored DG program with the utility programming the meter to support net metering. It also addresses situations where customers start the use of DG without notifying the utility. The meter has the intelligence to support DG interconnection requirements specified in Tariff Rule 21 and help to maintain safety of utility personnel during outage restoration.

This use case also explores the utility use of DG to help control real and reactive power requirements on the distribution system. In this case, the customer signs up to allow utility control of DG for regulation of real and reactive power. The customer must abide to utility request or face contractual (typically cost) penalties. The utility monitors in real-time actions taken by the customers. The utility signals may consist of power factor modifications and remote generation disconnection requests. Utilities may also have the capability of monitoring individual customer actions such as verification that requested load reduction actually takes place. The utility benefits by reduced power requirements from the grid during high-cost periods.

In summation , key benefits a utility can realize the following benefits from a DG-ready AMI system:

- Increased participation on load management
- Elimination of requirement for two independent sets of meters
- Provides a communication path from the utility to the load management devices (load management in the broad sense to include on-site generation)
- Reduced installation costs for enabling customer-provided DG (this may increase DG participation rates)
- Ability to dispatch and monitor DG

1.3 Use Case Detailed Narrative

A complete narrative of the functions of the use case from the Primary Actor's point of view, describing what occurs when, why, how, and under what conditions. This narrative will act as the basis for identifying the Steps and the value of the use case to SCE.

Distributed generation control using an AMI system has challenges and opportunities that should be investigated and defined. Technological advances and economies of scale may increase the penetration of distributed generation resources in the future. There are several scenarios that should be considered regarding DG.

- A customer enrolls in a DG program. The customer's meter is then programmed remotely to allow proper crediting of the account for generation received by the utility. Other sub-scenarios describe what happens if the customer starts generation before the meter can be properly programmed.
- Customer notification (and possible disconnection) should occur if DG is enabled without a valid utility contract.
- Utilities can use a customer's DG unit to help control real or reactive power imbalance on a distribution circuit. The trigger for these signals to customer DG units could be either voluntary (price-driven) or mandatory (contractually-driven). The design of these triggers is out-of-scope for this use case. Utility monitors energy flow at metering point to infer customer response. The utility may also use generator metering and monitoring to accurately determine actual customer response.

Several scenarios were envisioned and dropped from this use case

- Customer's DG Provides Customer with Power during Utility Outage. This scenario has no effect on the utility so was not covered in this use case. Utility interconnection requirements ensure that protective relaying will prevent back-feed during outages. The utility, for research purposes, may want to know the quantity of customer load maintained by the DG during an outage (in this case, it can simply ask the customer to report the size of the DG).
- Customer DG is Used to Provide Power for a Small Island. Again, this scenario does not involve the utility if it takes place behind the customer meter. If it were to involve the utility's distribution system, this would be very difficult for the utility to accomplish. The utility would need to supply enough automated disconnect switches to ensure that every possible island would be small enough to be served by any subset of customer DG units. In addition, the utility would need to communicate with customer generation and loads during power outages (not always possible) to maintain a balance of load and generation. The customer DG units would also need stand-alone capability (ability to regulate frequency and voltage to feed both dead lines and isolated loads) as well as start-up coordination among other customer's DG units (to allow load sharing and voltage control). Since many customer DG units are dependent on the utility power for commutation, the loss of the single strong frequency signal provided by the utility generator would also enhance the likely hood the system could quickly become unstable. Finally, while a DG operator could be contractually bound to operate it as dictated by the needs of the grid, contracts,with their inherent complexity, ambiguity, multiple interpretations, and tendency to resolve disputes, would not allow the utility to fulfill its obligation to provide safe and reliable operation of the distribution system.
- Utility Sites DG at Customer Premises.. This was evaluated and rejected at this time for a number of reasons. Effective control of these DG units would need to be at the speed of SCADA (approximately 4 second scans) which would be more economically served by a specialized communication system as opposed to requiring the entire AMI system to incur the costs of supporting this sort of traffic. Further, given the significant safety, security, access and other environmental concerns that come with the use of customer sites for utility generation, it becomes apparent that in the near term a more viable approach for distributed utility generation is utilization of the utilities own dispersed facilities such as substations, where environmental concerns have already been addressed and secure, high speed, highly reliable communications already exist. While the position of the distributed generation relative to the start or end of a feeder does have an impact on the infrastructure, there is no obvious major disadvantage to placing the generation at the head end of the feeder and some clear disadvantages to placing it elsewhere -- beyond the issues already discussed. Probably the most significant of these is the fact that the coordination and configuration of the reclosers, remote circuit switches and fuses is already complex enough. The placement of generation units with sufficient capacity to economically serve more than a single customer with the required logistical support would require significant modifications to protection equipment to insure safe and reliable operation of the system as a whole. Placing the generation at the head of the feeder would allow the protection equipment to continue to operate normally without major changes.
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1.4 Business Rules and Assumptions

Describe any business rules, assumptions and regulatory or policy constraints that apply to this use case

- For this Use Case a customer has a grid connection < 200 kW

- The meter collects bi-directional energy flows at the metering point. This information is required for basic billing.
- As detailed in use case D2 - Distribution Engineering or Operations optimize network based on data collected by the AMI system the meter will collect power quality measurements at the metering point..
- The AMI system collects metering and power quality information from DG units if that information is provided. This data may be required in the future. However, SCE does not currently have the right to require DG units to supply this information. Regulatory authorities generally want to know the "net" production from a DG unit (i.e. the power to run exciters, protective equipment, etc should be subtracted out).
- Customer allows utility to disconnect electrical service (this is only possible for meters less than or equal to 200 amp because larger services require external current transformers and therefore the disconnect cannot be incorporated into the meter itself)
- DG equipment may be able to communicate status and/or energy information to the meter (IEEE P1547.3 specified DG communication. P1547.3 is presently at Draft 03 dated 25-January-2006).
- The minimum DG interconnection requirements are specified in Tariff Rule 21. It also specifies protective equipment required to maintain safety of utility personnel during outage restoration.
- The utility will want the ability to dispatch customer-premise DG units in the future as part of a utility load management program.
- Communications to the meter and DG devices need not take place during a power outage
- Control of a DG unit, in large part, is similar to other forms of load control.
- There is value in determining the presence of DG units even if a customer DG unit generates less energy than the load (it simply appears as a load reduction). While not generally a problem for utilities, it is useful for the utility to know to understand extent for departing loads
- There is value in measuring generation produced by backup generators during outages. Various parties, including regulatory authorities seek to know how much back up generation is connected to the utility's system. Knowing this would allow them to determine how much generation is available at customer locations to supplement or reduce the amount of power flowing through the utility's grid. Accordingly, it would be nice to know which customers were running BU generation during outage, and how much energy was being produced. Present PUC rules prohibit requiring (but do allow) customers to provide metering of DG units.

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, meter, real-time database, ISO, power system). 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*
Meter Data Management System (MDMS)	System	Reads energy usage / production data from meters.
Distributed Resource Availability and Control System (DRAACS)	System	A system that collects detailed information about customer loads and customer response patterns. It also maintains information regarding the number of times a customer has complied in a given time period vs the compliance requirements of the tariff applicable to that customer. This information is brought together for the user so that the user can see what probable load is available to be curtailed in total and at various points in the network. The system will also receive and process requests for curtailment and will balance the requests across subscribers based on load, and how recently they have already responded.
Grid control center (GCC)	System	GCC operates the SCE transmission grid and measures the load at the customer site
Building Management System(BMS)	Device	Customer premise equipment which interfaces with AMI system (through the meter) to provide services for load management and DG
Meter	Device	Advanced electric revenue meter capable of two-way communications with the utility. The meter can receive, record, display and transmit data (e.g. 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.
Customer	Person	Residential or small business energy user that has a contract with the utility to receive electrical service from the utility and have an AMI meter installed. The customer may or may not participate in programs provided by the utility including pricing events, load control or distributed generation.
System Management Console	System	Monitoring of the AMI remote provisioning functions, control and diagnostics

Actor Name	Actor Type (person, device, system etc.)	Actor Description
Premise Gateway	Device	The Premise gateway is the controller for the Home-area network (HAN). It may be located in the AMI meter or on a pole or tower. The premise gateway provides the utility connectivity to in-home load control devices.
Customer Equipment	Equipment	Equipment at the customer site belonging to the customer that can be used for control of DG real and reactive power output
Customer Service System	System	A system responsible for producing customer invoices from accurate "bill ready" AMI meter readings. Invoices can be produced periodically (on cycle) or as a result of a specific event (off cycle). Accurate bills require accurate and timely information from the AMI meters. The system is responsible for storing customer specific information like site data, AMI meter numbers and rates and program participation. The system also tracks and manages customer invoices and payments.
Customer Representative	Person	Utility employed staff that responds to customer requests to activate, modify and/or terminate delivery of service. Customer Representatives also enroll customers in utility sponsored programs and answer questions related to the customer's energy consumption and cost data. Many off cycle bill requests are initiated by Customer Representative's action to correct billing errors (due to inaccurate physical reads or estimates).

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 is more than one scenario (set of steps) that is relevant, 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: Distributed Generation Metering - Customer delays generation until after DG program enrollment

Provide a scenario name that indicates whether the scenario is classified as "Primary" or "Alternate" (for example, "Primary Scenario: Distributed Generation Metering" or "Alternate Scenario: Customer unexpectedly connects DG") and an overview of the scenario.

In this scenario, the customer notifies the utility of the intent to energize DG. The utility accepts the customer DG request and completes any required programming of the meter and AMI infrastructure. The utility then informs the customer that the DG unit(s) can be energized. At this point, the customer energizes the DG unit(s). The customer need not ever become a net energy generator. The utility measures net energy flows in each direction independently.

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
(Identify the name of the event that start 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 consider the scenario complete)*
Customer enrolls in DG program	Meter	Customer has not pre-declared desire to participate in DG program	Any customer-generated energy is properly credited to customer. Utility has knowledge of DG unit(s)

3.1.1 Steps for this scenario

Describe the normal sequence of events that is 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 value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	Customer	Customer completes enrollment into utility DG program	
2	System Management Console	System Management Console programs the meter for net energy metering	
3	Customer	Customer energizes DG	This may or may not result in power flowing toward the utility
4	Meter	Meter begins collecting (if not already): • Watt-hours from utility • Watt-hours from customer • VAR-hours generated • VAR-hours consumed If DG information is also collected at customer DG site, these additional values will also be collected: • Watts-hours generated • VAR-hours produced while generating watts • VAR-hours consumed while generating watts	
5	Meter	Transmits DG information on default schedule	

Step #	***Actor***	***Description of the Step***	***Additional Notes***
6	MDMS	MDMS Verifies validity of all values: • Watt-hours from utility • Watt-hours from customer • VAR-hours generated • VAR-hours consumed If DG information is also collected at customer site, these additional values will also be transmitted: • Watts-hours generated • VAR-hours produced while generating watts • VAR-hours consumed while generating watts	Team member wanted it made clear that all of these values are independent and are never netted at the meter. In other words, these values can be assumed to always increase and never decrease. Value of individual directional watt measurements – allows utility to provide net energy metering (utility pays retail rates for excess DG) or for utility to pay differing rates for net energy production and consumption. Value of individual VAR measurements – allows utility to verify both minimum power factor requirements as well as monitor VAR output as compared to any commanded VAR control schemes.

3.2 Alternate Scenario: Distributed Generation Metering - Customer begins generation before DG program enrollment

Provide a scenario name that indicates whether the scenario is classified as "Primary" or "Alternate" (for example, "Primary Scenario: Distributed Generation Metering" or "Alternate Scenario: Customer unexpectedly connects DG") and an overview of the scenario.

In this scenario, the customer notifies the utility of the intent to energize DG. The customer subsequently energizes the DG prior to authorization by the utility. The customer need not ever become a net energy generator (however, if there is no net energy generation, then the utility may not know this scenario ever exists!). The utility may or may not take action against this customer for failure to wait for authorization. The meter recognizes customer energization of DG via a production of real power.

Triggering Event	Primary Actor	Pre-Condition	Post-Condition
(Identify the name of the event that start 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 consider the scenario complete)*
Customer enrolls in DG program	Meter	*Customer has not pre-declared desire to participate in DG program*	*Any customer-generated energy is properly credited to customer. Utility has knowledge of DG unit(s)*

3.2.1 Steps for this scenario

Describe the normal sequence of events that is 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 value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	Customer	Customer completes enrollment into utility DG program	
2	Customer	Customer energizes DG	This may or may not result in power flowing toward the utility so detection of DG can only occur when there is net energy flow from the customer to the utility

Step #	Actor	Description of the Step	Additional Notes
3	Meter	Meter detects that the customer is using DG and reports to meter management system	Utility may use this signal to issue a "reminder" to customer that DG enrollment request has not been completed. Again, this detection is only possible if there is net energy flow from the customer to the utility
4	System Management Console	System Management Console programs the meter for net energy metering	
5		Continues with Scenario 1, step 4	

3.3 Alternate Scenario: Distributed Generation Metering - Customer unexpectedly connects DG

Provide a scenario name that indicates whether the scenario is classified as "Primary" or "Alternate" (for example, "Primary Scenario: Distributed Generation Metering" or "Alternate Scenario: Customer unexpectedly connects DG") and an overview of the scenario.

In this scenario, the customer energizes DG without prior notification to the utility. The customer need not ever become a net energy generator (however, if the is no net energy generation, then the utility may not know this scenario ever exists!). The utility needs to encourage all DG customers to notify the utility for multiple reasons (claim "clean power" credits, claim load reduction credits, etc). The meter recognizes customer energization of DG via a production of real power. Upon recognition of a "rogue" DG unit, the utility takes appropriate action (such as issuance of warning letters or service disconnection) as appropriate. If the customer continues to generate energy without DG enrollment, the utility may refuse to credit the energy production as an incentive for the customer to complete the enrollment process.

Triggering Event	Primary Actor	Pre-Condition	Post-Condition
(Identify the name of the event that start 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 consider the scenario complete)*
Unauthorized power production is discovered	Meter	Customer has not pre-declared desire to participate in DG program	Any customer-generated energy is properly credited to customer. Utility has knowledge of DG unit(s)

3.3.1 Steps for this scenario

Describe the normal sequence of events that is 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 value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	Customer	Customer turns on distributed generation	
2	Meter	Meter detects that customer is using distributed generation (energy flows to utility) and reports to utility.	The meter can detect energy flow to the utility even if it has not been programmed to record net energy metering information
3	Customer Representative	Customer Representative notifies customer that they need to inform utility about DG device and register in program	
4	Meter	If customer does not inform the utility about their DG device and register in a program, a “disconnect on detected DG” flag would be set. If continued energy flow to the utility is detected, the meter would disconnect the customer.	
5	Customer	Customer completes enrollment into utility DG program	
6		Continues with Scenario 1, step 4	

3.4 Primary Scenario: Dispatch generation (watt control, peak shaving, VAR mgmt, PQ, line safety)

Provide a scenario name that indicates whether the scenario is classified as “Primary” or “Alternate” (for example, “Primary Scenario: Distributed Generation Metering” or “Alternate Scenario: Customer unexpectedly connects DG”) and an overview of the scenario.

In this scenario, the customer agrees to allow the utility some control of the DG unit(s). This can reduce the utility's need to provide generation during high cost (ex: CPP) periods. The customer DG units can also supply VAR support and/or set a desired power factor for the overall customer load.

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
(Identify the name of the event that start 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 consider the scenario complete)*
Customer enrolls to provide grid support.	Utility	Customer has DG unit contracted to utility for control	Customer DG device moves to new operating point (kW or kVAR)

3.4.1 Steps for this scenario

Describe the normal sequence of events that is 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 value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	Customer	Customer enrolls to provide grid support.	Customers must provide appropriate equipment to allow utility control of the DG unit(s)
2	GCC	Utility detects unfavorable conditions (e.g. use cases D1 and D2 – loss of generation, loss of transmission lines, or overloaded transformers)	
3	DRAACS	Utility determines what generation can be dispatched to solve the problem.	

Step #	*Actor*	*Description of the Step*	*Additional Notes*
4	DRAACS	Utility sends request to solve the problem. • increase/decrease demand • increase/decrease generation • increase/decrease VARs	
5	Premise Gateway	Receives request and forwards to Customer Equipment	
6	Customer Equipment	Customer equipment acknowledges (to DRAACS) and acts on the request.	If customer does not comply, he may be penalized at his next billing or disconnected depending on the contract.
7	Customer Service System	Customer Service System determines what generation was supplied through the next day's meter read for the purposes of billing and penalties	
8		Go to step 2.	

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)*
(D3FR1)The AMI system shall measure the following per-generator quantities (if available) • Watt-hrs generated • VAR-hrs generated • VAR-hrs consumed All of these quantities shall be independent (e.g. the VAR-hrs are not "netted" by the meter). These quantities must be able to be gathered from other devices elsewhere on the customer site (e.g., the generator controller may collect revenue-quality information which must be passed to the AMI system). This information can be either recorded in the meter or forwarded directly to the Premise Gateway.	1 2 3	4 3 5
(D3FR2)The AMI system shall measure the following quantities at the point of common coupling • Watt-hrs consumed from utility • Watt-hrs generated by customer and sent to utility • Var-hrs generated • Var-hrs consumed All of these quantities shall be independent (e.g. the Watt-hrs are not "netted" by the meter)	1 2 3	4 3 5
(D3FR3)If the customer is not approved for DG, the AMI system shall continue to record and report consumption (operate normally) but it will not record nor report net generation data i.e. it will not record: • Watt-hrs generated by customer and sent to utility • Var-hrs generated by customer and sent to utility .	2	3

Functional Requirements	Associated Scenario # (if applicable)	Associated Step # (if applicable)
(D3FR4)If the customer is not approved for DG, the AMI system shall notify the utility that it has detected net generation. Detection of generation will be done regardless of whether the energy recording function of the meter is active..	2	3
(D3FR6)The meter shall be able to be re-programmed remotely to support bi-directional metering. This reprogramming event will be logged in the meter and sent back with the next regular meter read.	1	2
(D3FR7)The AMI systems shall forward communications from the utility to and from Generation Control Equipment which is part of the customer's Building Management System (BMS) including: • increase/decrease demand • increase/decrease generation • increase/decrease VARs Any of these requests may specify a time period for which to perform the operation, or an "undo" command. This is the "generation dispatch" functionality.	4	4
(D3FR8)The AMI system shall be able to differentiate between multiple individual generators at a customer site	4	4
(D3FR9)The premise gateway shall log all the messages sent and received from utility to/from the BMS or customer's DG device	4	5, 6
Meter should support a "disconnect on detected DG" flag. Setting this flag would trip the service disconnect when DG is detected. Parameters for DG detection would include recognizing reverse flow at a configurable level (watts to kilowatts) over a configurable interval (five seconds to one hour) to prevent false triggering.	3	4
(D3FR10)Communications path between utility, meter, and BMS shall be secure (i.e. secure to the meter AND secure to the BMS)	4	4, 5, 6

4.2 Non-functional Requirements

Non-Functional Requirements	*Associated Scenario #* *(if applicable)*	*Associated Step #* *(if applicable)*
(D3NFR1)The AMI system shall be remotely programmable in steps to record per-generator and point of common coupling measurements in intervals as small as five minutes for billing and control.	1 2 3	4 3 5
(D3NFR2)Following a generator dispatch, the AMI system shall collect data from the customer at the next regular reading interval. (clarification: as opposed to collecting it immediately)	4	5
(D3NFR3)The AMI system shall support at least 500000 distributed generation customers.	4	5
The AMI system shall be able to remotely program the meter for met energy metering within 5 minutes from the reception of the request at the System Management Console	1 2	3 4

4.3 Business Requirements

Business Requirement	*Associated Scenario #* *(if applicable)*	*Associated Step #* *(if applicable)*
(D3BR1)Meter allows for service disconnect if unauthorized DG is discovered and customer fails to enroll in DG program. This will only be possible in self-contained meter forms.	3	4
(D3BR2)Edison's Net Energy Metering Tariff requires that the utility begin crediting net generation within 30 days after interconnection approval	1	1
(D3BR3)The utility must record the customer generator type(s) in order to assist in generation dispatch by generator type. For example, "green" generation might be dispatched first.	4	3
(D3BR4)The utility must have the ability to remotely disconnect customers (with self-contained meters) if DG is installed but customer refuses to sign DG contract. (Presently, the method used to gain customer attention is a letter or telephone call. In the future, however, more immediate measures may need to be taken in the interest of safety). The requirements for the meter presently encompass this capability, but without tariff support cannot be exercised.	3	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

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	2	System Management Console	Meter	Programming Information
1	5	Meter	Meter Data Management System	Collected DG Data since last report
2	4	System Management Console	Meter	Programming Information
3	2	Meter	System Management Console	DG Detected
2	3	Meter	System Management Console	DG Detected
3	2	Meter	System Management Console	DG Detected
4	4	DRAACS	Premise Gateway	DG Status Change Request
4	5	Premise Gateway	Customer Equipment	DG Status Change Request

Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
4	7	Meter	Meter Data Management System	Collected DG Data since last report

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, these are issues that are not resolved and 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.

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**
Net Energy Metering (NEM)	- Tariff or Billing Program that allow a customer to receive billing credits for generating more electricity than it consumes. Credits typically used during the billing period during which they are earned. If surplus credits exist at end of billing period, they may be carried forward for up to 12 months by billing system. - Requires at least 1 dual channel meter (measuring energy to and from the utility) to be located at the "Point of Common Coupling" (PCC) (e.g.: Service Entrance) - Generating facilities may be sized up to 1 MW in capacity, Tariffs currently limit eligibility to certain renewable and non-polluting technologies (Solar, Wind, Bio-gas from animal waste, and Fuel Cells) - Other generating technologies, not qualifying for Net Energy Metering credits, and/or qualifying for different Net Energy Metering credits may also be used by customer. Separate measurements need to be made for production of each generation technology in addition to energy delivered to and from Utility. Tariffs typically preclude utility from requiring metering on output of generators.
Net Generation Output Metering (NGOM)	- Metering installed on the output of customer's generation. Different from "Gross Generation" metering in that auxiliary loads used to make the generator operate are netted out before energy flowing to customer loads is measured. NGOM is used to bill "non-bypassible" a.k.a. "Departing Load" or "Exit Fee" charges (e.g.: PPPC, NDC, CTC, etc.), where applicable.
Non net-metered generation	- Used primarily to describe cases where generation does not qualify for NEM Tariffs. May include cases where energy is prevented from flowing to utility, restricted in the amount that flows to the utility, or allowed to flow to the utility and purchased
Distributed Generation (DG)	- General term used by SCE to describe generation installed and used by customers to supplement the energy received from the utility. DG may or may not produce excess energy that flows back to utility. Term may also be applied to generation installed and operated by utility to support local utility system needs.
Excess generation	- Amount of energy flowing to the utility, as measured by meter located at the PCC
Gross generation	- Actual energy produced by the customer's generation system.
Net Consumption	- Amount of energy flowing to the customer, as measured by meter located at the PCC

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.

CPUC Tariff Rule 21 – Interconnection procedure approved by the California Public Utilities Commission describing DG interconnection procedures – see http://www.sce.com/NR/sc3/tm2/pdf/Rule21.pdf for SCE information on Rule 21. Another California utility inclusion of Rule 21 is available at http://www.sdge.com/tm2/pdf/ERULE21.pdf

Section 2827 of the California Public Utilities Code, defined metering and interconnection requirements – see http://www.leginfo.ca.gov/cgi-bin/waisgate?WAISdocID=5520158037+3+0+0&WAISaction=retrieve

IEEE 519-1992, *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.*

UL Standard 1741, *Static Inverters and Charge Controllers for use in Photovoltaic Power Systems,*

IEEE P1547, *Standard for Distributed Resources Interconnected with Electric Power Systems*

IEEE P1547.3 - Draft Guide for Monitoring, Information Exchange and Control of Distributed Resources Interconnected with Electric Power Systems. See http://grouper.ieee.org/groups/scc21/1547.3/1547.3_index.html