Consumer Portal Scenario P9

1 Descriptions of Function

All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work should be so noted.

1.1 Function Name

Name of Function: Utility promotion of electric vehicles (EV) through reduced electricity rates for nighttime recharging of vehicle battery.

1.2 Function ID

IECSA identification number of the function

C-10, C10-1

1.3 Brief Description

Describe briefly the scope, objectives, and rationale of the Function

A utility company wants to promote the increased use of electric vehicles in its service area by offering significantly reduced electricity rates for nighttime recharging of vehicle battery. Each EV is given a unique id which is keyed to the customer so that the utility's billing system can bill the customer under the reduced EV charging rates. The system also permits the customer to use the charging station at another customer's site [such as at a friend's house] and have the system bill the vehicle owner instead of the customer whose charging station is used.

1.4 Narrative

A complete narrative of the Function from a Domain Expert's point of view, describing what occurs when, why, how, and under what conditions. This will be a separate document, but will act as the basis for identifying the Steps in Section 2.

A western utility has a residential customer base of 1 million meters. The meters are installed in single-family detached housing (SFD), single-family attached housing (SFA), apartment buildings and mobile homes. The utility wishes to promote the use of alternate fueled cars including electric vehicles and fuel-cell powered vehicles.

The utility decides to incentivize the residential use of electric vehicles by offering greatly reduced kWh tariffs for nighttime recharging. The issues confronting the utility are:

➢ They need to know which homes have electric vehicles by meter number and premise number.

The utility goes through the following procedures.

1. The utility offers discounted electricity to recharge electric vehicle batteries. To do this a customer must purchase the car and charging station using their own resources and as an incentive the utility offers greatly reduced nighttime charging rates/kWh. The customer plugs in the car to the charger and requests "charge at cheapest rates". The utility is notified of the cars presence, its ID number (which must correspond to the car registered with the homeowner), and its approximate charge requirement (provided by the car's on board computer). The utility schedules the recharge to take place during the evening hours and at different times than other EV charging (thus putting diversity into the load).
2. The billing department now calculates the amount of money to charge the EV customer based on EV rates and for the measured time period.
3. The same EV customer drives to a friend's home (who also has an EV) and requests a quick charge to make sure that he can get back home. When he plugs his EV into his friend's EV charger, the utility identifies the fact that the EV belongs to a different customer and places the charging bill on the correct persons invoice, not on the friend's bill who offered his charging station.
4. The billing department now calculates the amount of money to invoice the customer who owns the EV, based on EV rates and for the measured time period.

1.5 Actor (Stakeholder) Roles

Describe all the people (their job), systems, databases, organizations, and devices involved in or affected by the Function (e.g. operators, system administrators, technicians, end users, service personnel, executives, SCADA system, real-time database, RTO, RTU, Intelligent Electronic Device, power system). Typically, these actors are logically grouped by organization or functional boundaries or just for collaboration purpose of this use case. We need to identify these groupings and their relevant roles and understand the constituency. The same actor could play different roles in different Functions, but only one role in one Function. If the same actor (e.g. the same person) does play multiple roles in one Function, list these different actor-roles as separate rows.

Grouping (Community) ’		Group Description
Customer Site		*Those entities that are located at customer's premises*
Actor Name	**Actor Type (person, device, system etc.)**	**Actor Description**
Customer	Person	One signed up to participate in the Distributed Energy Resource (DER) program.
CustomerCommunicationPortal	System	Customer Communications Portal (CustomerCommunicationPortal), System handling communications function at customer's premises [in this case, identifying the customer, communications with the charging station, the EV's on-board computer, meter, and the utility]
Meter Device	Device	Device that can measure the power consumed by the customer along with the time at which the power is consumed (so that in this case the utility can charge the appropriate rate for the EV charging at time) and transmit the information to the utility for billing purposes
EV Charging Station	System	System at the customer site used to charge the EV batteries
EV Id Number	Device	Unique identification number assigned to each participating EV by the utility for tracking power used to charge the batteries of that vehicle
EV On-Board System	System	System in the EV used to communicate with the utility via the EV Charging Station and the CustomerCommunicationPortal at the customer location

Replicate this table for each logic group.

Grouping (Community) '		Group Description
Power Company Electric Vehicle Operations		Those entities that are charged with managing the EV-related functions for the power company
Actor Name	Actor Type (person, device, system etc.)	Actor Description
EVOperationSystem	System	System that contains information about the rates applicable to Electric Vehicle (EV) charging, customers participating in the EV program, their location, and details of their system, such as EV Id, amount of power needed to charge the system, and so on.
EVChargingScheduler	System	System that manages the scheduling of charging of EV to ensure system load diversity
CustomerId	Device	Customer identification key that is used by the power company to identify customer for associating the customer with its billing activities
CustomerBillingSystem	System	System that handles generation of bills for the services provided to the customer
Utility Communications Network	System	System responsible for managing communications between the utility and the participants in the EV program [for functions such as remote meter reading, controlling EV charging stations at customer sites, monitoring EV charging activities and other related communications activities]
EV		

Grouping (Community) ’		Group Description
Others		Those entities that are involved in this activity, but do not fit in any of the Groupings above
Actor Name	Actor Type (person, device, system etc.)	Actor Description
Third Party EV Charging Station	System	System at a different customer's site [other than the owner of the EV being charged] for charging EV batteries
EnergyServiceProvider		

1.6 Information exchanged

Describe any information exchanged in this template.

Information Object Name	Information Object Description
EV Charge Request from Customer's Home Location	Request from customer to charge EV at "cheapest available rates" from the home location along with EV Id, CustomerId and related EV information
EV Charge Implementation at Customer's Home Location	System order to verify customer information, schedule EV charging after checking other EV charging already scheduled in that area, initiating the charging operation, alerting the CustomerCommunicationPortal and meter to acquire the power used for charging and time when used, collecting the metering information at the conclusion of the charging activity, and flagging the power delivered for appropriate billing rates by the billing system
EV Charge Request from Third Party Location	Request from customer to charge EV from a third party location along with EV Id, CustomerId, third party location EV Charging Station and customer id information and related EV information

Information Object Name	Information Object Description
EV Charge Implementation at Third Party Location	System order to verify customer and third party location information, schedule a quick-charge EV charging operation, alerting the CustomerCommunicationPortal and meter to acquire the power used for charging and time when used, collecting the metering information at the conclusion of the charging activity, and flagging the power delivered for appropriate billing rates by the billing system to the customer account associated with the EV (and not the third party location customer whose EV Charging Station was used for the quick charge operation)

1.7 Activities/Services

Describe or list the activities and services involved in this Function (in the context of this Function). An activity or service can be provided by a computer system, a set of applications, or manual procedures. These activities/services should be described at an appropriate level, with the understanding that sub-activities and services should be described if they are important for operational issues, automation needs, and implementation reasons. Other sub-activities/services could be left for later analysis.

Activity/Service Name	Activities/Services Provided
Receive Customer Initiated EV Charge Request	On receipt of customer initiated EV charge request, verify charge request origin by accessing EVOperationSystem database to compare EV Id with CustomerId sent by the CustomerCommunicationPortal: if the request origin is same as customer home location, then set flag to implement EV charging at customer location; if request origin is not customer home location, then set flag to implement EV charging at third party location.
Implement EV Charging	Initiate EV charging actions: access EVOperationSystem Database to determine charging requirements, access EVChargingScheduler to assign time slot for charging to ensure load diversity, initiate charging at the assigned time, alert CustomerCommunicationPortal and meter to record power consumption and to transmit power usage data on completion of the charging operation, and signal CustomerCommunicationPortal to turn off the charging station. If the request originated from a third party location, then implement a quick charge operation as soon as possible [so as to enable the customer EV to be charged for travel back to customer home location].
Complete Post-Charge Activities	Initiate actions to transmit metering data to customer billing system to generate a charge based on applicable EV tariff rates. If the operation is customer home location charging, then the customer's

Activity/Service Name	Activities/Services Provided
	account is billed; if the operation is third party charging, then the customer account associated with the EV is billed for the charging operation.

1.8 Contracts/Regulations

Identify any overall (human-initiated) contracts, regulations, policies, financial considerations, engineering constraints, pollution constraints, and other environmental quality issues that affect the design and requirements of the Function.

Contract/Regulation	Impact of Contract/Regulation on Function
EV Program Tariffs	Reduced electric power rates based on off-peak charging based on customer acquiring required equipment at their cost – such as the EV, the charging station and related equipment

Policy	From Actor	May	Shall Not	Shall	Description (verb)	To Actor
Install EV Equipment	Customer			X	Customer needs to buy their EV and install EV Charging system at site to participate in the program	EnergyServiceProvider
Provide EV Id	EnergyServiceProvider			X	Provide customer's EV with a unique id that will be transmitted when the EV is plugged into a charging station	Customer
Provide EV Rates	EnergyServiceProvider			X	Provide reduced electric power rates that will be applied to charging EV at off-peak times	Customer

Constraint	Type	Description	Applies to
Charging Period	Rate Availability	A customer can utilize special EV power rates for charging during specified off-peak periods	Request for EV charging by customer

2 Step by Step Analysis of Function

Describe steps that implement the function. If there is more than one set of steps that are relevant, make a copy of the following section grouping (Preconditions and Assumptions, Steps normal sequence, and Steps alternate or exceptional sequence, Post conditions)

2.1 Steps to implement function

Name of this sequence.

2.1.1 Preconditions and Assumptions

Describe conditions that must exist prior to the initiation of the Function, such as prior state of the actors and activities

Identify any assumptions, such as what systems already exist, what contractual relations exist, and what configurations of systems are probably in place

Identify any initial states of information exchanged in the steps in the next section. For example, if a purchase order is exchanged in an activity, its precondition to the activity might be 'filled in but unapproved'.

Actor/System/Information/Contract	Preconditions or Assumptions
EV Equipment	Assumes that the customer has specified EV equipment, such as EV, Charging Station and related equipment, at customer location
EV Program tariff	Assumes that a tariff exists with details of program requirements and reduced charging power rates that the customer can sign up
EVOperationSystem	Assumes that the utility has a database with customer EV information keyed to customer id and location information
CustomerCommunicationPortal	Assumes that the CustomerCommunicationPortal is installed in the customer location that will permit communications with the customer and EV equipment

Actor/System/Information/Contract	Preconditions or Assumptions
EV Id	Assumes each EV has been assigned a unique Id and that this information is transmitted by EV and/or accessible by the utility

2.1.2 Steps – Normal Sequence

Describe the normal sequence of events, focusing on steps that identify new types of information or new information exchanges or new interface issues to address. Should the sequence require detailed steps that are also used by other functions, consider creating a new "sub" function, then referring to that "subroutine" in this function. Remember that the focus should be less on the algorithms of the applications and more on the interactions and information flows between "entities", e.g. people, systems, applications, data bases, etc. There should be a direct link between the narrative and these steps.

The numbering of the sequence steps conveys the order and concurrency and iteration of the steps occur. Using a Dewey Decimal scheme, each level of nested procedure call is separated by a dot '.'. Within a level, the sequence number comprises an optional letter and an integer number. The letter specifies a concurrent sequence within the next higher level; all letter sequences are concurrent with other letter sequences. The number specifies the sequencing of messages in a given letter sequence. The absence of a letter is treated as a default 'main sequence' in parallel with the lettered sequences.

Sequence 1:

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1.1 - Do step 1
1.2A.1 - In parallel to activity 2 B do step 1
1.2A.2 - In parallel to activity 2 B do step 2
1.2B.1 - In parallel to activity 2 A do step 1
1.2B.2 - In parallel to activity 2 A do step 2
1.3 - Do step 3
1.3.1 - nested step 3.1
1.3.2 - nested step 3.2
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Sequence 2:

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2.1 - Do step 1
2.2 – Do step 2
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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 Environments
#	*Triggering event? Identify the name of the event.[1]*	*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 section1.5.*	*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	Customer Request for EV Charging	Customer	Request for EV charging	Customer plugs in EV into charging station	EV On-Board System	EV Charging Station and CustomerCommunication Portal	Charging Request	?	Intra-Customer Site
1.1.1		EV On-Board System	EV On-Board System Identifies the EV	EV On-Board System sends EV Id Number and charging requirements	EV On-Board System	CustomerCommunication Portal	EV Id, EV charge requirements		Intra-Customer Site
1.1.2		CustomerCommunicationPortal	CustomerCommunicationPortal location and EV information	CustomerCommunicationPortal at location sends EV information, CustomerId and CustomerCommunicationPortal location information	CustomerCommunication Portal	EVOperation System	Customer information and EV/CustomerCommunicationPortal location information		Intra-Customer Site
1.2		EVOperationSystem	Determine type of charging to implement	Power Company compares EV and location information to	EVOperation System	EVOperation System	Identify if the vehicle is at customer or		Intra-Customer Site

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[1] Note – A triggering event is not necessary if the completion of the prior step – leads to the transition of the following step.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
				determine type of charging to implement			third-party location		
2.1	Charging request from customer home	EVOperationSystem	Determine electric rate applicable	EVOperationSystem queries EVOperationSystem to determine electric rate applicable to request	CustomerId, EV Id Number	EVOperation System	EV power rates		Intra-Customer Site
2.1.1		EVOperationSystem	Confirms charging requirements	EVOperationSystem confirms charging requirements	EVOperation System	EVOperation System	EV charging requirements		Intra-Customer Site
2.2		EVCharging Scheduler	Assign charging time slot	EVOperationSystem queries EVChargingScheduler to assign charging time slot	EVChargingS cheduler	EVOperation System			Intra-Customer Site
2.2.1		EVCharging Scheduler	Informs CustomerCommunicationPortal on charging start time	EVChargingScheduler informs CustomerCommunicationPortal on charging start time	EVChargingS cheduler	CustomerCo mmunication Portal	Time slot allotment for EV charging		Intra-Customer Site
2.3		CustomerCo mmunicationPortal	Turns on Charging Station	CustomerCommunicationPortal turns on Charging Station at assigned time	CustomerCo mmunication Portal	EV Charging Station, EV	Initiate EV charging		Intra-Customer Site
2.3.1		CustomerCo mmunicationPortal	CustomerCommunicationPortal alters meter	CustomerCommunicationPortal alerts meter to start monitoring power used for charging	CustomerCo mmunication Portal	Meter Device	Start measuring power consumption		Intra-Customer Site

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
2.3.2		EV On-Board System	Turn off charging	EV On-Board System turns off Charging station on completing the charging operation	EV On-Board System	EV Charging Station	Turn off power to EV		Intra-Customer Site
2.3.3		Meter Device	Power Consumption information	Meter Device sends power consumption information to CustomerCommunicationPortal	Meter Device	CustomerCommunication Portal	Power consumed for EV charging		Intra-Customer Site
2.3.4		EVOperationSystem	Completion of charging	CustomerCommunicationPortal confirms to EVOperationSystem on completion of charging operation	CustomerCommunication Portal	EVOperation System	Completion of charging operation		Intra-Customer Site
3.1	Charging Request from third party location	EVOperationSystem	Mark as third party charging event	EVOperationSystem alerts EVOperationSystem to mark charging operation as third party charging event		EVOperation System	Flag identifying operation as third-party charging event		Intra-Customer Site
3.1.1		EVOperationSystem	Collect EV and Customer information	EVOperationSystem collects EV customer Id and CustomerCommunicationPortal customer Id [owner of the third-party charging station] information	CustomerId of EV owner, EV Id Number, CustomerId of CustomerCommunication Portal	EVOperation System	EV and Customer information		Intra-Customer Site

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
3.1.2		EVOperationSystem	Determine electric rate applicable	EVOperationSystem queries EVOperationSystem to determine electric rate applicable to request	CustomerId, EV Id Number	EVOperation System	EV power rates		Intra-Customer Site
3.1.3		EVOperationSystem	Confirm charging requirements	EVOperationSystem confirms charging requirements	EVOperation System	EVOperation System	EV charging requirements		Intra-Customer Site
3.2		EVOperationSystem	Assign charging time slot	EVOperationSystem queries EVChargingScheduler to assign charging time slot	EVChargingScheduler	EVOperation System			Intra-Customer Site
3.2.1		EVCharging Scheduler	Informs CustomerCommunicationPortal on charging start time	EVOperationSystem informs CustomerCommunicationPortal on charging start time	EVChargingScheduler	CustomerCommunication Portal	Time slot allotment for EV charging		Intra-Customer Site
3.3		CustomerCommunicationPortal	Turns on Charging	CustomerCommunicationPortal turns on Charging Station at assigned time	CustomerCommunication Portal	EV Charging Station, EV	Initiate EV charging		Intra-Customer Site
3.3.1		CustomerCommunicationPortal	CustomerCommunicationPortal alters meter	CustomerCommunicationPortal alerts meter to start monitoring power used for charging	CustomerCommunication Portal	Meter Device	Start measuring power consumption		Intra-Customer Site
3.3.2		EV On-Board System	Turn off charging	EV On-Board System turns off Charging Station on completing	EV On-Board System	EV Charging Station	Turn off power to EV		Intra-Customer Site

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
				the charging operation					
3.3.3		Meter Device	Power Consumption information	Meter Device sends power consumption information to CustomerCommunicationPortal	Meter Device	CustomerCommunication Portal	Power consumed for EV charging		Intra-Customer Site
3.3.4		EVOperationSystem	Completion of charging	CustomerCommunicationPortal confirms to EVOperationSystem on completion of charging operation	CustomerCommunication Portal	EVOperation System	Completion of charging operation		Intra-Customer Site
3.3.5		EVOperationSystem	Power Consumption data sent to Database	Power consumption data flagged to EV owner's CustomerId	CustomerCommunication Portal	EVOperation System	Assign power usage to EV owner's account		Intra-Customer Site
4.1		EVOperationSystem	Transmit power consumption to Billing	Transmit power consumption information to CustomerBillingSystem	EVOperation System	CustomerBillingSystem	Power consumer and applicable rate for EV charging		Intra-Customer Site
4.1.1		CustomerBillingSystem	Billing information for the power consume	Alert EV owner's CustomerCommunicationPortal with charge information	CustomerBillingSystem	CustomerCommunication Portal	Billing information for the power consumed for charging		Intra-Customer Site
4.1.2		EVOperationSystem	Acknowledgment of charging	Confirm charging operation completion to EVChargingScheduler	EVOperation System	EVChargingScheduler	Acknowledgment of charging operation completion		Intra-Customer Site

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2.1.3 Steps – Alternative / Exception Sequences

Describe any alternative or exception sequences that may be required that deviate from the normal course of activities. Note instructions are found in previous table.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments

2.1.4 Post-conditions and Significant Results

Describe conditions that must exist at the conclusion of the Function. Identify significant items similar to that in the preconditions section.

Describe any significant results from the Function

Actor/Activity	Post-conditions Description and Results
Customer	Confirmation of EV charging and billing information
EV	EV batteries fully charged
EV owner's CustomerCommunicationPortal	Updated with details of power delivery (amount, duration and billed amount) for EV charging event
Customer Billing system	Updated with EV owner's account charged with power consumed for the EV charging event
Third-Party CustomerCommunicationPortal	Updated with confirmation of power used for EV charging to EV owner's account

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Actor/Activity	Post-conditions Description and Results
EVOperationSystem	Updated with information on EV Id, CustomerId, power consumed and account charged [EV owner]
EVChargingScheduler	Updated with actual system performance during the EV charging event for refining future scheduling

2.2 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..

2.3 Diagram

For clarification, draw (by hand, by Power Point, by UML diagram) the interactions, identifying the Steps where possible.

3 Auxiliary Issues

3.1 References and contacts

Documents and individuals or organizations used as background to the function described; other functions referenced by this function, or acting as "sub" functions; or other documentation that clarifies the requirements or activities described. All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work must be so noted.

ID	Title or contact	Reference or contact information
[1]	P. S. Vishwanath	Paragon Consulting Services, 301-323-4088
[2]	Joe Kelly	Paragon Consulting Services, 503-978-8289

3.2 Action Item List

As the function is developed, identify issues that still need clarification, resolution, or other notice taken of them. This can act as an Action Item list.

ID	Description	Status
[1]		
[2]		

3.3 Revision History

For reference and tracking purposes, indicate who worked on describing this function, and what aspect they undertook.

No	Date	Author	Description
0.1	December 22, 2003		First draft
0.2	December 29, 2003	P S V	Revisions and updates to missing sections

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