NEDO System Use Case #S1

Cooperative Control among Smart Grid and External Area EPS Energy Management Systems

Version 7.0

May 16, 2011

1 Descriptions of Function

This is a System Level Use Case which describes high level interaction among energy management systems (EMS) within an Area EPS.

1.1 Function Name

Cooperative control among the Smart Grid and external area electric power system (EPS) energy management systems (EMS).

1.2 Brief Description

This is a System Level Use Case which describes high level interaction among energy management systems (EMS) within an Area EPS. These EMS's include scheduling and power system operations within the Area EPS, called Web_trader/PSO, and a **Smart Grid energy management system,** called μ EMS. This use case describes cooperative control between the Smart Grid and the Area EPS. This use case also describes interaction between μ EMS and the PV/Load Forecasting system and Smart House. Interaction within the PV/Load Forecasting system and Smart House are described in Local Level Use Cases, respectively.

In the first Scenario, **Active Power Schedule Cooperation with external EMS**, specific considerations for cooperation between the μ EMS and Web_trader/PSO for making day-ahead (or n-days ahead) scheduling in the total Area EPS are described. The issue of how to realize total optimization in energy usage in both the Smart Grid and Area EPS is addressed.

In the second Scenario, **Active power Online Schedule Update cooperation with external EMS** is described in terms of economic power dispatch and the latest update for 2.5 hours ahead scheduling. Cooperation between the μ EMS and Web_trader/PSO is also considered.

In the third Scenario, **Voltage and Reactive power control within the Smart Grid** for energy storage and PV control is described.

1.3 Narrative

The Smart Grid is a localized power network consisting of Distributed Generation /Loads with bi-directional ICT communication. Energy usage *inside* the Smart Grid is optimized by its own energy management system. The term used for this special EMS is " μ EMS". This can be extended to the total optimization of the entire power network by the μ EMS cooperating with the external energy management. Inside the smart grid, on the other hand, there may be small "smart grids" such as HEMS, BEMS, etc. The μ EMS can also cooperate with these internal "EMS" so that they can realize optimal energy usage in a hierarchical manner. This use case describes these kinds of cooperation among the μ EMS, HEMS and external EMS of the Area EPS in terms of Scheduling (Scenario1), Online Schedule Updates (Scenario2) and hierarchical control inside the Smart grid (Scenario3).

The major Actors of this case are:

- μEMS (EMS for the Micro or Smart Grid)
- HEMS (home energy management system in a "smart house")
- PV_Output_Forecasting Systems (forecasts from local weather and specialized on-site measurements)
- AMI (advanced metering infrastructure – "smart meters")
- RTU (remote terminal unit at substation serving both)
- ES&PCS (energy storage and power conditioning system)
- PV&PCS (photovoltaic panels and power conditioning systems)
- μ EMS_Operator (micro EMS operator)
- Web_Trader (scheduling tool used by utility)
- PSO (power system operator in utility)
- PC (server in external Area EPS utility)

Scenario1: Active power Schedule Cooperation with external EMS

Optimal Scheduling in the Area EPS is considered in this scenario. This is executed on the day-ahead schedule (or upon a schedule change).

A one day-ahead schedule is described in this use case. (In case of a schedule change, the same sequence would be executed manually by the PSO Operator or the μ EMS_Operator).

Scenario2: Active power Online Schedule Update cooperating with external EMS

An online schedule update in the Area EPS is considered. This is executed every hour in the manner of 2 hours (to be prepared for 1.5 hours) ahead of the exact time. The online schedule becomes the base of real time control in the Smart Grid. (By using this Updated Schedule, real time active power control is performed. A control signal is sent to the ES_PCS and the PV_PCS every second; the DR signal is sent to the Smart House every 15 minutes or status change into emergency condition.

Scenario3: Voltage and Reactive power control in SG (energy storage control, PV control)

Feeder voltage is to be maintained within regulated range by the online control by μ EMS. This control to PV_PCS and ES_PCS is performed every 10 Minutes.

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As an example, Fig. 1 shows the Interaction among EMS in Smart Grids in New Mexico in the U.S.-Japan collaboration.

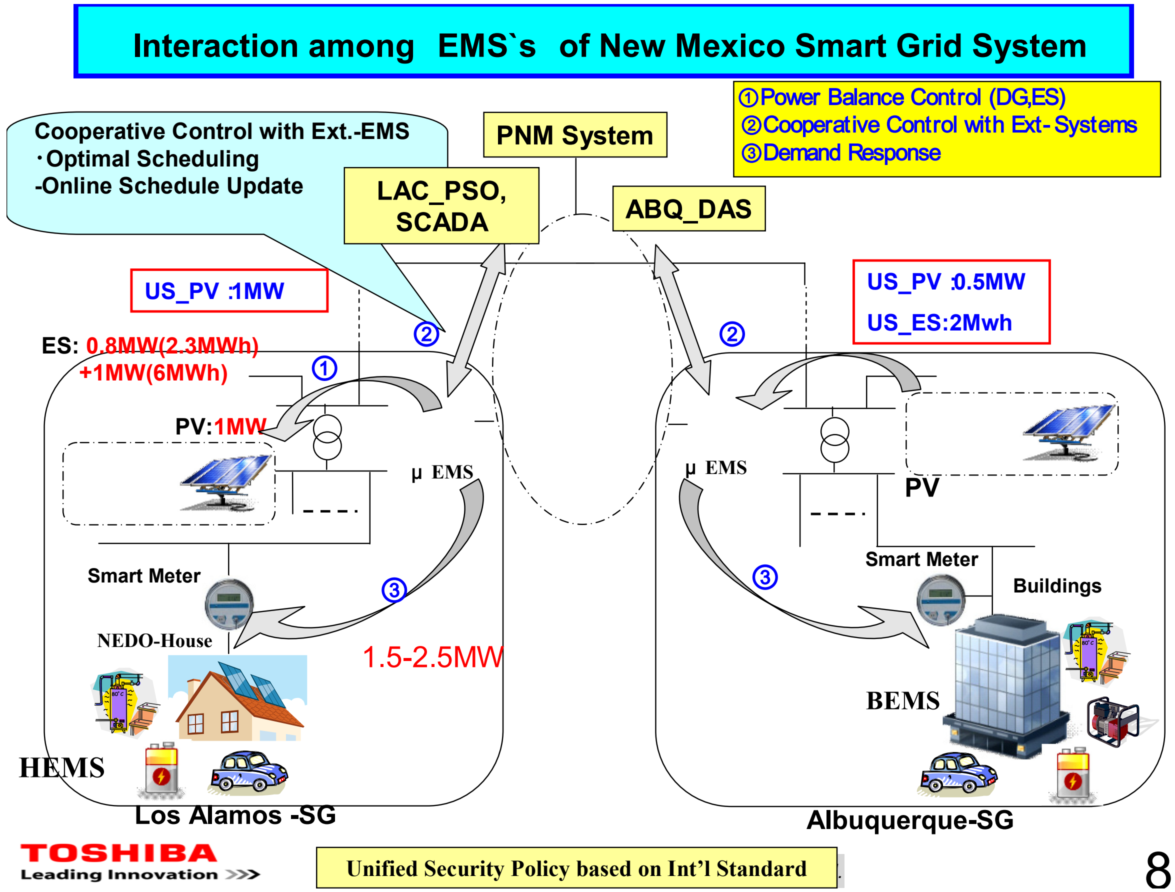

Fig. 1 Interaction among EMS in Smart Grids in New Mexico

1.4 Actor (Stakeholder) Roles

Grouping (Community) '		*Group Description*
Actors inside of Smart Grid		***Actors that perform their specific functions inside of Smart Grid***
Actor Name	*Actor Type (person, organization, device, system, or subsystem)*	*Actor Description*
μ EMS	System	Energy Management System dedicated to Smart Grid. This system enables monitor, control and scheduling of Smart Grid.
HEMS	System	Home Energy Management system. In this Use case, means Smart House. For details, please see Use Case #L4. "Equipment control within smart house by HEMS"
PV_Output_ Forecasting System	System	PV_Output_Forecasting System makes PV output prediction for long-term (8days hourly basis) and short –term (24 hours by minute). For details, please see Use case #L5 " PV_Output_Forecasting at Los Alamos County site".
AMI	Subsystem	Advanced Metering Infrastructure used to bidirectional communication between μ EMS and houses. con
RTU	Device	Remote Terminal Unit used to communicate μ EMS with Equipment Terminal Sensors.
ES&PCS	Device	Energy Storage and PCS. Control signal is sent to PCS from μ EMS. Actually, there are two kinds of ES (NaS and Lead-Acid). However, they operate almost identically in terms of high level description. μ EMS communicates with ES_PCS via TCP/IP for high speed operation.

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Grouping (Community)'		*Group Description*
Actors inside of Smart Grid		***Actors that perform their specific functions inside of Smart Grid***
Actor Name	*Actor Type (person, organization, device, system, or subsystem)*	*Actor Description*
PV&PCS	Device	PV and PCS. Control signal is sent to PCS from μEMS. Only 400kW/500kVA PV_PCS（Controllable PCS） is available for P&Q control. Controllable PCS communicates with μEMS via TCP/IP, Other PV_PCS, on the other hand, communicates with μEMS via RTU by DNP3.0.
μEMS_ Operators	Person	Operators supervising energy flow inside of Smart Grid. Monitor and control Smart Grid through μEMS.

Grouping (Community)'		***Group Description***
Actors outside of Smart Grid		***Actors that perform their specific functions outside of Smart Grid***
Actor Name	***Actor Type (person, organization, device, system, or subsystem)***	***Actor Description***
Web_Trader	System	IT-System to access Power Market. Through this system PSO can sell/buy Power/Energy from the Market.
AREA EPS_PC	Device	PC device enables communication between μEMS and PSO.
AREA EPS_PSO	Person	Power system Operator responsible for AREA EPS.

1.5 Information Exchanged

Information Object Name	*Information Object Description*
AREA EPS Pre Schedule (Loads and Resources)	System load and resource prediction for AREA EPS service area. Includes Max 4days by every 1 minute data.
Send_System_ load_command	Command for transfer AREA EPS system load to μ EMS through PC. This command is used by PSO.
PV forecast	Long term or short term PV forecasting data from PV_Forecasting system
Smart Grid Power system data	Power system data in the Smart Grid such as ES_SOC, Network Configuration ,PV_Condition etc
Additional data from HEMS	This is for future use. Operational Range of HEMS Power consumption, if any.
1 day ahead Optimal Scheduling	1 day ahead optimal PV/ES Scheduling in Smart Grid. This is produced by μ EMS.
Contribution Scheduling to AREA EPS	Total of power contribution from Smart Grid to AREA EPS service area. This is one of the results of cooperative control.
ES Scheduling	Day Ahead Scheduling of ES or short term scheduling of ES
HEMS Scheduling (including PV forecast)	Currently only PV forecast data is included for the HEMS to make its power scheduling. Other data is for future use.
AREA EPS total generation Scheduling	1 day ahead Scheduling of AREA EPS service area. This is completed by PSO.
Schedule Update command	Command for requesting μ EMS to send schedule update. This command is used every hour to get schedule update for 1.5H ahead Scheduling. This includes charge /discharge request direction (1:discharge -1:charge)
Schedule Update request	Request for μ EMS to send schedule update. This request is performed every hour to get schedule

Information Object Name	*Information Object Description*
	update for 1.5H ahead Scheduling. This includes charge /discharge request direction (1:discharge -1:charge)
Short term Optimal Scheduling	Optimal PV/ES short term Scheduling in Smart Grid. This is produced by μ EMS.
Contribution Scheduling change to AREA EPS	Update of contribution from Smart Grid to AREA EPS service area. This is made at the Schedule Update in Scenario2. Contribution Scheduling is + when direction is discharge, and – for charge.
Active power control	Perform online active Power control to ES_PCS, Controllable_PV_PCS every 1 Sec's, using short term PV & Load forecasting functions. Also send DR signal to Smart House every 5 Min or status change into emergency condition.
Voltage Violation check (considering a certain amount of margin)	Checking function whether feeder voltage is violated (outside of range) or not (within pre-specified range). For the range, a certain amount of margin is considered.
Voltage violation Status	Result of voltage violation check, (violation occurs = 1, not occurs = 0)
PV_Q_Control Margin	Control Margin of reactive power of Controllable_PV_PCS
ES_Q_Control Margin	Control Margin of reactive power of ES_PCS
Reactive control signal	Control Signal from μ EMS to change reactive power output of PV/ES

1.6 Activities/Services

Activity/Service Name	*Activities/Services Provided*
AREA EPS_PSO	Pre Scheduled hourly data is prepared daily by AREA EPS PSO.

Activity/Service Name	*Activities/Services Provided*
	AREA EPS PSO transfers pre schedule manually to μ EMS through PC.

1.7 Contracts/Regulations

The following Contracts/Regulations are examples from the NEDO collaboration with Los Alamos County Utilities in Los Alamos, New Mexico.

Contract/Regulation	*Impact of Contract/Regulation on Function*
Network Integrated Transmission Service Agreement (NITSA), Ancillary Service, Schedule 3, Regulation and Frequency Response Service	Los Alamos County purchases +/- 2 MW of regulation and Frequency response service from the Public Service Company of New Mexico (PNM). Every hour of the day the Power System Operators adjust the schedule accordingly to match the load within the +/- 2 MW bandwidth. The 2 MW bandwidth is to account for differences in the actual load relative to the forecast from two hours earlier.
Network Integrated Transmission Service Agreement (NITSA), Ancillary Service, Schedule 4, Energy Imbalance Service	Los Alamos County purchases Ancillary Service Schedule 4, Energy Imbalance Service, from the Public Service Company of New Mexico (PNM). This service is intended to cover a loss in load due to an unplanned outage or lacking resources in excess of the 2 MW bandwidth covered by Schedule 3.
	Above 2 items are included in PNM_Regulations.

1.8 Terms and Acronyms

TERM	DEFINITION
Control Signal	Signal from μ EMS to the PCS of PV /ES to control active /reactive power of PV / ES. Usually set point or raise /lower signal is sent according to the control mode .
Cooperative Control	Control to accomplish total optimization by communicating with plural EMS`s
DR signal	Control signal for Demand Response
ext-EMS	Energy Management System for the Power network outside of relevant Smart Grid
LAC Web_Trader	Terminal used for LAC PSO to participate Power Market
Local Level Use Case	Use Cases are categorized into 2 levels in terms of the degree of abstraction or depth of details.; that is System Level Use Case and Local Level Use Case. Local Level Use Cases will describe inside of relevant local smart grid , while System Level Use Cases will describe interaction of each local smart grids.
Smart Grid	microgrid, excluding LAC distribution system
System Level Use Case	See "Local Level Use Case" above

ACRONYMS	
DG	Distributed Generator
ES	Energy Storage
ES_PCS	PCS for ES
ES_SOC	State Of Charge of ES
ext-EMS	Energy Management System for external Power System
HEMS	Home Energy Management System
ICT	Information Communication Technology
LAC	Department of Public Utilities Los Alamos County
LAC_PC	PC for LAC PSO
PSO	Power System Operator
PV_PCS	PCS for PV
RTU	Remote Terminal Unit
μEMS	Energy Management System for Micro or Smart Grid

2 Step by Step Analysis of Function

2.1 Steps to implement Scenario 1: Active power Schedule Cooperation with external EMS

2.1.1 Preconditions and Assumptions

Actor/System/Information/Contract	*Preconditions or Assumptions*
PSO	PSO has made a 1day ahead system load prediction in total AREA EPS area. This has already stored in PC.
Smart Grid Equipment Data and Range	Equipment data and Operational Range has already been determined in Data base or by Manual entry
Optimization mode	Two kinds of optimization modes are available; Mode1: model minimization of SOC variation. Mode2: maximize Time shift effect of energy usage considering system load forecast. This mode is pre-specified by μ EMS Operators by the discussion with PSO.

2.1.2 Steps – Active power Schedule Cooperation with external EMS

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
1.1	by 2 pm. ,1 day ahead	PSO	PSO enters Send_ System_load_ command to PC	PSO enters Send_System_ load command to PC	PSO	PC	Send_System_ load_command		
1.2	PSO enters Send_System _ load_comman d	PC	PC sends system load of total AREA EPS area	PC send AREA EPS Pre Schedule (Loads and Resources) in total AREA EPS area to μ EMS	PC	μ EMS	AREA EPS Pre Schedule (Loads and Resources)	ICCP-TASE.2 (IEC60870-6) or FTP	

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#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
1.3 A	µ EMS Gets AREA EPS Pre Schedule	µ EMS	Gets PV forecasts	µ EMS gets PV forecast data from PV_Output_ forecasting system	PV_Output_f orecasting system	µ EMS	PV forecast	ICCP-TASE.2 (IEC60870-6) or FTP	
1.3 B	µ EMS Gets AREA EPS Pre Schedule	µ EMS	Get Smart Grid power system data	µ EMS gets Smart Grid Power system data	RTU & Power Equipment	µ EMS	Smart Grid Power system data(ES_SOC, Network Configuration ,P V_Condition etc)	-TCP/IP for ES_SOC and Controllable_ PV_PCS -RTU (DNP3.0) for others	
1.3 C	µ EMS Gets AREA EPS Pre Schedule	µ EMS	Get HEMS scheduling Data	µ EMS gets HEMS Scheduling data	HEMS	µ EMS	Additional data from HEMS(operation al Range if any etc)	AMI ＊＊This function is for future	
1.4	µ EMS Gets System load and Smart Grid data	µ EMS	Make 1day ahead Scheduling	µ EMS makes 1 day ahead optimal Scheduling	µ EMS	µ EMS	1 day ahead Optimal Scheduling	2 kinds of optimization modes are pre-specified by µ EMS operator.	
1.5 A	µ EMS makes Scheduling , by 3pm.,1 day ahead	µ EMS	Send contribution Scheduling	µ EMS sends contribution scheduling to PC	µ EMS	PC	Contribution Scheduling to AREA EPS	ICCP-TASE.2 (IEC60870-6) or FTP	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
1.5 B	μ EMS makes Scheduling	μ EMS	Send ES Scheduling	μ EMS sends ES scheduling to PCS	μ EMS	ES_PCS	ES Scheduling	TCP/IP ＊＊This function is for future	
1.5 C	μ EMS makes Scheduling	μ EMS	Send HEMS Scheduling	μ EMS sends Scheduling to HEMS	μ EMS	HEMS	HEMS Scheduling (Including PV forecast)	AMI ＊＊currently only PV schedule is sent.	
1.6	PC gets contribution scheduling	PSO	PSO makes AREA EPS Scheduling	PSO	PSO, PC, Web_trader	PSO, PC, Web_Trader	AREA EPS total generation Scheduling		

2.1.3 Post-conditions and Significant Results

Actor/Activity	*Post-conditions Description and Results*
μ EMS operator	Gets optimal Scheduling for Smart Grid
PSO	Gets optimum Scheduling for AREA EPS total area

2.2 Steps to implement Scenario 2: Active power Online Schedule Update cooperating with external EMS

2.2.1 Preconditions and Assumptions

Actor/System/Information/Contract	*Preconditions or Assumptions*
PSO	For the 1.5H-ahead Scheduling, It's enough to get Online Schedule Update from μ EMS by 2 H ahead of exact time.
μ EMS	Perform online active Power control to ES_PCS, Controllable_PV_PCS every 1 Sec, using short term PV & Load forecasting functions. Also send DR signal to Smart House every 5 Min or status change into emergency condition.

2.3 Steps – Active power Online Schedule Update cooperating with external EMS

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
2.1	2H ahead of exact time	PSO	PSO enters Schedule Update command to PC	PSO enters Schedule Update command to PC	PSO	PC	Schedule Update command		
2.2	PSO enters Schedule Update command	PC	PC sends Schedule Update Request	PC sends Schedule Update Request to μ EMS	PC	μ EMS	Schedule Update Request .This includes charge /discharge direction	ICCP-TASE.2 (IEC60870-6) or FTP	

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#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
2.3 A	μ EMS Gets Schedule Update Request	μ EMS	Gets PV short term forecasts for 24 Hours	μ EMS gets PV short term forecast data from PV forecasting system	PV forecasting system	μ EMS	PV short term forecast	ICCP-TASE.2 (IEC60870-6) or FTP	
2.3 B	μ EMS Gets Schedule Update Request	μ EMS	Get Smart Grid power system data	μ EMS gets Smart Grid Power system data	RTU & Power Equipment	μ EMS	Smart Grid Power system data(ES_SOC, Network Configuration ,PV_Condition etc)	-TCP/IP for ES_SOC and Controllable_PV_PCS -RTU (DNP3.0) for others	
2.3 C	μ EMS Gets Schedule Update Request	μ EMS	Get HEMS scheduling Data	μ EMS gets HEMS Scheduling data	HEMS	μ EMS	Additional data from HEMS(operational Range if any etc)	AMI ＊＊This function is for future	
2.4	μ EMS Gets Short Term PV Scheduling and Smart Grid data	μ EMS	Make short Term EDC/ Scheduling	μ EMS makes short term scheduling and 2H ahead contribution change according to charge/discharge direction	μ EMS	μ EMS	Short term Optimal Scheduling, 2H ahead contribution change to AREA EPS		
2.5 A	μ EMS makes contribution change to AREA EPS	μ EMS	Send contribution change	μ EMS sends 2H ahead contribution change to PC	μ EMS	PC	Contribution Scheduling change to AREA EPS	ICCP-TASE.2 (IEC60870-6) or FTP	

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
2.5 B	μ EMS makes short term scheduling	μ EMS	Send ES short term Scheduling	μ EMS sends ES scheduling to PCS	μ EMS	ES_PCS	ES Scheduling	TCP/IP ＊＊This function is for future	
2.5 C	μ EMS makes short term scheduling	μ EMS	Send HEMS Scheduling	μ EMS sends Scheduling to HEMS	μ EMS	HEMS	HEMS Scheduling (including PV forecast)	AMI ＊＊This function is for future	
2.6	PC gets contribution scheduling change	PSO	PSO makes AREA EPS 1.5H ahead Re scheduling	PSO makes AREA EPS 1.5H ahead Re-scheduling	PSO, PC, Web_trader	PSO,PC, Web_Trader	AREA EPS total generation Scheduling	IP	
2.7	μ EMS makes short term scheduling	μ EMS	Active power control by μ EMS	μ EMS performs real time active power control every 1 sec.	μ EMS	ES_PCS. Controllable_ PV_PCS	Active power control	TCP/IP	

2.3.1 Post-conditions and Significant Results

Actor/Activity	*Post-conditions Description and Results*
PSO	Can make efficient 1.5H ahead Scheduling and trade
μ EMS	Can perform real time active power control based on updated scheduling

2.4 Steps to implement Scenario 3: Voltage & Reactive Power Control in AREA EPS Smart Grid (ES/PV control)

2.4.1 Preconditions and Assumptions

Actor/System/Information/Contract	*Preconditions or Assumptions*
Smart Grid	Operating under normal condition, N-1criteria is kept during the operation
μ EMS	Monitors and Performs online active control to ES_PCS, Controllable_PV_PCS every 1 Sec's, using short term PV & Load forecasting functions. Also send DR signal to Smart House every 15 Min or status change into emergency condition. Monitors Smart Grid system data other than PV/ES every 10 sec.
AREA EPS_SCADA	AREA EPS_SCADA monitors and performs switching operation at TC2, TC3, and Feeder 16 of Smart Grid Area
Reactive power injection	If a violation occurs, a predefined amount of reactive power is injected from Controllable_PV_PCS & ES_PCS. This amount is specified in the Data base.

2.4.2 Steps – Voltage & Reactive Power Control in AREA EPS Smart Grid (ES/PV control)

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
3.1	Every 1Min or status change.	μ EMS	Get Feeder Voltage	μ EMS gets feeder #16 voltage through RTU	RTU	μ EMS	Feeder voltage data	RTU(DNP3.0)	
3.2	μ EMS Gets feeder voltage	μ EMS	Check Voltage Violation	μ EMS Checks feeder #16 Voltage Violation	μ EMS	μ EMS	Voltage Violation check, Voltage violation Status	Considering certain amount of Margin	

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#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
3.3 A.1 A	Voltage Violation occurs	μ EMS	Gets condition data of PV	μ EMS gets PV_Q_control Margin through Controllable_PV_PCS	Controllable _PV_PCS	μ EMS	PV_Q_Control Margin	If voltage violation doesn't occur please move on to Step #3.3B TCP/IP	
3.3 A.1 B	Voltage Violation occurs	μ EMS	Gets condition data of ES	μ EMS gets ES_Q_control Margin through ES_PCS	ES_PCS	μ EMS	ES_Q_Control Margin	If voltage violation doesn't occur please move on to Step #3.3B TCP/IP	
3.3 A.2	Voltage Violation occurs	μ EMS	Determine control signal to ES_PCS & Controllable_ PV_PCS	Predefined amount of reactive power is injected from Controllable_PV_PCS and ES_PCS. μ EMS determines control signal to ES & PV	μ EMS	μ EMS	Reactive control signal	If voltage violation doesn't occur please move on to Step #3.3B	
3.3 A.3	μ EMS calculates /determines control signal to ES & PV	μ EMS	Send reactive control signal	μ EMS Sends reactive control signal to ES_PCS & Controllable_PV_PCS	μ EMS	ES_PCS, Controllable_ PV_PCS	Reactive control signal	TCP/IP If voltage violation does not occur, please move on to Step #3.3B	

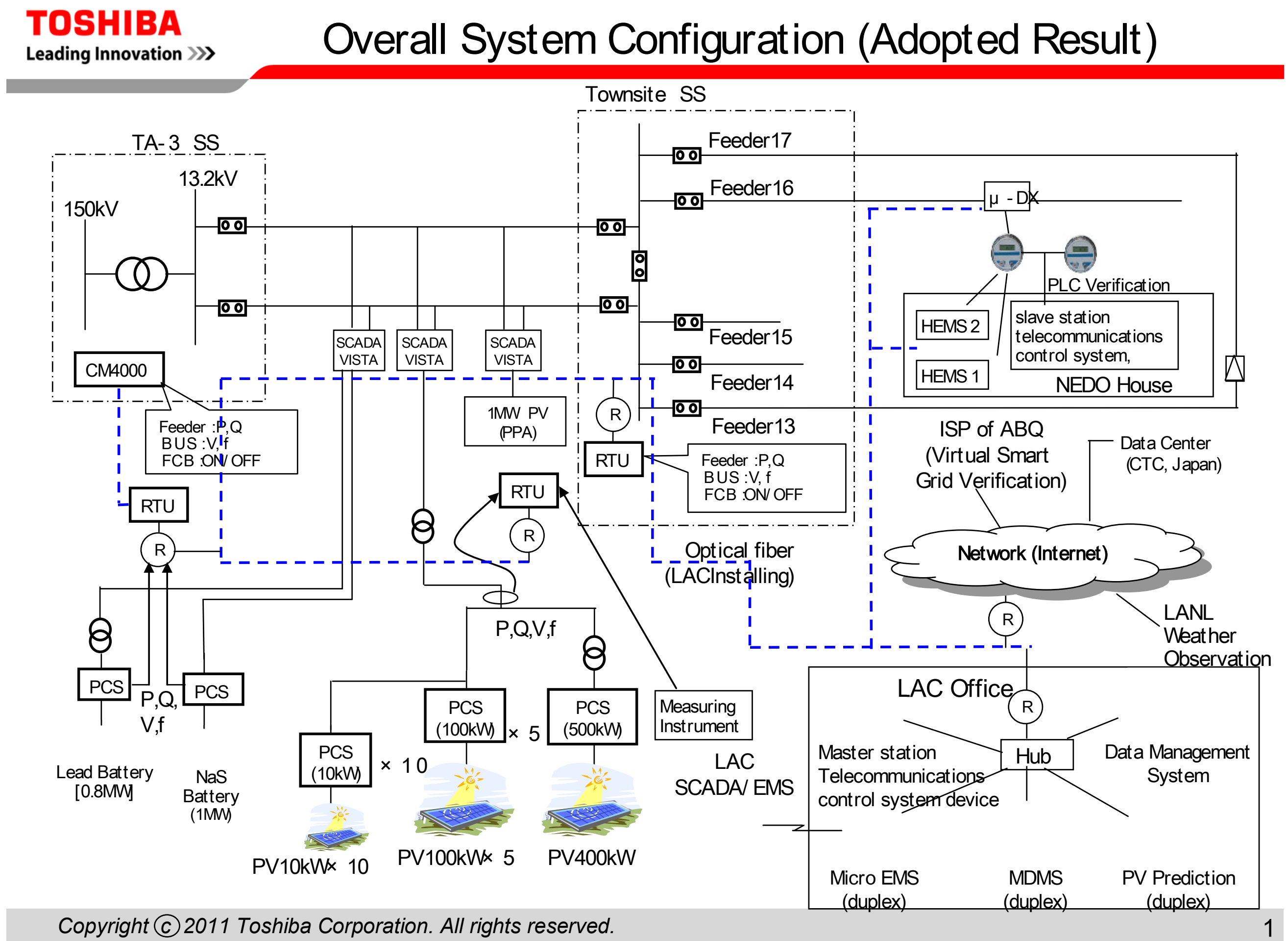
#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
3.3 B	Voltage Violation doesn't occur	μ EMS	No control	μ EMS not send control signal (condition record only)	μ EMS	nothing	No control	This is the normal step for this sequence. Please move on to step #3.4	
3.4	Completion of 1 cycle of reactive control(3.1-3.3)	μ EMS	Delay for next cycle execution or status change	μ EMS delays for next cycle execution or status change	μ EMS	μ EMS	Delay		

2.4.3 Post-conditions and Significant Results

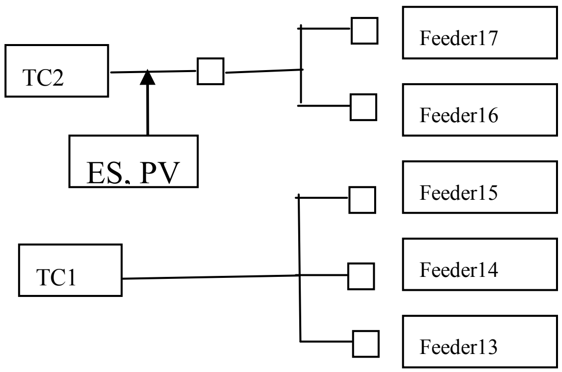
Actor/Activity	*Post-conditions Description and Results*
Smart Grid	Feeder voltage is kept within pre-specified range with appropriate margin.

2.5 Diagrams

2.5.1Normal System Configuration



2.5.2 Voltage Control in normal condition.



3 Auxiliary Issues

3.1 References and contacts

ID	Title or contact	Reference or contact information
[1]	L4. Equipment control within Smart House by HEMS	
[2]	L5. PV output forecasting at Los Alamos County site	
[3]		

3.2 Revision History

No	Date	Author	Description
0	08-10-2010	H.Hayashi	Draft for Review 1
1	10-11-2010	H.Hayashi	Draft for Review 2
2	11-08-2010	H.Hayashi	For Review of the 1st Use Case Working Group meeting, NEDO NM Project
3	01-06-2011	H.Hayashi	For Review of the 2nd Use Case Working Group meeting, NEDO NM Project
4	01-21-2011	S. Cummins	Add descriptions in “1.8 Contracts/Regulations”
5	02-02-2011	H.Hayashi	For Review of the 3rd Use Case Working Group meeting, NEDO NM Project
6	04-24-2011	H. Hayashi	Final Version – Use Case for NEDO NM Project
7	05-16-2011	J. Reilly and H. Hayashi	Revision as a Generic Use Case