The Utility Use Case #2

Utility and or Customer Provides Electrical Energy Storage in Conjunction with Photovoltaic

Date 12-15-2009, Version 1.9

1 Descriptions of Function

1.1 Function Name

Utility and or Customer Provides Electrical Energy Storage in Conjunction with Photovoltaic

1.2 Function ID

IECSA identification number of the function

L-11.1.2

1.3 Brief Description

This use case will describe the process to allow the Utility and/or a Customer to provide electrical energy storage in conjunction with PV.
In the first scenario the Customer uses AMI data, including dynamic economic signals (or tariffs), to adjust their load profile using electrical energy storage to optimize their energy costs/profits. The second scenario the Utility utilizes energy storage to mitigate adverse affects on voltage levels due to sudden output reductions impacting Load Tap Changers and Capacitor Bank Controls. The issue of how the Utility will strategically implement electrical energy storage, Load Tap Changers and Capacitor Bank Controls to minimize the affects of large scale cloud transients on the PV systems will be addressed here.

1.4 Narrative

Until recently distributed generation at the Utility has had an insignificant contribution to the resource portfolio. The state of New Mexico (NM) Renewable Portfolio Standard, enacted in 2006 is starting to drive larger quantities of renewables, and due to the "distributed generation (DG) carve out", increasing amounts of Distributed Generation. The "carve out" states that by 2011 1.5% of the 10% renewable energy requirement shall be met with Distributed Generation. This number increases to 3% by 2015 when the

total renewable requirement rises from 10 to 15%. These requirements will require a substantial increase in Distributed Generation, requiring 15MW in 2011, jumping to 45MW of Distributed Generation by 2015.
Of all the Distributed Generation technology options available; solar PV has the greatest potential and is expected to dominate due to its lower cost, lower projected cost (due to global manufacturing increase), high local and regional insolation, lower installation cost, lack of emissions, abundance of open space and ease of integration. Other Distributed Generation technologies may play a part but are expected to have a limited impact. Although combined heat and power (CHP) (also known as cogeneration) is an efficient, clean and reliable approach to generating power and thermal energy from a single fuel source; the CHP technologies lack the numerous heat sinks required for this to be an effective Distributed Generation source for the Utility at this time. There are opportunities for small bio mass and land fill applications that may be pursued but they are not expected to contribute near the extent that PV will.
Distributed Generation control using either direct inverter control or through 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 Distributed Generation.
The following are general benefits that can be derived from Distributed Generation.

- Distributed Generation can serve as a voltage support mechanism
- Distributed Generation can offset fuel costs and prevent some peaking resource operation
- Distributed Generation can potentially offset or defer distribution capital costs related to build outs and upgrades at the substation and feeder level

By incorporating electrical energy storage with PV, these general benefits can be seen and expanded through the ability of the combination to create a dispatchable and perhaps peaking oriented resource. PV's intermittency precludes many of these general benefits from being obtained. Adding storage creates a distributed resource that can be firmly operated or dispatched, whose benefits are known before hand and can then be implemented in the standard design of new substations, feeders and the upgrades of existing substations and feeders.

This use case will walk through the implementation of electrical energy storage by a Customer and by the utility. Two primary scenarios will be used:

- Customer uses AMI data including dynamic economic signals (or tariffs) to adjust their load profile using electrical energy storage to optimize their energy costs and/or profits
- Utility utilizes energy storage to mitigate adverse affects on voltage levels due to sudden output reductions impacting Load Tap Changers and Capacitor Bank Controls

This use case augments UC-1 where the Customer adds PV with or without AMI.
In the first scenario the Customer already has PV equipment installed but finds that the peak output of the solar panels does not coincide with the time when he needs the power. The Customer adds batteries locally which are used to store the electrical energy

from the solar panels. The batteries then source the energy needed when the Customer peak load requires it. This system enables the large commercial or industrial Customer to reduce peak load and thus reduce (possibly significantly) his cost of power from the utility.
In the second scenario the utility already has PV equipment installed but finds there are adverse affects on voltage levels due to sudden output reductions from the solar panels impacting Load Tap Changer Controls and Capacitor Bank Controls. The output voltage changes from the PV equipment are frequent enough that the duty cycle for the Load Tap Changer Controls and Capacitor Bank Controls equipment is far higher than before the PV equipment was installed. This will lead to higher maintenance costs and premature failure of this equipment. The utility adds batteries locally which are used to store the electrical energy from the solar panels. The batteries then source the energy needed on the feeder when the output of the PV equipment changes. The result is a reduction in the voltage changes on the feeder and a reduction in the duty cycle for the Load Tap Changer Controls and Capacitor Bank Controls equipment.

Scenario 1

Customer uses AMI data including dynamic economic signals (or tariffs) to adjust their load profile using electrical energy storage to optimize their energy costs / profits. Customer uses electrical energy storage to optimize load profile.
This use case augments UC-1 where the Customer adds PV with or without AMI.
In the first scenario the Customer already has PV equipment installed but finds that the peak output of the solar panels does not coincide with the time when he needs the power. The Customer adds batteries locally which are used to store the electrical energy from the solar panels. The batteries then source the energy needed when the Customer peak load requires it. This system enables the large commercial or industrial Customer to reduce peak load and thus reduce (possibly significantly) his cost of power from the utility.

Scenario 2

Utility utilizes energy storage to mitigate adverse affects on voltage levels due to sudden output reductions impacting Load Tap Changer Controls and Capacitor Bank Controls
In this scenario the utility already has PV equipment installed but finds there are adverse affects on voltage levels due to sudden output reductions from the solar panels impacting Load Tap Changers and Capacitor Bank Controls. The output voltage changes from the PV equipment are frequent enough that the duty cycle for the Load Tap Changers and Capacitor Bank Controls is far higher than before the PV equipment was installed. This will lead to higher maintenance costs and premature failure of this equipment. The utility adds batteries locally which are used to store the electrical energy from the solar panels. The batteries then source the energy needed on the feeder when the output of the PV equipment changes. The result is a reduction in the voltage changes on the feeder and a reduction in the duty cycle for the Load Tap Changers and Capacitor Bank Controls while maintaining feeder voltage within ANSI Range A limits.

1.5 Actor (Stakeholder) Roles

Grouping (Community)		*Group Description*
Actors Functioning from Customer Premises		*Actors that perform their specific functions from the Customer premises.*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
Customer Storage Battery and Charging System	System	The storage batteries used to store the electrical energy and the monitoring system to change the charge/discharge rate and status of the batteries. Charging system may be capable of communicating key data to other applications. System owned by the Customer.
Home Area Network	System	HAN. Any Customer side automation that can make use of utility signals to affect energy usage within the premises will be considered as the Home Area Network for this project. Home Area Network can affect DER, lighting, security, etc. The Utility will not own Home Area Network.
Customer Energy Management System	System	CEMS. Customer owned premise system which interfaces with the Home Area Network and the AMI Premise Interface to provide services for load management and distributed generation. Additionally, may provide the Customer ability to control Customer owned equipment independent of the AMI.
Customer	Person	Residential or small business energy user that has a contract with the utility to receive electrical service from the utility and have a meter installed (possibly an AMI Meter). The Customer may or may not participate in programs provided by the utility including pricing events, load control or distributed generation.
AMI Renewable Energy Credit Meter	Device	AMI REC Meter. AMI Renewable Energy Credit Meter is a revenue grade meter used to measure the energy supplied by Customer Owned Distributed Generation. The Renewable Energy Credit Meter information is recorded and forwarded to the PV Program Manager. Advanced electric revenue meter capable of two-way communications with the utility. A device that serves as a gateway between the

Grouping (Community)		*Group Description*
Actors Functioning from Customer Premises		*Actors that perform their specific functions from the Customer premises.*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
		utility, Customer site, and load controllers of the Customer. The meter measures, records, displays, and transmits data such as energy usage, generation, text messages, event logs, etc. to authorized systems (i.e., the AMI Network Management System) and provides other advanced utility functions.
Customer Owned Distributed Generation	Device	DG. Distributed Generation that the Customer or agent of the Customer owns and operates at its premise.
AMI Net/Billing Meter	Device	AMI Net/Billing Meter is a bi-directional revenue grade meter used to measure energy supplied by the Distributed Generation or used by the Customer. Advanced electric revenue meter capable of two-way communications with the utility. A device that serves as a gateway between the utility, Customer site, and load controllers of the Customer. The meter measures, records, displays, and transmits data such as energy usage, generation, text messages, event logs, etc. to authorized systems (i.e., the AMI Network Management System) and provides other advanced utility functions.
AMI Meter	Device	Advanced electric revenue meter capable of two-way communications with the utility. A device that serves as a gateway between the utility, Customer site, and Customer load controllers. The meter measures, records, displays, and transmits data such as energy usage, generation, text messages, event logs, etc. to authorized systems (i.e., the AMI Network Management System) and provides other advanced utility functions.
AMI Premise Interface	System	The AMI Premise Interface is one of the communications radios that could be "under glass" of the AMI Meter. (There are two radios built in to the AMI Meter. One is for the AMI System and is a longer range radio. The other is for the AMI Premise Interface and it has a smaller range.) This is the communication resource to

Grouping (Community)		*Group Description*
Actors Functioning from Customer Premises		*Actors that perform their specific functions from the Customer premises.*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
		the Inverter and the Home Area Network (if available).
Customer Inverter	Device	Equipment at the Customer site belonging to the Customer that can be used for control of Distributed Generation real and reactive power output.
Customer Predefined Profile	System	The Customer completes a profile upon installation that will determine how the Customer premise will function under different circumstances (pricing, etc.). This profile is programmed into the Customer Energy Management System.

Grouping (Community)		*Group Description*
The Utility Actors		*Actors that perform their specific functions as a part of the Utility*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
The Utility	System	Host utility.
Meter Data Management System	System	MDMS. System that gathers, validates, estimates and permits editing of meter data such as energy usage, generation, and meter logs. It stores this data for a limited amount of time before it goes to a data warehouse (Meter Data Archive), and makes this data available to authorized systems and authorized personnel.
Distributed Resource Availability and Control System	System	DRAACS. System and subsystems responsible for maintaining an estimate, with a known precision, of how much resource is available for dispatch. Distributed Resource Availability and Control System is also responsible for accepting requests for blocks of energy and/or capacity and implementing that request by issuing load

Grouping (Community)		*Group Description*
The Utility Actors		*Actors that perform their specific functions as a part of the Utility*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
		control requests. Distributed Resource Availability and Control System contains an optimization function that can determine the optimal Customer set to request curtailment from based upon a variety of factors/parameters, including the size and location of the desired Demand Response (DR) resource. Distributed Resource Availability and Control System is expected to track the "as implemented" response to load control requests and issue additional load reduction requests to selected Customer sets until authorized load reduction target is met. Distributed Resource Availability and Control System uses measured responses to load demand requests to refine its internal model. Note: Any Distributed Resource Availability and Control System in use today may be parts of other systems being used. No platform exists to bring it into an operational tool today.
Grid Control Center	System	GCC. The Grid Control Center controls grid operations through the Energy Management System, SCADA and Distribution Management System in the control area. The Grid Control Center will communicate to grid operators to ensure grid reliability and also sends signals.
Customer Information System	System	CIS. Maintains Customer contact information, calculates and formats Customer bills, receives, and applies payments for individual accounts. The system is responsible for storing Customer information such as site data, meter number, rates, and program participation.
Customer Service Representative	Person	CSR. Staff employed by the utility who respond to Customer complaints, to outage notifications, or to Customer requests to activate, modify and/or terminate delivery of service. Customer Service Representatives also enroll a Customer in utility sponsored programs and answer questions related to the energy consumption and cost data of the Customer. Many off-cycle reading, billing, work orders and diagnostics requests are initiated by the Customer Service Representative in

Grouping (Community)		*Group Description*
The Utility Actors		*Actors that perform their specific functions as a part of the Utility*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
		response to Customer contact.
AMI Network Management System	System	AMI NMS. AMI Network Management System is the utility back office system that is responsible for remote two-way communications with the AMI Meters to retrieve data and execute commands. The AMI Network Management System has the responsibility to balance load on the communications network resulting from scheduled meter reads and to retry meters when communications fail. AMI Network Management System is the component responsible for monitoring the health of the AMI system, managing and implementing remote firmware updates, configuration changes, provisioning functions, control and diagnostics.
PV Program Manager	Person	Person or department responsible for administering the retail solar program.
Distribution Management System	System	DMS. A system that integrates the functions of SCADA, outage management, work management, distribution load management, reactive control, and asset management into a single console and set of applications.
Load Tap Changer Controls	Device	LTC Controls. Tap changing device that senses voltage and changes taps to raise or lower the voltage to remain in a set bandwidth. These are deices that act automatically generally after sensing the voltage out-of-bandwidth for 30 seconds.
Capacitor Bank Controls	Device	Cap Bank Controls. The control units used to monitor and operate banks of capacitors on the lines. The Capacitor Bank Controls are used for power factor correction on the Utility's system. The banks are measured in volt-amperes reactive (VAr). The Capacitor Bank Controls work autonomously or can be controlled by SCADA.
AMI	System	Advanced Metering Infrastructure. Advanced electric revenue metering system capable of two-way communications between the Customer and the utility. A device

Grouping (Community)		*Group Description*
The Utility Actors		*Actors that perform their specific functions as a part of the Utility*
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
		that serves as a gateway (AMI Premise Interface) between the utility, Customer site, and load controllers of the Customer. The meter measures, records, displays, and transmits data such as energy usage, generation, text messages, event logs, etc. to authorized systems (i.e., the AMI Network Management System) and provides other advanced utility functions..
Voltage Measurement System	System	AMI Meters installed in critical location throughout the electric grid that check voltage and power quality parameters on the system. These meters report back to the Distribution Management System any out-of-range voltage parameters.
Volt/Volt-Ampere Reactive Power (VAR) Control Application	System	Voltage/VAR Control Application. Application that receives voltage information from the Voltage Measurement System and the Distribution Management System. The application is set up to ensure voltage stability on the grid.
Utility Inverter	Device	Equipment at the utility's site that can be used for control of Distributed Generation real and reactive power output.
Utility Storage Battery and Charging System	Device	Storage Battery and Charging System equipment at the utility's site that will be used for the charge/discharge and monitoring of the storage battery system.
Distribution Operations	Person	DO. Operating over the distribution system, using SCADA and Distribution Management System to make decisions concerning the distribution grid.

1.6 Information exchanged

Information Object Name	*Information Object Description*
Economic Event Information	Economic Event Information compiled by the PV Program manager to alert a Customer to an upcoming pricing event. The Economic Event Information will allow the Customer to alter their usage automatically via their Customer Energy Management System. The Economic Event Information will be compared to the Customer Predefined Profile and will allow the Customer Energy Management System to respond accordingly.
Charge/Discharge Command	A command signal that will request a specific charge or discharge response from the Customer Energy Management System to the Customer Storage Battery and Charging System.
Equipment Status Signal	The Equipment Status Signal is the signal sent from the Customer Inverter to inform the Meter Data Management System and the Distributed Resource Availability and Control System the status of the Customer Storage Battery and Charging System equipment or the Utility Storage Battery and Charging System equipment.
AMI Renewable Energy Credit Meter and AMI Net/Billing Meter Read Request	A request for a AMI Renewable Energy Credit Meter Read and a request for an AMI Net/Billing Meter Read
AMI Renewable Energy Credit Meter Read Request	A request for an AMI Renewable Energy Credit Meter Read.
AMI Net/Billing Meter Read Request	A request for an AMI Net/Billing Meter Read.
AMI Renewable Energy Credit Meter Data	Meter data for a specific AMI Renewable Energy Credit Meter. This data includes voltage, current, load and power quality parameters.
AMI Net/Billing Meter Data	Meter data for a specific AMI Renewable Energy Credit Meter. This data includes voltage, current, load and power quality parameters.
AMI Renewable Energy Credit Meter Data and AMI Net/Billing Meter Data	Meter data for a specific AMI Renewable Energy Credit Meter and meter data for a specific AMI Net/Billing Meter. This data includes voltage, current, load and power quality parameters.

Information Object Name	*Information Object Description*
Voltage Limit Event Alert	An AMI Net/Billing Meter (distribution node) detects a Voltage Limit Event Alert (voltage out of ANSI A standards) and sends the alert, jumping queue, to the AMI Network Management System via the AMI Infrastructure.
Acknowledgement of Voltage Limit Event Alert	An acknowledgement of the Voltage Limit Event Alert. This is typically acknowledged by the Distribution Operations at the Distribution Management System.
Begin the Volt/Volt-Ampere Reactive Power (VAR) Control Application	To initialize or begin Volt/Volt-Ampere Reactive Power (VAR) Control Application.
Data from the Distribution Management System	The Volt/Volt-Ampere Reactive Power (VAR) Control Application uses current system data from the Distribution management System to compile effected system equipment and effected area to develop a listing of equipment and commands to resolve the system problem.
Utility Storage Battery and Charging System Operational Command	A command signal that will request a specific charge or discharge response from the Utility Storage Battery and Charging System.
Voltage Limit Event Alert Data	Effected system equipment and metering data from a specific Voltage Limit Event Alert.
Relevant Voltage Limit Event Alert Data	All relevant historical data concerning a specific Voltage Limit Event Alert. This relevant historical data will be compiled and saved.

1.7 Activities/Services

Activity/Service Name	*Activities/Services Provided*

1.8 Contracts/Regulations

Contract/Regulation	*Impact of Contract/Regulation on Function*
Customer Distributed Generation Service Contract	No Customer can operate on the Utility's system in a manner that is detrimental to the Utility or other Customer.
Customer Pricing Contract	The Customer has signed a Customer Pricing Contract to allow them to adjust their loads and/or Distributed Generation source with pricing.
Customer	The Customer has completed a Predefined Profile for the normal use of their Distributed Generation installation. This profile has been programmed into the Customer Energy Management System. The Customer Energy Management System will function automatically based on this profile.

Policy	*From Actor*	*May*	*Shall Not*	*Shall*	*Description (verb)*	*To Actor*

Constraint	*Type*	*Description*	*Applies to*

2 Step by Step Analysis of Function

2.1 Steps to implement function - Scenario 1

Scenario 1 - Customer uses AMI data including dynamic economic signals (or tariffs) to adjust their load profile using electrical energy storage to optimize their energy costs and/or profits.

2.1.1 Preconditions and Assumptions

Actor/System/Information/Contract	*Preconditions or Assumptions*
Customer	AMI system provides price signal or tariff.
Customer	Storage owned, controlled and maintained by Customer.
Customer	Customer is exposed to variable price signal.
Customer	Inverters have to be communicating (two-way) and must be able to communicate with the Utility's Premise Interface system.
The Utility	AMI exists.
Customer	Home Area Network and AMI Premise Interface exist.
The Utility	The Utility has an aggregation level Distributed Generation application and review process.
The Utility	Assume the renewable cost threshold is not exceeded.
Customer	Tariffs and user agreements exist.
Customer	There is a functioning AMI infrastructure in place with communications to PV installations.
The Utility	NERC CIP requirements do not apply.
Customer	Renewable Energy Credit credits exist, are true and measurable.
Customer	Customer has ability to override utility signals, but will not during this scenario.
The Utility	Use Case-1 Scenario 3 (inverter control) is completed and operating.

Actor/System/Information/Contract	*Preconditions or Assumptions*
Customer	Home Area Network/Customer Energy Management System does not have control of the Customer Inverter. It may receive status information from the Customer Inverter.
Customer	The Customer has completed a Predefined Profile for the normal use of their Distributed Generation installation. This profile has been programmed into the Customer Energy Management System. The Customer Energy Management System will function automatically based on this profile.
Customer	Customer has given the Utility control of their Customer Storage Battery and Charging System via the Predefined Profile programmed into the Customer Energy Management System.
Customer	This scenario describes a non-emergency economic event. This does not cover a situation in which the Distribution Operations would need to be involved.

2.1.2 Steps

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
#	*Triggering event? Identify the name of the event*	*What other actors are primarily responsible for the Process/Activity? Actors are defined in section1.5.*	*Label that would appear in a process diagram. Use action verbs when naming activity.*	*Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. "If …Then…Else" scenarios can be captured as multiple Actions or as separate steps.*	*What other actors are primarily responsible for Producing the information? Actors are defined in section 1.5.*	*What other actors are primarily responsible for Receiving the information? Actors are defined in section1.5.* *(Note – May leave blank if same as Primary Actor)*	*Name of the information object. Information objects are defined in section 1.6*	*Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren't captured in the spreadsheet.*	*Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.*
1.1	The Utility calls a (non-emergency) economic event on the system.	PV Program Manager	Enters Economic Event Information	PV Program Manager enters the Economic Event Information into the Meter Data Management System.	PV Program Manager	Meter Data Management System	Economic Event Information	This information will be sent to the Customer.	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
1.1.1	Meter Data Management System sends Economic Event Information to AMI Network Management System	Meter Data Management System	Meter Data Management System sends Economic Event Information to AMI Network Management System	The Meter Data Management System sends the Economic Event Information to the AMI Network Management System.	Meter Data Management System	AMI Network Management System	Economic Event Information		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
1.1.2	AMI Network Management System sends Economic Event Information to AMI Premise Interface	AMI Network Management System	AMI Network Management System sends Economic Event Information to AMI Premise Interface	The AMI Network Management System pushes the Economic Event Information out to the AMI Premise Interface via the AMI Infrastructure.	AMI Network Management System	AMI Premise Interface	Economic Event Information		
1.1.3	Economic Event Information Delivered to the Customer Energy Management System	AMI Premise Interface	Economic Event Information Delivered to the Customer Energy Management System	The AMI Premise Interface delivers the Economic Event Information to the Customer Energy Management System via the Home Area Network.	AMI Premise Interface	Customer Energy Management System	Economic Event Information		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
1.1.4	Customer Energy Management System Compares Economic Event Information with Customer Profile	Customer Energy Management System	Customer Energy Management System Compares Economic Event Information with Customer Profile	The Customer Energy Management System compares the Economic Event Information to the Customer Predefined Profile and processes a Charge/Discharge Command.	Customer Energy Management System	Customer Energy Management System	Economic Event Information		
1.1.5	Charge/Discharge Command to the Customer Storage Battery and Charging System	Customer Energy Management System	Charge/Discharge Command to the Customer Storage Battery and Charging System	The Customer Energy Management System sends a Charge/Discharge Command to the Customer Storage Battery and Charging System via the Home Area Network.	Customer Energy Management System	Customer Storage Battery and Charging System	Charge/Discharge Command		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
1.1.6	Response to Charge/Discharge Command	Customer Storage Battery and Charging System	Response to Charge/Discharge Command	The Customer Storage Battery and Charging System responds to the Charge/Discharge Command.	Customer Storage Battery and Charging System	Customer Storage Battery and Charging System	Charge/Discharge Command		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
1.2	Customer Inverter Senses Status	Customer Inverter	Customer Inverter Senses Status	The Customer Inverter senses an Equipment Status Signal from the Customer Storage Battery and Charging System and responds accordingly.	Customer Storage Battery and Charging System	Customer Inverter	Equipment Status Signal	The Customer Inverter and the Customer Storage Battery and Charging System can't have direct communication due to security concerns. So the Customer Inverter senses an Equipment Status Signal and acts accordingly.	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
1.2.1	Equipment Status Signal Sent by Customer Inverter	Customer Inverter	Equipment Status Signal Sent by Customer Inverter	The Customer Inverter sends an Equipment Status Signal (status of the Customer Storage Battery and Charging System) to the AMI Premise Interface.	Customer Inverter	AMI Premise Interface	Equipment Status Signal		
1.2.2	Equipment Status Signal Sent by AMI Premise Interface	AMI Premise Interface	Equipment Status Signal Sent by AMI Premise Interface	The AMI Premise Interface sends the Equipment Status Signal to the AMI Network Management System via the AMI Infrastructure	AMI Premise Interface	AMI Network Management System	Equipment Status Signal		
1.2.3	Equipment Status Signal Sent by AMI Network Management System	AMI Network Management System	Equipment Status Signal Sent by AMI Network Management System	The AMI Network Management System sends the Equipment Status Signal to the Meter Data Management System.	AMI Network Management System	Meter Data Management System	Equipment Status Signal		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
1.2.4	Distributed Resource Availability and Control System Receives Signal	AMI Network Management System	Distributed Resource Availability and Control System Receives Signal	Distributed Resource Availability and Control System receives the Equipment Status Signal from the AMI Network Management System.	AMI Network Management System	Distributed Resource Availability and Control System	Equipment Status Signal		
1.3	Meter Data Management System requests Meter Reads	Meter Data Management System	Meter Data Management System requests Meter Reads	The Meter Data Management System places a request for AMI Renewable Energy Credit Meter and AMI Net/Billing Meter reads during the next metering reading interval to the AMI Network Management System.	Meter Data Management System	AMI Network Management System	AMI Renewable Energy Credit Meter and AMI Net/Billing Meter Read Request		
1.3A.1	AMI Renewable Energy Credit Meter Read Request	AMI Network Management System	AMI Renewable Energy Credit Meter Read Request	The AMI Network Management System Delivers the Meter Read Request to the AMI Renewable Energy Credit Meter via the AMI Infrastructure	AMI Network Management System	AMI Renewable Energy Credit Meter	AMI Renewable Energy Credit Meter Read Request		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
1.3B.1	AMI Net/Billing Meter Read Request	AMI Network Management System	AMI Net/Billing Meter Read Request	The AMI Network Management System Delivers the Meter Read Request to the AMI Net/Billing Meter via the AMI Infrastructure	AMI Network Management System	AMI Net/Billing Meter	AMI Net/Billing Meter Read Request		
1.3A.2	AMI Renewable Energy Credit Meter Data	AMI Renewable Energy Credit Meter	AMI Renewable Energy Credit Meter Data	The AMI Renewable Energy Credit Meter sends the AMI Renewable Energy Credit Meter Data to the AMI Network Management System via the AMI Infrastructure.	AMI Renewable Energy Credit Meter	AMI Network Management System	AMI Renewable Energy Credit Meter Data		
1.3B.2	AMI Net/Billing Meter Data	AMI Net/Billing Meter	AMI Net/Billing Meter Data	The AMI Net/Billing Meter sends the AMI Net/Billing Meter Data to the AMI Network Management System via the AMI Infrastructure.	AMI Net/Billing Meter	AMI Network Management System	AMI Net/Billing Meter Data		
1.3.1	Meter Data to the Meter Data Management System	AMI Network Management System	Meter Data to the Meter Data Management System	The AMI Network Management System delivers the AMI Renewable Energy Credit Meter Data and the AMI Net/Billing Meter Data to the Meter Data Management System.	AMI Network Management System	Meter Data Management System	AMI Renewable Energy Credit Meter Data and AMI Net/Billing Meter Data		

2.1.3 Post-conditions and Significant Results

Actor/Activity	*Post-conditions Description and Results*
Customer	Customer has researched their options and will have their Distributed Generation System act accordingly to benefit their costs/payback.
Customer	Customer Storage Battery and Charging System charging system shall detect when battery is fully charged.
The Utility	AMI Renewable Energy Credit Meter only allows power to flow one direction (out)
Customer	Battery charging comes ONLY from PV
Customer	Customer Energy Management System shall be able to accept economic signal from PV Program Manager
Customer	Customer Energy Management System capable of energy and cost optimization based on the Customer's Predefined Profile.
Customer	AMI meter data provides feedback to measure Customer response to economic signal
The Utility	Distributed Resource Availability and Control System shall retrieve data from Meter Data Management System via AMI Infrastructure to determine effectiveness of economic signal response.
The Utility	PV Program Manager may creates economic signal (Day ahead, RT, TOU, etc)

2.2 Steps to implement function - Scenario 2

Scenario 2 - Utility utilizes energy storage to mitigate adverse affects on voltage levels due to sudden output reductions impacting Load Tap Changers and Capacitor Bank Controls.

2.2.1 Preconditions and Assumptions

Actor/System/Information/Contract	*Preconditions or Assumptions*
The Utility	Utility has installed energy storage on distribution grid at centralized locations (not on Customer site).
The Utility	Utility placement of energy storage determined from system study.
The Utility	Utility owned PV at central location(s) and Customer owned PV installed in many locations on distribution grid.
The Utility	Central storage is utility owned and controlled.
The Utility	Amount of storage is proportional to PV on system.
The Utility	Utility has no control over distributed PV
The Utility	Distribution system is urban not rural (no voltage regulation).
The Utility	Grid can support all power requirements even without utility PV and storage

2.2.2 Steps

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
#	*Triggering event? Identify the name of the event*	*What other actors are primarily responsible for the Process/Activity? Actors are defined in section1.5.*	*Label that would appear in a process diagram. Use action verbs when naming activity.*	*Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. "If …Then…Else" scenarios can be captured as multiple Actions or as separate steps.*	*What other actors are primarily responsible for Producing the information? Actors are defined in section 1.5.*	*What other actors are primarily responsible for Receiving the information? Actors are defined in section1.5.* *(Note – May leave blank if same as Primary Actor)*	*Name of the information object. Information objects are defined in section 1.6*	*Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren't captured in the spreadsheet.*	*Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.*
2.1	A distribution node (AMI Net/Billing Meter) detects a Voltage Limit Event.	AMI Net/Billing Meter	An AMI Net/Billing Meter detects a Voltage Limit Event Alert	An AMI Net/Billing Meter (distribution node) detects a Voltage Limit Event Alert (voltage out of ANSI A standards) and sends the alert, jumping queue, to the AMI Network Management System via the AMI Infrastructure.	AMI Net/Billing Meter	AMI Network Management System	Voltage Limit Event Alert	This Voltage Limit Event Alert will end up at the Distribution Management System.	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.1.1	The AMI Network Management System sends the Alert to the Meter Data Management System	AMI Network Management System	The AMI Network Management System sends the Alert to the Meter Data Management System	The AMI Network Management System sends the Voltage Limit Event Alert to the Meter Data Management System	AMI Network Management System	Meter Data Management System	Voltage Limit Event Alert		
2.1.2	The AMI Network Management System delivers Alert.	AMI Network Management System	The AMI Network Management System delivers Alert.	The AMI Network Management System delivers the Voltage Limit Alert to the Volt/Volt-Ampere Reactive Power (VAR) Control Application.	AMI Network Management System	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Voltage Limit Event Alert		
2.1.3	The AMI Network Management System delivers Alert to the Distribution Management System.	AMI Network Management System	The AMI Network Management System delivers Alert to the Distribution Management System.	The AMI Network Management System delivers the Voltage Limit Alert to the Distribution Management System.	AMI Network Management System	Distribution Management System	Voltage Limit Event Alert		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.2	The Distribution Operations acknowledges the Voltage Limit Event Alert.	Distribution Operations	The Distribution Operations acknowledges the Voltage Limit Event Alert.	The Distribution Operations acknowledges the Voltage Limit Event Alert at the Distribution Management System.	Distribution Operations	Distribution Management System	Acknowledgement of Voltage Limit Event Alert		
2.4	The Distribution Operations begins the Volt/Volt-Ampere Reactive Power (VAR) Control Application.	Distribution Operations	The Distribution Operations begins the Volt/Volt-Ampere Reactive Power (VAR) Control Application.	The Distribution Operations begins the Volt/Volt-Ampere Reactive Power (VAR) Control Application.	Distribution Operations	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Begin the Volt/Volt-Ampere Reactive Power (VAR) Control Application	From the Distribution Management System station.	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
2.4.1	The Volt/Volt-Ampere Reactive Power (VAR) Control Application collects data from the Distribution Management System.	Volt/Volt-Ampere Reactive Power (VAR) Control Application	The Volt/Volt-Ampere Reactive Power (VAR) Control Application collects data from the Distribution Management System.	The Volt/Volt-Ampere Reactive Power (VAR) Control Application collects data from the Distribution Management System concerning effected equipment including Utility Storage Battery and Charging System and area.	Distribution Management System	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Data from the Distribution Management System	Includes effected equipment including Utility Storage Battery and Charging System and area.	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.4.2	The Volt/Volt-Ampere Reactive Power (VAR) Control Application sends Operational Command to the Distribution Management System.	Volt/Volt-Ampere Reactive Power (VAR) Control Application	The Volt/Volt-Ampere Reactive Power (VAR) Control Application sends Operational Command to the Distribution Management System.	The Volt/Volt-Ampere Reactive Power (VAR) Control Application sends Utility Storage Battery and Charging System Operational Command to the Distribution Management System.	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Distribution Management System	Utility Storage Battery and Charging System Operational Command		
2.4.3	The Distribution Management System Sends Operational Command to the AMI Network Management System.	Distribution Management System	The Distribution Management System Sends Operational Command to the AMI Network Management System.	The Distribution Management System Sends the Utility Storage Battery and Charging System Operational Command to the AMI Network Management System.	Distribution Management System	AMI Network Management System	Utility Storage Battery and Charging System Operational Command		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.4.4	The AMI Network Management System sends Operational Command to the Premise Interface.	AMI Network Management System	The AMI Network Management System sends Operational Command to the Premise Interface.	The AMI Network Management System sends the Utility Storage Battery and Charging System Operational Command to the Premise Interface.	AMI Network Management System	AMI Premise Interface	Utility Storage Battery and Charging System Operational Command		
2.4.5	The AMI Premise Interface Sends Operational Command to the Utility Inverter	AMI Premise Interface	The AMI Premise Interface Sends Operational Command to the Utility Inverter	The AMI Premise Interface Sends the Utility Storage Battery and Charging System Operational Command to the Utility Inverter	AMI Premise Interface	Utility Inverter	Utility Storage Battery and Charging System Operational Command		
2.4.6	The Utility Inverter processes Operational Command.	Utility Inverter	The Utility Inverter processes Operational Command.	The Utility Inverter processes Utility Storage Battery and Charging System Operational Command and sends it to the Utility Storage Battery and Charging System.	Utility Inverter	Utility Storage Battery and Charging System	Utility Storage Battery and Charging System Operational Command		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.4.7	The Utility Storage Battery and Charging System responds accordingly.	Utility Storage Battery and Charging System	The Utility Storage Battery and Charging System responds accordingly.	The Utility Storage Battery and Charging System processes Utility Storage Battery and Charging System Operational Command and responds accordingly.	Utility Storage Battery and Charging System	Utility Storage Battery and Charging System	Utility Storage Battery and Charging System Operational Command		
2.5	The Utility Storage Battery and Charging System sends an Equipment Status Signal.	Utility Storage Battery and Charging System	The Utility Storage Battery and Charging System sends an Equipment Status Signal.	The Utility Storage Battery and Charging System sends a Utility Storage Battery and Charging System Equipment Status Signal to the Utility Inverter.	Utility Storage Battery and Charging System	Utility Inverter	Equipment Status Signal		
2.5.1	The Utility Inverter sends an Equipment Status Signal.	Utility Inverter	The Utility Inverter sends an Equipment Status Signal.	The Utility Inverter sends a Utility Storage Battery and Charging System Equipment Status Signal to the AMI Premise Interface.	Utility Inverter	AMI Premise Interface	Equipment Status Signal		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.5.2	The AMI Premise Interface sends an Equipment Status Signal.	AMI Premise Interface	The AMI Premise Interface sends an Equipment Status Signal.	The AMI Premise Interface sends a Utility Storage Battery and Charging System Equipment Status Signal to the AMI Network Management System.	AMI Premise Interface	AMI Network Management System	Equipment Status Signal		
2.5.3	The AMI Network Management System sends an Equipment Status Signal.	AMI Network Management System	The AMI Network Management System sends an Equipment Status Signal.	The AMI Network Management System sends a Utility Storage Battery and Charging System Equipment Status Signal to the Distribution Management System.	AMI Network Management System	Distribution Management System	Equipment Status Signal		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.5.4	The Distribution Management System sends a Utility Storage Battery and Charging System Equipment Status Signal.	Distribution Management System	The Distribution Management System sends a Utility Storage Battery and Charging System Equipment Status Signal.	The Distribution Management System sends a Utility Storage Battery and Charging System Equipment Status Signal to the Volt/Volt-Ampere Reactive Power (VAR) Control Application.	Distribution Management System	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Equipment Status Signal		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.6	The Meter Data Management System sends an AMI Renewable Energy Credit Meter Read Request.	Meter Data Management System	The Meter Data Management System sends an AMI Renewable Energy Credit Meter Read Request.	The Meter Data Management System sends an AMI Renewable Energy Credit Meter Read Request to the AMI Network Management System.	Meter Data Management System	AMI Network Management System	AMI Renewable Energy Credit Meter Read Request	A request for an AMI Renewable Energy Credit Meter Read.	
2.6.1	The AMI Network Management System delivers the AMI Renewable Energy Credit Meter Read Request.	AMI Network Management System	The AMI Network Management System delivers the AMI Renewable Energy Credit Meter Read Request.	The AMI Network Management System delivers the AMI Renewable Energy Credit Meter Read Request to the AMI Renewable Energy Credit Meter via the AMI Infrastructure.	AMI Network Management System	AMI Renewable Energy Credit Meter	AMI Renewable Energy Credit Meter Read Request		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.6.2	AMI Renewable Energy Credit Meter sends metering data to the AMI Network Management System.	AMI Renewable Energy Credit Meter	AMI Renewable Energy Credit Meter sends metering data to the AMI Network Management System.	AMI Renewable Energy Credit Meter sends AMI Renewable Energy Credit Meter Data to the AMI Network Management System via the AMI Infrastructure.	AMI Renewable Energy Credit Meter	AMI Network Management System	AMI Renewable Energy Credit Meter Data		
2.6.3	The AMI Network Management System delivers AMI Renewable Energy Credit Meter Data.	AMI Network Management System	The AMI Network Management System delivers AMI Renewable Energy Credit Meter Data.	The AMI Network Management System delivers AMI Renewable Energy Credit Meter Data to the Meter Data Management System.	AMI Network Management System	Meter Data Management System	AMI Renewable Energy Credit Meter Data		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.6.4	The Distribution Management System receives AMI Renewable Energy Credit Meter Data.	AMI Network Management System	The Distribution Management System receives AMI Renewable Energy Credit Meter Data.	The Distribution Management System receives AMI Renewable Energy Credit Meter Data from the AMI Network Management System.	AMI Network Management System	Distribution Management System	AMI Renewable Energy Credit Meter Data		
2.6.5	The Volt/Volt-Ampere Reactive Power (VAR) Control Application Receives Renewable Energy Credit Meter Data.	Distribution Management System	The Volt/Volt-Ampere Reactive Power (VAR) Control Application Receives Renewable Energy Credit Meter Data.	The Volt/Volt-Ampere Reactive Power (VAR) Control Application Receives AMI Renewable Energy Credit Meter Data from the Distribution Management System.	Distribution Management System	Volt/Volt-Ampere Reactive Power (VAR) Control Application	AMI Renewable Energy Credit Meter Data		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.7	The Volt/Volt-Ampere Reactive Power (VAR) Control Application Receives Voltage Limit Event Alert Data.	Volt/Volt-Ampere Reactive Power (VAR) Control Application	The Volt/Volt-Ampere Reactive Power (VAR) Control Application Receives Voltage Limit Event Alert Data.	The Volt/Volt-Ampere Reactive Power (VAR) Control Application Receives Voltage Limit Event Alert Data from the Distribution Management System.	Distribution Management System	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Voltage Limit Event Alert Data		
2.7.1	The Volt/Volt-Ampere Reactive Power (VAR) Control Application compiles all relevant Voltage Limit Event Alert Data.	Volt/Volt-Ampere Reactive Power (VAR) Control Application	The Volt/Volt-Ampere Reactive Power (VAR) Control Application compiles all relevant Voltage Limit Event Alert Data.	The Volt/Volt-Ampere Reactive Power (VAR) Control Application compiles all Relevant Voltage Limit Event Alert Data and sends it to the Distribution Management System.	Volt/Volt-Ampere Reactive Power (VAR) Control Application	Distribution Management System	Relevant Voltage Limit Event Alert Data		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IEC SA Environments
2.7.2	The Distribution Management System sends all relevant Voltage Limit Event Alert Data.	Distribution Management System	The Distribution Management System sends all relevant Voltage Limit Event Alert Data.	The Distribution Management System sends all Relevant Voltage Limit Event Alert Data To the Meter Data Management System.	Distribution Management System	Meter Data Management System	Relevant Voltage Limit Event Alert Data		

2.2.3 Post-conditions and Significant Results

Actor/Activity	*Post-conditions Description and Results*
The Utility	By using Utility storage, the Utility will be able to ensure the effects of the inherent PV fluctuations will not cause undo stress and operations on the Load Tap Changer Controls and Capacitor Bank Controls.
The Utility	Voltage Measurement System shall provide voltage profile of entire feeder
The Utility	Remote communications shall be enabled for Load Tap Changer Controls and Capacitor bank controls
The Utility	The Utility shall maintain feeder voltage within ANSI"A" guidelines
The Utility	Voltage/VAR application shall track Load Tap Changer Controls and Capacitor Bank Controls actions (counts).
The Utility	Utility owned PV status can be derived from SCADA.
The Utility	Battery storage technology shall respond fast enough and with sufficient duration to mitigate Load Tap Changer Controls operations due to PV ramp rate
Customer	If the battery is drained, the Customer Inverter or the Customer Energy Management System

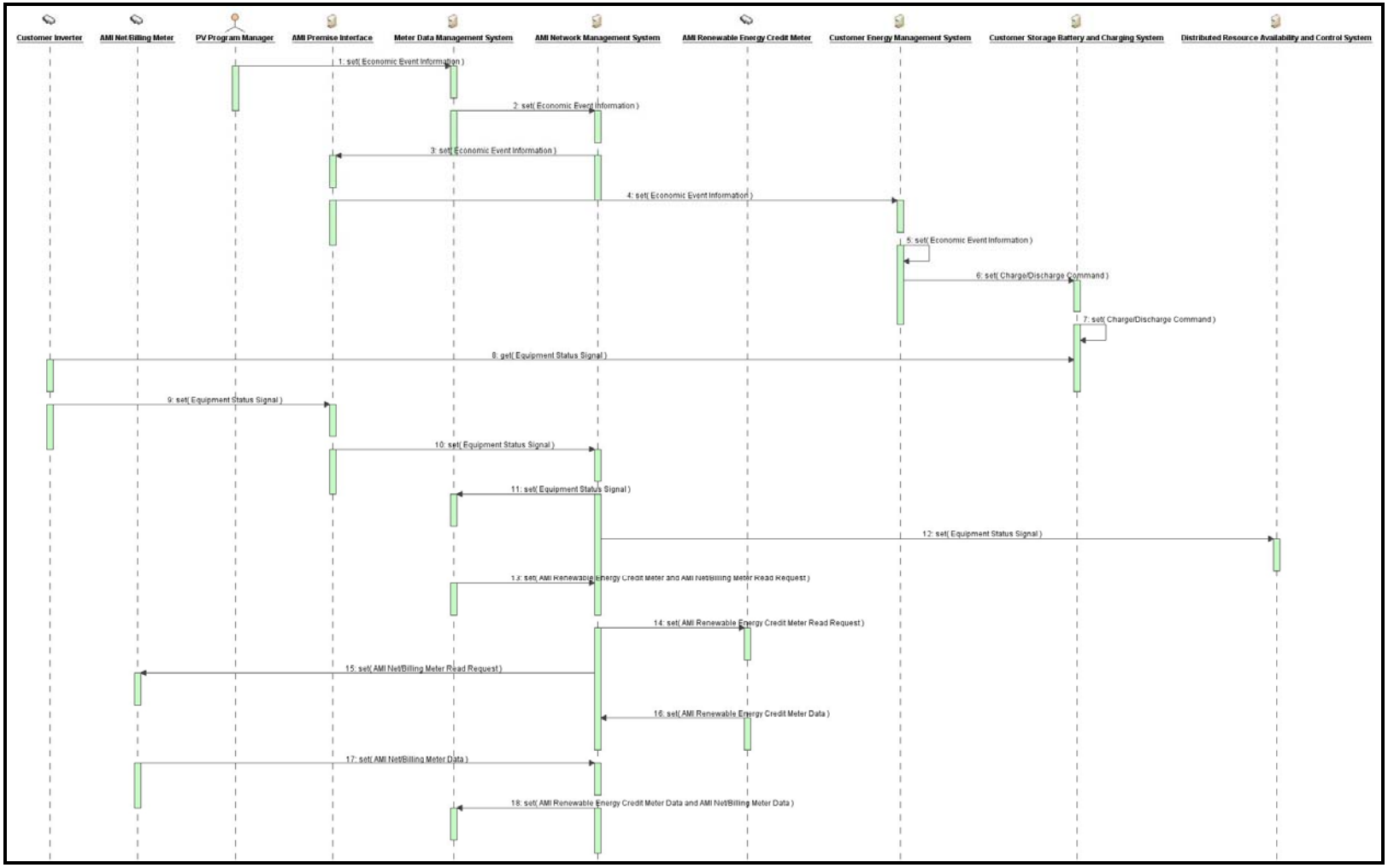
Actor/Activity	*Post-conditions Description and Results*
	shall divert PV output to battery and isolate both from the grid.

2.3 Architectural Issues in Interactions

Elaborate on all architectural issues in each of the steps outlined in each of the sequences above. Reference the Step by number. Double click on the embedded excel file – record the changes and save the excel file (this updates the embedded attachment).

"DomainTemplate - Architectural Issues.x

2.4 Additional Diagrams



Use Case 2 Scenario 1 Sequence Diagram

3 Auxiliary Issues

3.1 References and contacts

ID	Title or contact	Reference or contact information
[1]	ANSI C84.1-1995 Electrical Power Systems and Equipment – Voltage Ratings (60HZ0	ANSI A and ANSI B Voltage Requirements
[2]		

3.2 Common Terms and Definitions

ID	Term	Definition
[1]	**Feeder Penetration**	PV penetration is the rated capacity (KW) of the aggregated generation, including the proposed Generating Facility compared to the annual peak load (KW) as most recently measured at the substation or calculated for that portion of a public utility's electric system connected to a Customer bounded by automatic sectionalizing devices or the end of the distribution line. Units are % of peak on the feeder or portion of a public utility's electric system In Manuel's discussions with the state, "Distributed Generation will be viewed by the rating of devices at point of common coupling."
[2]	**AMI**	Advanced Metering Infrastructure. "AMI" for the Utility for this project- refers to systems that measure, collect and analyze energy usage, and send information to the Customer through advanced electricity meters, via various communication media on request or on a pre-defined schedule. This infrastructure includes advanced electrical meters, communications, and Meter Data Management software. The communication between the end use energy consumer and the utility is two way communications. The AMI infrastructure and communications for the purposes of this project ends at the meter, which provides a Premise Interface to the Inverter or possibly the Home Area Network.

[3]	**AMI Premise Interface**	The Premise Interface is one of the communications radios "under glass" of the AMI Meter. (There are two radios built in to the AMI Meter. One is for the AMI System and is a longer range radio. The other is for the Premise Interface and it has a smaller range.) This interfaces to the Customer Inverter and the Home Area Network (if available).
[4]	**Home Area Network**	Any Customer side automation that can make use of utility signals to affect energy usage within the premises will be considered as the Home Area Network for this project. Home Area Network can affect DER, lighting, security, etc. The Utility will not own Home Area Network.
[5]	**Smart Grid**	The Utility's perspective is that the "smart grid" is a grid that integrates the electrical grid with communications/ automation with a fully integrated IT infrastructure to enhance reliability, involve the consumer, and integrate distributed resources. It is the seamless integration of the electric network, a communications network, and all the necessary software and hardware to monitor, control and manage the creation, distribution, storage and consumption of energy by any Customer type. The smart grid of the future needs to be interactive, distributed, and extended to any consuming device.
[6]	**Real Time Pricing (RTP) Model**	An electricity pricing methodology that enables automatic Customer load response based on a pre-defined price matrix in response to a utility signal for hourly pricing.
[7]	**Distributed Generation (DG) and Distributed Energy Resource (DER)**	For this project Distributed Generation (DG) will be defined as utility or Customer provided photovoltaic generation or storage connected at the distribution voltage level (12.47kV) or service voltage level. Distributed Energy Resources (DER) on the other hand will include all Distributed Generation and demand response capability through the Home Area Network.
[8]	**Electrical Storage**	The definition for storage for this project will be considered electrical storage (providing a way to add electrons to the grid). Alternate Scenario (and UC-3 – DR): The definition for storage for this project will be electrical storage along with thermal storage (building envelop/thermal storage) and demand response techniques aligned with commercial and residential cooling and refrigeration systems in addition to innovative approaches to demand response aligned with data center energy consumption.

3.3 Action Item List

ID	Description	Status
[1]		
[2]		

3.4 Revision History

No	Date	Author	Description
1.1	8-15-09	Brian D. Green	Draft for Review
1.2	9-15-09	Ron Pasquarelli	Revise formatting and content for new IntelliGrid template
1.5	9-28-09	Ron Pasquarelli	Revise formatting and content for new IntelliGrid template
1.6	10-2-09	Ron Pasquarelli	Cleanup – add actor the Utility
1.7	10-06-09	Brian D. Green	Cleanup - Actors
1.8	10-06-09	Brian D. Green	Cleanup – Actors continued
1.9	12-15-09	Brian D. Green	Make the document generic and ready for posting on EPRI's Smart Grid Use Case Repository.

Endnotes