Document History

Revision History

Revision Number	Revision Date	Revision/ Reviewed By	Summary of Changes	Changes marked

Approvals

This document requires the following approvals.

Name	Title

1.1 Use Case Title

PR1 – Vehicle Use Case
Customer charges the PEV

1.2 Use Case Summary

This use case details the Charge process for the customer to transfer energy to the PEV. This is precluded by specific enrollment process by one or more of the connection architectures as described in Use Cases S1-3 and locations as described in Use Cases L1-4.

1.3 Use Case Detailed Narrative

3. Step by Step Analysis of Each Scenario

Use Case PR1: Customer charges the PEV.

3.1 Scenario Description

Primary Scenario (PR1-A): Customer is enrolled in a TOU Schedule

For those customers enrolled in a PEV Time-of-Use (TOU) pricing demand side management program, applicable energy prices and rate periods (e.g., off-peak, mid-peak, on-peak, etc.) will be made known to the Customer and PEV. PEV initiates charging based on Customer-defined preference settings (considering peak/off-peak rate periods) in the PEV. PEV may not receive demand response discrete event notifications; however, some Customers enrolled in PEV TOU demand side management programs could also enroll in a Discrete Event demand side management program. Because no regular periodic communications between PEV and vehicle is required to support a basic PEV TOU pricing demand side management program, an explicit scenario for this option was not included in this use case. However, Utility-to-PEV communications for PEVs enrolled in a TOU demand side management program does offer other benefits (e.g., updated rates displayed in PEV).

Primary Scenario (PR1-B): Customer is enrolled in a PEV Discrete Event demand side management program (Direct Load Control) and PEV (and/or PEV customer) receives and responds to discrete demand response events

For those customers enrolled in a PEV discrete event demand side management program (possibly in exchange for special PEV tariffs or other incentives), this program allows the utility to request an automated load reduction at the customer site by issuing event information to the PEV. The customer can override and/or opt-out of the request in exchange for a reduced incentive. Typically, PEV demand response events are downloaded at least 24 hours ahead, however they could be provided day-of in the case of a grid reliability emergency

- Utility shall be able to transmit discrete demand response event messages to an ESCI and onward to PEV.

- Utility shall track Customer preference for remote notification of PEV Demand Response (DR) events.

- Utility shall transmit PEV Demand Response event alerts to Customer via Customer-designated communication channel(s).

- Customer shall have the ability to override and/or opt-out of discrete demand response events.

Vehicle Use Case Task Force
PR1: Customer charges the PEV

- PEV shall charge based on Customer-configurable preferences and shall take appropriate action based upon discrete demand response events.

- PEV shall send Customer opt-out notification message to Utility.

- Pre–event notification shall be sent to customers in advance in a range from one minute in an emergency up to 24 hours for normal/planned discrete demand response events

Triggering Event	Primary Actor	Pre-Condition	Post-Condition
(Identify the name of the event that start the scenario)	*(Identify the actor whose point-of-view is primarily used to describe the steps)*	*(Identify any pre-conditions or actor states necessary for the scenario to start)*	*(Identify the post-conditions or significant results required to consider the scenario complete)*
As electrical system approaches overload and/or resources become constrained	*PEV*	*Customer has subscribed to a PEV demand side management discrete event program.*	*Conditions that led to constrained resources have abated or been mitigated. Customer returns to normal PEV load operation.*

3.1.1 Steps for this scenario

Step #	Actor	Description of the Step	Additional Notes
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	Utility	At least 24 hours prior to event, Utility sends out remote notification to PEV Customers enrolled in PEV DR programs indicating demand response action.	
2	Utility	Utility shall transmit PEV Demand Response event alerts notification via pager, e-mail, text message on cell phone, web page, etc.	
3	Utility	Utility shall track Customer preference for remote notification of PEV Demand Response (DR) events	

Step #	Actor	Description of the Step	Additional Notes
4	Customer	Customer selects/adjusts demand side management preference(s) on PEV (if necessary) and connects PEV to energy portal at his local premise.	
5	Utility	Utility downloads demand response discrete event information to PEV via ESCI. Message includes event information or load reduction request notification.	
6	PEV	PEV charging proceeds based on Customer defined preferences (which considers receipt of demand side management information).	
7	Customer	Customer has the ability to override and/or opt-out of demand response event using Customer-configurable preferences in the PEV. Customer may receive a reduced incentive for exercising this option.	Other means of indicating override or opt-out (e.g., outside of vehicle) may also be considered here.

Primary Scenario (PR1-C): Customer is enrolled in a Periodic/Hourly Pricing Price Response program and PEV receives and responds to periodic/hourly energy prices (day-ahead schedule)

For those customers enrolled in a hourly price demand side management program, this program will download a schedule of 24 hours critical peak pricing for the next day, at least 24 hours ahead, based upon a prediction of energy shortages.

- The utility will download day-ahead 24 hour prices for each hour to the PHEV. PHEV charging proceeds based on Customer-selected preference settings in the PHEV

- Utility shall be able to transmit periodic/hourly pricing tables to an ESCI and onward to PHEV.

- Utility shall apply correct rate structure for accurate customer billing considering any enrolled PHEV demand side management programs and the benefits for compliance or charges for overrides and opt outs which are included in those programs.

- PHEV shall charge based on Customer-configurable preferences and shall take appropriate action based upon a periodic/hourly price table.

- PHEV shall send Customer opt-out notification message to Utility

Vehicle Use Case Task Force
PR1: Customer charges the PEV

Triggering Event	Primary Actor	Pre-Condition	Post-Condition
(Identify the name of the event that start the scenario)	*(Identify the actor whose point-of-view is primarily used to describe the steps)*	*(Identify any pre-conditions or actor states necessary for the scenario to start)*	*(Identify the post-conditions or significant results required to consider the scenario complete)*
Utility determines day-ahead periodic/hourly pricing	*PEV*	*Customer has subscribed to a PEV periodic/hourly pricing demand side management program.*	*Conditions that led to constrained resources have abated or been mitigated. Customer return to normal PEV load operation.*

3.2.1 Steps for this scenario

Step #	Actor	Description of the Step	Additional Notes
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	Utility	Utility determines periodic/hourly prices for the next day, based on forecasts.	
2	Utility	In the case of abnormally high hourly prices, Utility may send out remote notification to PEV Customers enrolled in this type of PEV DR Program advising demand response action. Notification can be via pager, e-mail, text message on cell phone, web page, etc.	
3	Customer	Customer selects/adjusts demand side management preference(s) on PEV (if necessary) and connects PEV to energy portal at his local premise.	See Issue 1.0 (Section 6)

Step #	Actor	Description of the Step	Additional Notes
4	Utility	Utility downloads day-ahead periodic/hourly pricing rate table to PEV via ESCI. Table includes periodic/hourly prices for each period in the next day, or current day if table not yet downloaded for current day.	
5	PEV	PEV charging proceeds based on Customer-defined preferences (which considers current hourly/periodic pricing table). Customer may set or adjust limits for acceptable price for charging.	

Primary Scenario (PR1-D): Non-enrolled PEV (or Customer with non-communicating PEV) connects to energy portal

This scenario describes what happens if an un-enrolled PEV can communicate with local area network (e.g., LAN, HAN, PAN) or Customer has PEV that cannot communicate or cannot communicate with a specific Utility's network.

Note: Customer may however, be able to use EVSE interface to take advantage of one or more of the programs offered at the EVSE site.

Triggering Event	Primary Actor	Pre-Condition	Post-Condition
(Identify the name of the event that start the scenario)	*(Identify the actor whose point-of-view is primarily used to describe the steps)*	*(Identify any pre-conditions or actor states necessary for the scenario to start)*	*(Identify the post-conditions or significant results required to consider the scenario complete)*
The customer plugs in the PEV using either EVSE cordset or Premise EVSE for charging	*PEV*	*Customer has a PEV, but is unenrolled in a Utility PEV program, has a non-communicating PEV, or both.*	*No communication session established with Utility network or devices. PEV charges successfully with all energy charges accruing to charging premise account.*

3.3.1 Steps for this scenario

Step #	Actor	Description of the Step	Additional Notes
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1	PEV	PEV connects at any customer location. This could be in the PEV operator's home utility service territory or in a foreign utility service territory. Customer can plug in his PEV using either EVSE cordset or Premise EVSE for charging	
1a	Customer	Customer connects EVSE **cordset** to Energy Portal at Premise.	Startup steps are provided in S1 (Steps 5a through Step 10)
1b	EVSE	Customer connects **Premise Mounted** EVSE to PEV.	Startup steps are provided in S2 or S3 (Steps 5a through Step 10)
2	PEV	PEV prepares for charging rate (charger size or ALC, whatever is lowest). PEV senses power to on-board charging unit and activates 'On Plug' state	
3	PEV/ Energy Services Communications Interface (ESCI)	PEV (if communications enabled) and Energy Services Communications Interface (ESCI) initiate a secure communications session.	Implementation could have PEV or ESCI as initiator of session. If PEV does not have communications capability (or if communication is disabled), charging will commence with all energy charges accruing to premise customer at default rate for customer account.
4	PEV	PEV ID is transmitted to ESCI	

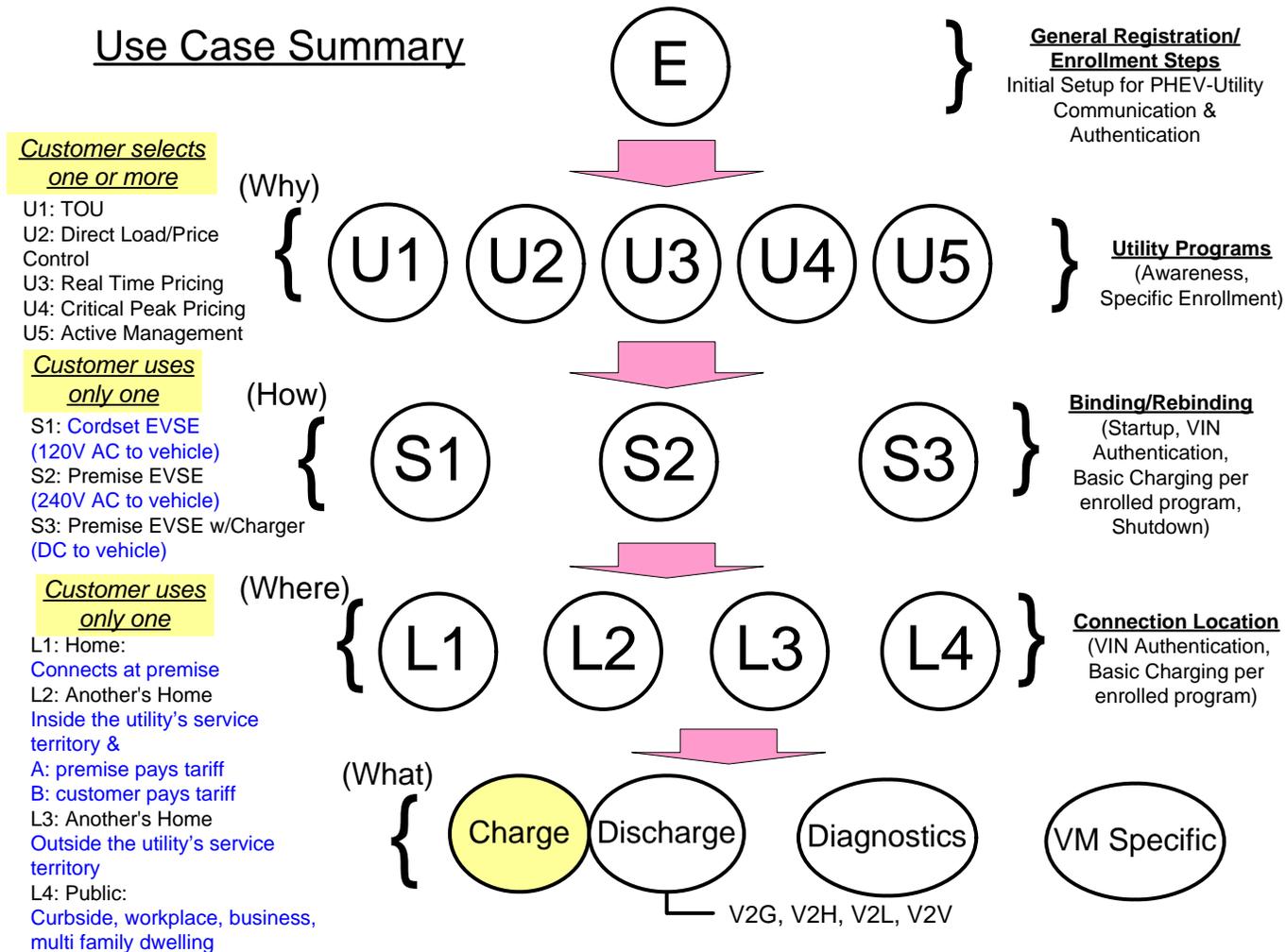| Step #	Actor	Description of the Step	Additional Notes
5	Utility	Utility checks PEV ID, Premise ID against internal database. If not found (because PEV is roaming outside of home utility), utility forwards PEV ID to Clearinghouse for verification.	
6	Utility/Clearinghouse	Neither utility nor clearinghouse has record of the PEV ID	Utility will have PEV ID of un-enrolled PEV, should it desire to identify it and contact operator regarding potential enrollment in utility program.
7	PEV	PEV begins charging based on Customer selected preferences. All energy charges accrue to premise account.	

4. Requirements

This use case is the 5th and final in a series that follows Use Cases L1-4 for energy transfer locations. This use case defines the steps for the customer to charge the PEV.

Use Case Summary

**General Registration/
Enrollment Steps**
Initial Setup for PHEV-Utility
Communication &
Authentication

E

*Customer selects
one or more* (Why)

U1: TOU
U2: Direct Load/Price
Control
U3: Real Time Pricing
U4: Critical Peak Pricing
U5: Active Management

U1 U2 U3 U4 U5

Utility Programs
(Awareness,
Specific Enrollment)

*Customer uses
only one* (How)

S1: Cordset EVSE
(120V AC to vehicle)
S2: Premise EVSE
(240V AC to vehicle)
S3: Premise EVSE w/Charger
(DC to vehicle)

S1 S2 S3

Binding/Rebinding
(Startup, VIN
Authentication,
Basic Charging per
enrolled program,
Shutdown)

*Customer uses
only one* (Where)

L1: Home:
Connects at premise
L2: Another's Home
Inside the utility's service
territory &
A: premise pays tariff
B: customer pays tariff
L3: Another's Home
Outside the utility's service
territory
L4: Public:
Curbside, workplace, business,
multi family dwelling

L1 L2 L3 L4

Connection Location
(VIN Authentication,
Basic Charging per
enrolled program)

(What)

Charge Discharge Diagnostics VM Specific

V2G, V2H, V2L, V2V

4.1 Functional Requirements

Func. Req. ID	Functional Requirement	Associated Scenario # (if applicable)	Associated Step # (if applicable)

4.2 Non-Functional Requirements

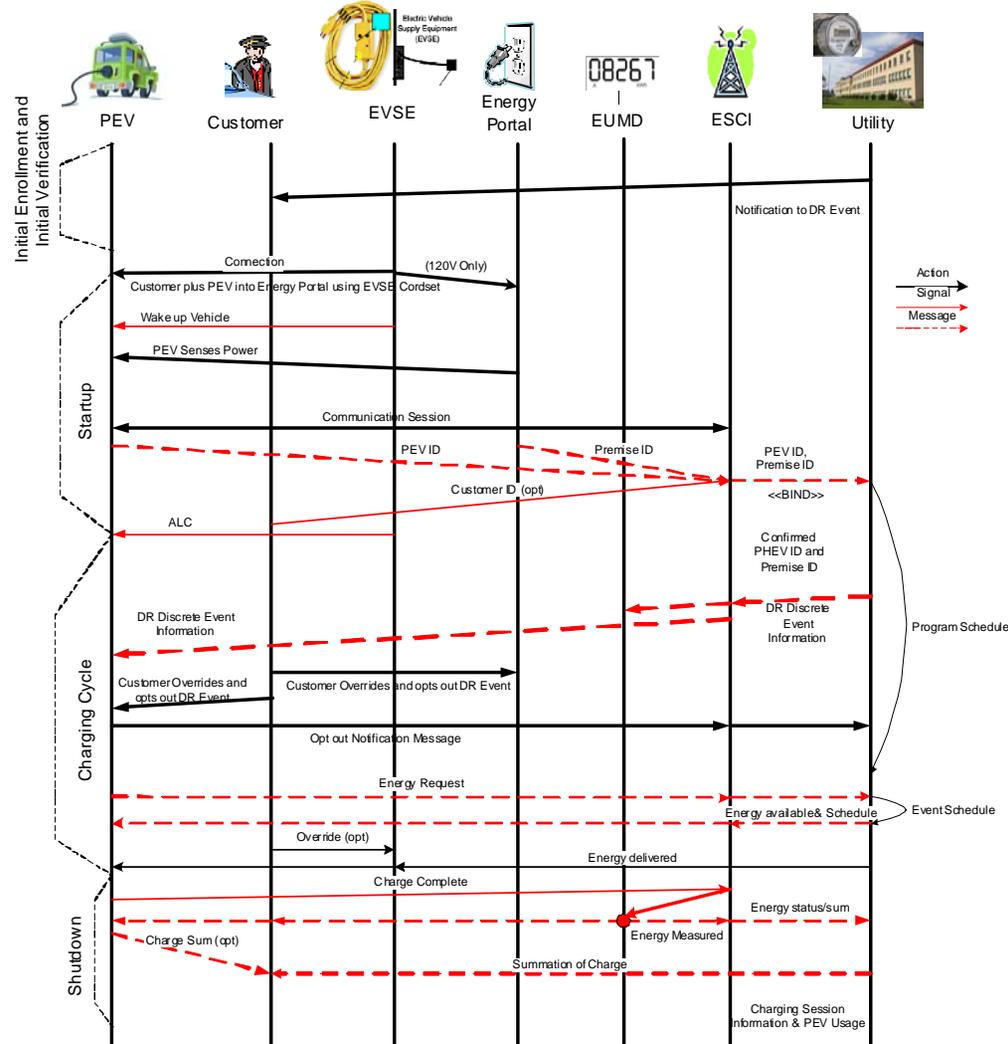| Non-func. Req. ID	Non-Functional Requirement	Associated Scenario # (if applicable)	Associated Step # (if applicable)

4.3 Business Requirements

Bus. Req. ID	Business Requirement	Associated Scenario # (if applicable)	Associated Step # (if applicable)

5. Use Case Models

5.1 Sequence Diagram for PEV Charging

5.2

Created by Rich Scholer - 1/19/2009