

**SmartConnect Use Case:**  
**P1 – Utility Provides Services to Plug-in Electric Vehicle (PEV)**  
**Customer**  
**January 20, 2009**

## Document History

### Revision History

Revision Number	Revision Date	Revision / Reviewed By	Summary of Changes	Changes marked
0.1	080627	Jerry Melcher	Initial Draft document	N
0.2	080702	Jerry Melcher	Draft document - JCMb	Y
0.3	080724	Jerry Melcher	Addition of S2, Utility provides billing services scenario	Y
1.0	080811	Bryan Lambird	Includes modifications required by taking binding and re-binding scenarios out of Use Case P2; S2 and S3 removed at this time for socialization purposes; will be included in v2.0	Y
2.0	090119	Deborah Catanese	Edits to drafts previously reviewed by SMEs	Y

### Approvals

This document requires following approvals.

Name	Title
<i>Bryan Lambird</i>	<i>Project Manager, Edison SmartConnect</i>
<i>Loic Galliac</i>	<i>Senior Engineer, Energy Conversion &amp; Storage Group</i>

# Contents

1.	Use Case Description.....	5
1.1	Use Case Title .....	5
1.2	Use Case Summary.....	5
1.3	Use Case Detailed Narrative .....	5
1.4	Business Rules and Assumptions .....	6
2.	Actors .....	7
3.	Step-by-Step Analysis of Each Scenario.....	9
3.1	Primary Scenario: Customer enrolls in PEV program and completes initial setup for PEV – Utility communications.....	9
3.1.1	Steps for this scenario .....	9
3.2	Primary Scenario: PEV and utility establish/re-establish communications session at the time of charging .....	11
3.2.1	Steps for this scenario .....	12
3.3	Primary Scenario: Utility provides billing services to PEV Customer .....	12
3.3.1	Steps for this scenario .....	13
3.4	Primary Scenario: Utility provides Customer access to PEV information .....	14
3.4.1	Steps for this scenario .....	14
4.	Requirements .....	16
4.1	Functional Requirements.....	16
	Non-Functional Requirements.....	18
5.	Use Case Models (optional) .....	20
5.1	Information Exchange.....	20
5.2	Diagram .....	22
5.2.1	System Diagram .....	22
5.2.2	Sequence Diagram: Scenario 1 .....	23

5.2.3	Sequence Diagram: Scenario 2 .....	24
6.	Use Case Issues .....	25
7.	Glossary .....	26
8.	References .....	27
9.	Bibliography (optional).....	28

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# 1. Use Case Description

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## 1.1 Use Case Title

Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer

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## 1.2 Use Case Summary

Consumers are turning to emerging transportation options that are more fuel-efficient and environmentally favorable growing the market for all-electric and plug-in hybrid vehicles. These plug-in electric vehicles (PEV) require electric utilities that are capable of supporting the resulting emerging loads. The most reasonable option for utilities is to provide electricity for charging these vehicles at off-peak times when energy costs are low and generation and power delivery assets are underutilized. PEV manufacturers are eager to work with utilities to develop the customer rates/programs that provide greater incentives for consumers to purchase their product. In order to develop utility customer rates and programs specifically marketed to PEV owners, the utility must provide special services to their customers. These services include the ability to:

- Enroll, register and setup (one-time) initial communications between a PEV and the utility
- Repeatedly re-establish communications for each PEV charging session (repeat communications/re-binding)
- Provide PEV charging and other status data to customer information channels (e.g. Web, display devices)
- Accurately bill PEV customers according to their selected rates/programs

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## 1.3 Use Case Detailed Narrative

Within a utility's service territory, PEV owners can plug in their vehicles to receive a charge of electrical energy at their premises or at other charging locations. The utility may offer a PEV incentive that charges lower tariffs for off-peak charging and higher ones for on-peak charging. Along with these scaled rate options, the utility must provide the necessary support services for supplying energy to PEV owners. Customers should have access to PEV program enrollment services, communications session binding, billing, and information services. SCE's PEV enrollment system includes registration and commissioning capabilities and the utility's Energy Services Communication Interface (ESCI) allows PEV owners/customers to establish a communications binding (session) at any authorized charging location. Energy supplied to the PEV is reported to the utility and the customer is billed. The customer can access information related to the utility's PEV programs, their energy usage, and PEV charging status/information via a Web site or other customer provided display equipment.

This use case covers three scenarios:

- 1) Customer enrolls in PEV program and completes initial setup for PEV and utility communications
- 2) PEV and utility establish/re-establish communications session at the time of charging
- 3) Utility provides billing services to customer for PEV charging
- 4) Utility provides customer access to PEV charging and status information

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## **1.4 Business Rules and Assumptions**

- PEV customer has an account with the utility and the electric services at the charging premises are provided by that utility.
- PEV and the utility have communications capabilities, enabled by the utility-provided ESCI.
- The utility offers PEV programs and services to its customers and provides the necessary support processes for enrollment, communications and billing.
- In the absence or failure of PEV-utility communications, or if PEV I.D. validation fails, PEV charging proceeds; however, the incentive rates do not apply and all energy charges accrue to the premises' account according to the premises customer's default rate/service plan.
- The actual PEV charging processes, including scenarios for intra- and inter- utility roaming, apply as covered in Use Case P2.
- An End Use Measurement Device (EUMD) is available for PEV charging. If not, charging proceeds without incentive rates and with all energy charges accruing to the premises customer. Charging status indicators/metrics may or may not be available to the customer for presentation/display purposes.
- EUMD function is inclusively located anywhere in a particular zone from the PEV to the branch circuit panel connection.
- To allow for the possibility that the EUMD is part of or within the PEV, such PEV acts as a sub-meter to the primary utility billing meter at any charging premises as opposed to being a separate service account with a dual meter socket adapter.

**P1 – Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer**

## 2. Actors

*Describe the primary and secondary actors involved in the use case. This might include all the people (their job), systems, databases, organizations, and devices involved in or affected by the function (e.g. operators, system administrators, customer, end users, service personnel, executives, meter, real-time database, ISO, power system). Actors listed for this use case should be copied from the global actors list to ensure consistency across all use cases.*

<b>Actor Name</b>	<b>Actor Type (person, device, system etc.)</b>	<b>Actor Description</b>
Customer (PEV)	Person	The operator of a plug-in electric vehicle (PEV) and a customer of the home electric utility. Has enrolled in the utility's PEV program and has selected a PEV rate tariff. Responsible for connecting the PEV to an energy portal for charging.
Plug-in Electric Vehicle (PEV)	System	Mode of transportation that plugs into an energy portal at a charging premises. The vehicle is capable of two-way communications with the utility through the Energy Services Communications Interface (ESCI).
Energy Portal	Device	Any charging point for a PEV. At a minimum, it is a 120V, 15A outlet, but can be a 240V Electric Vehicle Supply Equipment (EVSE) outlet connected to the premises circuit.
Utility	Organization	A generic term referring to the collection of systems, business functions, and organizations that form an electric utility organization. The term is used whenever the precise actor is not known or many actors utilize a service.
Energy Services Communication Interface (ESCI)	System	Communicates with and exchanges information between the utility, PEV, and End Use Measurement Device (EUMD). Provides PEV charging session information (PEV I.D., interval kWh consumption) to the utility and passes energy information, including price signals, schedules, event messages, configuration, and security data from the utility to the PEV. This interface may or may not be facilitated by an Advanced Metering Infrastructure (AMI) that includes a Home Area Network (HAN).
End Use Measurement Device (EUMD)	Device	Measures and communicates energy usage information payload to the Energy Services Communication Interface (ESCI). Provides charging session information such as PEV I.D. and interval kWh consumption from PEV to utility. Receives configuration information (e.g., interval for metering kWh consumption) from utility.
Electric Vehicle Supply Equipment (EVSE)	Device	The electrical cord and connectors for the transfer of electrical energy from energy portal to PEV. Can be 120V or 240V AC depending upon type and size of energy portal. Meets SAE standards (SAE 2293, SAE 1772, SAE J2836, etc.) May or may not have EUMD and/or ESCI communications capability.

## Edison SmartConnect Program

### P1 – Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer

<i>Actor Name</i>	<i>Actor Type (person, device, system etc.)</i>	<i>Actor Description</i>
Roaming Utility	Organization	Electric service provider that supplies energy to a PEV when it is outside of the customer's utility service territory.
Clearinghouse	Organization	Handles global PEV account services. Maintains the information necessary to facilitate account validation and billing transactions when a customer charges a PEV at a location other than the one they are enrolled with.
Customer Energy Management System (CEMS)	System	A customer supplied system for monitoring and managing energy use at their residence or business. It includes human interface displays for interacting with the system and allows the customer to program functions, control loads, and display energy costs, usage and related information. It can be programmed to take action based upon price inputs or event messages from the utility, or changes to customer's load. Interfaces with HAN devices and the SmartConnect meter.
Customer Account	System	Account assigned to a customer for the collection of charges for billing their energy usage.
Guest	Person	A friend or family member who has permission to use a customer's premises for charging a PEV. May be liable for PEV charging costs depending on the preferences set-up in the PEV program by the customer.

### 3. Step-by-Step Analysis of Each Scenario

*Describe steps that implement the scenario. The first scenario should be classified as either a primary scenario or an alternate scenario by starting the title of the scenario with either the work “Primary” or “Alternate”. A scenario that successfully completes without exception or relying heavily on steps from another scenario should be classified as Primary; all other scenarios should be classified as Alternate. If there are more than one relevant scenario (set of steps), make a copy of the following section (all of 3.1, including 3.1.1 and tables) and fill out the additional scenarios.*

#### 3.1 Primary Scenario: Customer enrolls in PEV program and completes initial setup for PEV – Utility communications

This scenario describes one of SmartConnect’s most common functions, the utility enrolling a customer in its program/service specifically developed for the PEV owner enabling them to fuel their vehicle(s) during off-peak periods for reduced tariffs. This scenario describes how the customer enrolls their PEV in the utility program and the steps required to establish the initial communications session with the utility.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
The customer acquires a PEV and contacts the utility to enroll in its PEV program.	Customer	Customer has a PEV and wishes to enroll in PEV program. Utility offers PEV programs to its customers.	The utility has successfully enrolled a customer’s PEV in its PEV program and the PEV has established an initial communications session with the utility.

##### 3.1.1 Steps for this scenario

*Describe the normal sequence of events required to complete the scenario.*

## Edison SmartConnect Program

### P1 – Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	Customer	Initiates request to enroll PEV in a PEV program by contacting the utility and providing their customer and PEV information (account information, PEV I.D., etc.).	Customer uses phone, Internet, or other communications channel.  Preference for PEV is its VIN #
2	Utility	Authenticates customer I.D., account, and premises information, and collects PEV information including PEV I.D.	
3	Utility	Provides PEV program information and selections to the customer.	
4	Customer	Selects PEV program and service plan and sets PEV program parameters (i.e. guest charging, allow roaming, etc.), officially enrolling the customer and their PEV in the utility's PEV program.	
5	Customer	Connects their PEV to the energy portal at their premises.	
6	PEV	Senses power connection to the on-board charging unit and activates the On-Plug state.	
7	PEV and ESCI	Initiate a secure communications session.	Implementation could designate the PEV or ESCI as initiator of session.
8	PEV	Transmits the PEV I.D. to the ESCI.	Unique PEV I.D. will ultimately support portability of charging and other functions.
9	ESCI	Maintains communications session and security between PEV and utility. Transmits request for validating PEV I.D. to the utility (including premises I.D.).	
10	Utility	Identifies and authenticates PEV and premises I.D.	
11	Utility	Transmits confirmation message via ESCI to PEV indicating successful binding with premise ESCI. Confirmation message includes authentication parameters for PEV.	Authentication parameters should include utility rate program information.

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
12	PEV	Receives confirmation message and sets authentication parameters.	
13	PEV	Transmits via ESCI a message to the utility acknowledging receipt of the valid confirmation message and setting of authentication parameters.	
14	Utility	Transmits message via ESCI and detects EUMD at customer premises; message includes authentication parameters for EUMD.	Authentication parameters should include utility rate program information (e.g. interval size, etc.).
15	EUMD	Receives detection message and sets authentication parameters.	
16	EUMD	Transmits message via ESCI to the utility acknowledging receipt of a valid detection message and setting of authentication parameters.	

### **3.2 Primary Scenario: PEV and utility establish/re-establish communications session at the time of charging**

This scenario describes the steps required to establish a PEV-to-utility communications session each time a PEV plugs in for charging or requests an information exchange. This scenario assumes that initial PEV-to-utility communications have been established, including the setup of authentication parameters in the PEV and EUMD.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
Customer plugs in a PEV for charging or to exchange information with the utility	Customer	Enrollment and initial setup (as described in Scenario 1) has been completed.	PEV and utility have established a communications session upon PEV being plugged in.

### 3.2.1 Steps for this scenario

*Describe the normal sequence of events required to complete the scenario.*

<b>Step #</b>	<b>Actor</b>	<b>Description of the Step</b>	<b>Additional Notes</b>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	PEV	Senses power to on-board charging unit and activates the On-Plug state.	
2	PEV and ESCI	Initiate a secure communications session.	Implementation could have either PEV or ESCI initiating the session.
3	PEV	Transmits PEV I.D. to the ESCI.	Unique PEV I.D. will ultimately support portability of charging and other functions.
4	ESCI	Maintains a communications session and security link between PEV and utility. ESCI transmits to the utility a request for validating PEV and premises identification.	
5	Utility	Verifies PEV I.D. and premises I.D.	
6	Utility	Transmits confirmation message via ESCI to EUMD indicating successful binding with premises ESCI.	
7	ESCI	Transmits confirmation message to PEV indicating successful communications binding of PEV to utility so that charging can proceed according to enrolled PEV program.	

### 3.3 Primary Scenario: Utility provides billing services to PEV Customer

This scenario describes what happens when a customer charges their PEV into a premises serviced by their utility and the utility generates a bill for the energy delivered. Utility may receive its billing information from an in-territory EUMD or an external Clearinghouse.

<b>Triggering Event</b>	<b>Primary Actor</b>	<b>Pre-Condition</b>	<b>Post-Condition</b>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
Utility receives charging session information from EUMD.	Utility	Customer has subscribed to a PEV program and set their tariff preference.	The utility has a record of the energy purchased transaction related to the customer premises and associated PEV I.D., and posts the charge to the customer account.

### 3.3.1 Steps for this scenario

*Describe the normal sequence of events that is required to complete the scenario.*

<b>Step #</b>	<b>Actor</b>	<b>Description of the Step</b>	<b>Additional Notes</b>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	EUMD	Via the ESCI or Clearinghouse, sends charging session information to the utility.	
2	Utility	Receives energy charging information and verifies I.D. information for the premises, PEV, customer, account, and utility.	
3	Utility	Posts charging session information to customer account(s) for debit.	
4	Utility	Posts non-utility energy charges/bill to the Clearinghouse.	
5	Utility	Utility posts charging session information to customer account(s) for credit (guest charging).	

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
6	Utility	Utility prepares monthly bill with PEV charging session charges/usage information.	
7	Utility	Utility sends bill to customer.	

### **3.4 Primary Scenario: Utility provides Customer access to PEV information**

This scenario describes what happens when a customer requires information related to PEV programs, energy supplied to their PEV, billing, PEV tariffs, demand-side management events, and other historical data related to the customer’s PEV account.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the step</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
The customer requests PEV program, energy usage and billing information.	Customer	Customer has subscribed to a PEV program. Utility has implemented access method that allows customer to view PEV program, energy usage and billing information.	The customer has successfully reviewed the PEV program, usage and billing information.

#### **3.4.1 Steps for this scenario**

*Describe the normal sequence of events required to complete the scenario.*

## Edison SmartConnect Program

### P1 – Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	Customer	Requests PEV program, energy usage, and billing information.	
2	Utility	Provides customer with information on their PEV program, energy usage, and billing using access methods selected by customer.	

## 4. Requirements

*Detail the Functional, Non-Functional and Business Requirements generated from the workshop in the tables below. If applicable list the associated use case scenario and step.*

### 4.1 Functional Requirements

<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
The utility shall have plug-in electric vehicle (PEV) program enrollment methods and processes available and known to the customer.	1	1
The utility shall have operational PEV programs and services for customers to enroll in.	1	1,3
PEV shall have a unique I.D. which can be stored within and communicated from PEV.	1	1, 2, 8
The utility shall maintain information on all customers and PEV enrolled in their PEV programs, including associated PEV, customer and premises I.D., and parameters of the program enrolled in (allow roaming, guest charging, etc.)	1	2, 4, 10
The utility shall be able to determine customers/premises not enrolled in PEV program.	1	2, 4, 10
PEV shall be plugged into an energy portal (PEV On-Plug state) prior to participating in any communications session with the ESCI.	1 2	5, 6 1
PEV shall be able to plug into EVSE enabled with a 120V or 240V AC energy portal. Establishing communications with the utility is not required.	1	5,6
The ESCI shall be installed at the customer premises and be capable of communications with the utility and the PEV/EUMD to facilitate exchange of authentication and charging session information.	1 2	7, 8, 9, 11, 13, 14, 16 2, 3, 4, 6, 7
PEV, EUMD and ESCI shall be able to establish a secure communications link.	1 2	7 2
If ESCI communications cannot be established between PEV and the utility within a configurable period of time after achieving On-Plug state, charging shall proceed (according to customer preferences) with all charges accruing to the account for the customer's premises at the customer's regular utility rate.	1 2	7 2

<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
PEV shall be capable of communicating with ESCI.	1	8, 11, 13
	2	3, 7
PEV shall be capable of communicating with the utility through an ESCI.	1	8, 11, 13
	2	3, 7
PEV shall be capable of providing to the ESCI its unique PEV I.D. upon initiation of a communications session between the PEV and ESCI.	1	8
	2	3
ESCI shall be able to provide the premises I.D. to the utility (along with PEV I.D. provided by the PEV) for validation/verification.	1	9
	2	4
The utility shall be able to verify usage attributed to PEV charging and sourced from the same customer/premises that provide the ESCI for PEV-to-utility communications (e.g., load correlation to ESCI communications).	1	9
	2	4
The utility shall be able to send a confirmation message via ESCI to PEV to authenticate PEV and premises I.D. information and establish a successful PEV/ESCI binding.	1	11
	2	6, 7
PEV shall be capable of receiving a confirmation message from the utility via ESCI establishing a valid charging session. This indication can be made available to the customer for indicating whether a communications session has been successfully established.	1	12
	2	7
PEV shall be able to receive utility authentication parameters as necessary upon initial binding with ESCI, or upon change of utility authentication parameters.	1	12
PEV shall be able to send messages to the utility via ESCI acknowledging successful authentication and completion of initial setup of the PEV according to utility's PEV program.	1	13
EUMD shall be required to discretely measure usage provided for PEV charging.	1	14
	2	6
EUMD function shall be inclusively located anywhere in a zone from the PEV and branch circuit panel connection.	1	14
	2	6
EUMD shall be capable of communicating with the utility through an ESCI.	1	14, 16, 17
	2	6

<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
The utility shall be able to send a detection message via ESCI to EUMD to indicate authentication of PEV and premises I.D. information and establishment of a successful PEV/ESCI binding.	1	14
EUMD shall be capable of receiving a detection message from the utility via ESCI establishing a valid charging session. This indication can in turn be made available to the customer to indicate that a communications session has been successfully established.	1 2	15 6
EUMD shall allow for remote reconfiguration of energy measurement interval length.	1	15
EUMD shall be able to receive utility authentication parameters as necessary upon initial binding with ESCI, or upon change of utility authentication parameters (e.g. usage measurement interval).	1	15
EUMD shall be able to send messages to the utility via ESCI acknowledging successful authentication and completion of initial setup of EUMD according to utility PEV program.	1	16
Following initial enrollment and setup, re-establishment of PEV-to-utility communications shall be achieved without the full authentication and discovery steps required for initial session.	2	6, 7
EUMD shall exist that can send energy charging session information to the utility.	3	1
A Clearinghouse shall exist that can send energy charging session information to utility.	3	1
Customer shall have an active account and utility shall have a system for posting energy charges to the customer account.	3	2,3
Customer account exists in Clearinghouse which shall receive energy charges for out-of-territory customers.	3	4
Customer shall have active account and utility shall have system for crediting energy charges to the customer account.	3	5
Utility shall have a system for producing and sending monthly bills to customers.	3	6,7

## Non-Functional Requirements

<i>Non-Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
Time shall be maintained by each device in the system to UTC with 1 second resolution.	1	8, 11-16
	2	3, 6, 7

## Edison SmartConnect Program

### P1 – Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer

<i>Non-Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
PEV shall attempt initiating communication sessions before initiating charging.	1	7
	2	2
PEV shall wait a minimum time (i.e. 1 minute) to allow for a communications session to be established before charging activation.	1	7
	2	2

## 5. Use Case Models (optional)

*This section is used by the architecture team to detail information exchange, actor interactions and sequence diagrams*

### 5.1 Information Exchange

*For each scenario detail the information exchanged in each step.*

*This will need to be updated given step and reqts update.....should be in synch with sequence diagram also.*

<b>Scenario #</b>	<b>Step #, Step Name</b>	<b>Information Producer</b>	<b>Information Receiver</b>	<b>Name of information exchanged</b>
#	Name of the step for this scenario.	What actors are primarily responsible for producing the information?	What actors are primarily responsible for receiving the information?	Describe the information being exchanged.
1	<u>1</u>	Customer	Utility	Customer information, financial data, premise address, contact information, customer account number, PEV I.D.
1	<u>3</u>	Utility	Customer	PEV program and tariff information
1	<u>4</u>	Customer	Utility	PEV program selection and preferences
1	<u>5</u>	Utility	Customer	Commissioning steps to customer
1	<u>7</u>	PEV	ESCI	Exchange for secure communication session
1	<u>8</u>	PEV	ESCI	PEV I.D.
1	<u>9</u>	ESCI	Utility	PEV I.D.
1	<u>11</u>	Utility	PEV	Authentication message, parameters
1	<u>13</u>	PEV	Utility	Confirmation of authentication message, parameters
1	<u>14</u>	Utility	ESCI	Detection of EUMD
1	<u>15</u>	ESCI	EUMD	Detection of EUMD
1	<u>16</u>	EUMD	Utility	Acknowledgement message

## Edison SmartConnect Program

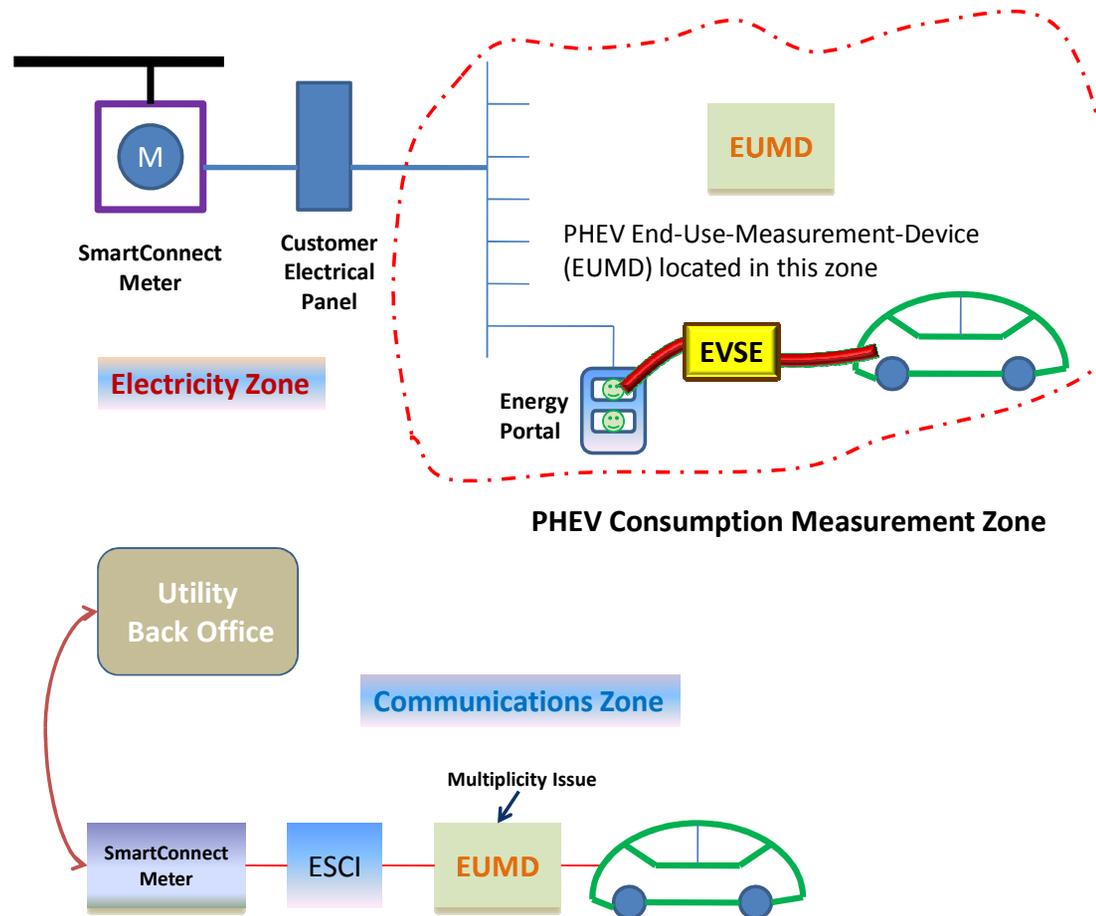
### P1 – Utility Provides Services to Plug-In Electric Vehicle (PEV) Customer

<i>Scenario #</i>	<i>Step #, Step Name</i>	<i>Information Producer</i>	<i>Information Receiver</i>	<i>Name of information exchanged</i>
2	<u>1</u>	EUMD	Utility	Charging session event message: <ul style="list-style-type: none"> <li>• PEV I.D.</li> <li>• Premise I.D.</li> <li>• Metered energy supplied by each metering interval</li> </ul>
2	<u>1</u>	Clearinghouse	Utility	Charging session event message: <ul style="list-style-type: none"> <li>• PEV I.D.</li> <li>• Premise I.D.</li> <li>• Customer I.D.</li> <li>• Utility I.D.</li> <li>• Metered energy supplied by each metering interval</li> </ul>
2	<u>3</u>	Utility	Customer Account	Charging session event debit transaction: <ul style="list-style-type: none"> <li>• PEV I.D.</li> <li>• Metered energy supplied by each metering interval</li> </ul>
2	<u>4</u>	Utility	Clearinghouse	Charging session event debit transaction: <ul style="list-style-type: none"> <li>• PEV I.D.</li> <li>• Premise I.D.</li> <li>• Customer I.D.</li> <li>• Utility I.D.</li> <li>• Metered energy supplied by each metering interval</li> </ul>
2	<u>5</u>	Utility	Customer Account	Charging session event debit transaction: <ul style="list-style-type: none"> <li>• PEV I.D.</li> <li>• Customer I.D.</li> <li>• Utility I.D.</li> <li>• Metered energy supplied by each metering interval</li> </ul>
2	<u>7</u>	Utility	Customer	Monthly energy usage bill including summary of all PEV related energy charges both debits and credits

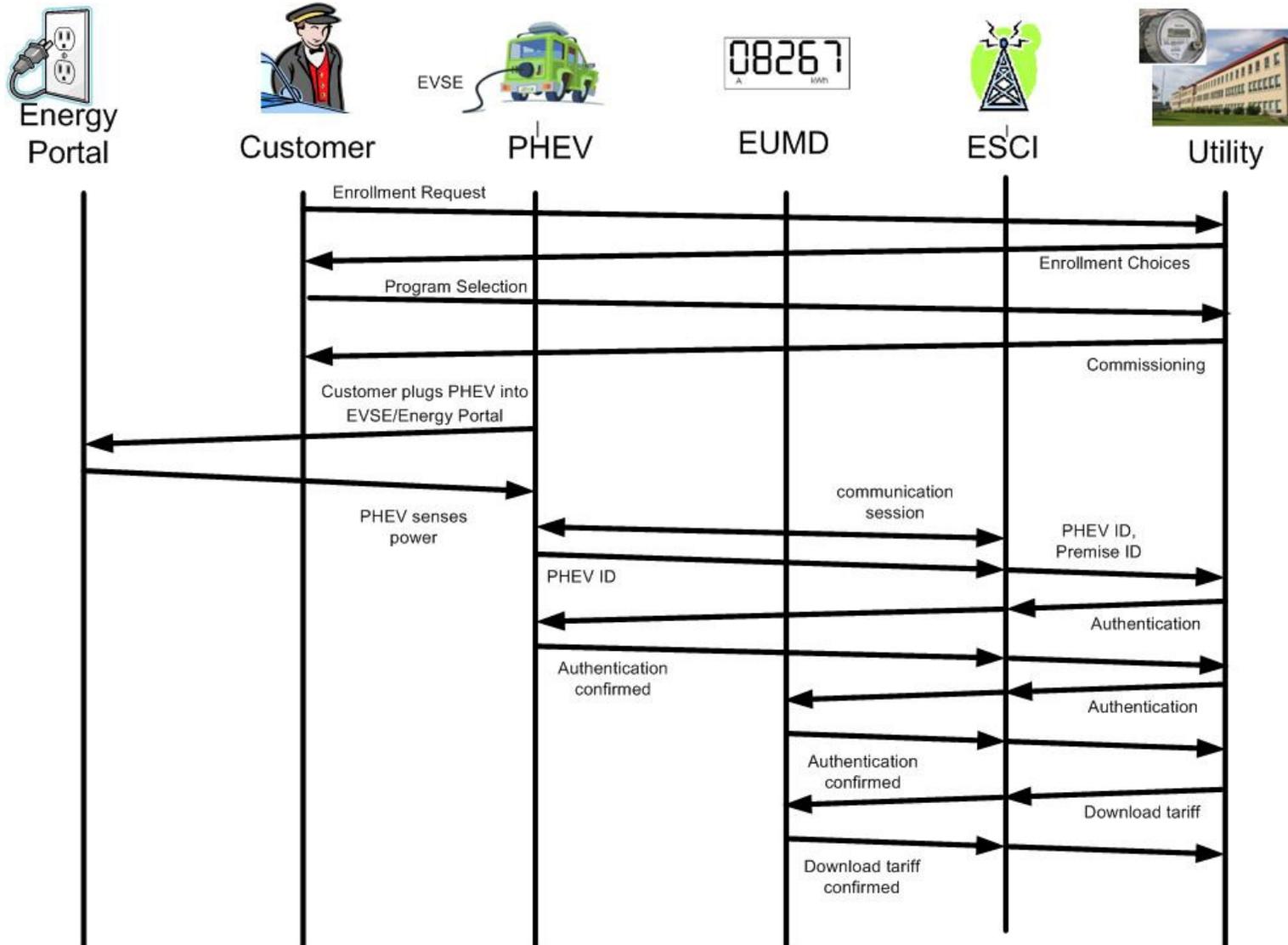
## 5.2 Diagram

The architecture team shall use this section to develop an interaction diagram that graphically describes the step-by-step actor-system interactions for all scenarios. The diagrams shall use standard UML notation. Additionally, sequence diagrams may be developed to help describe complex event flows.

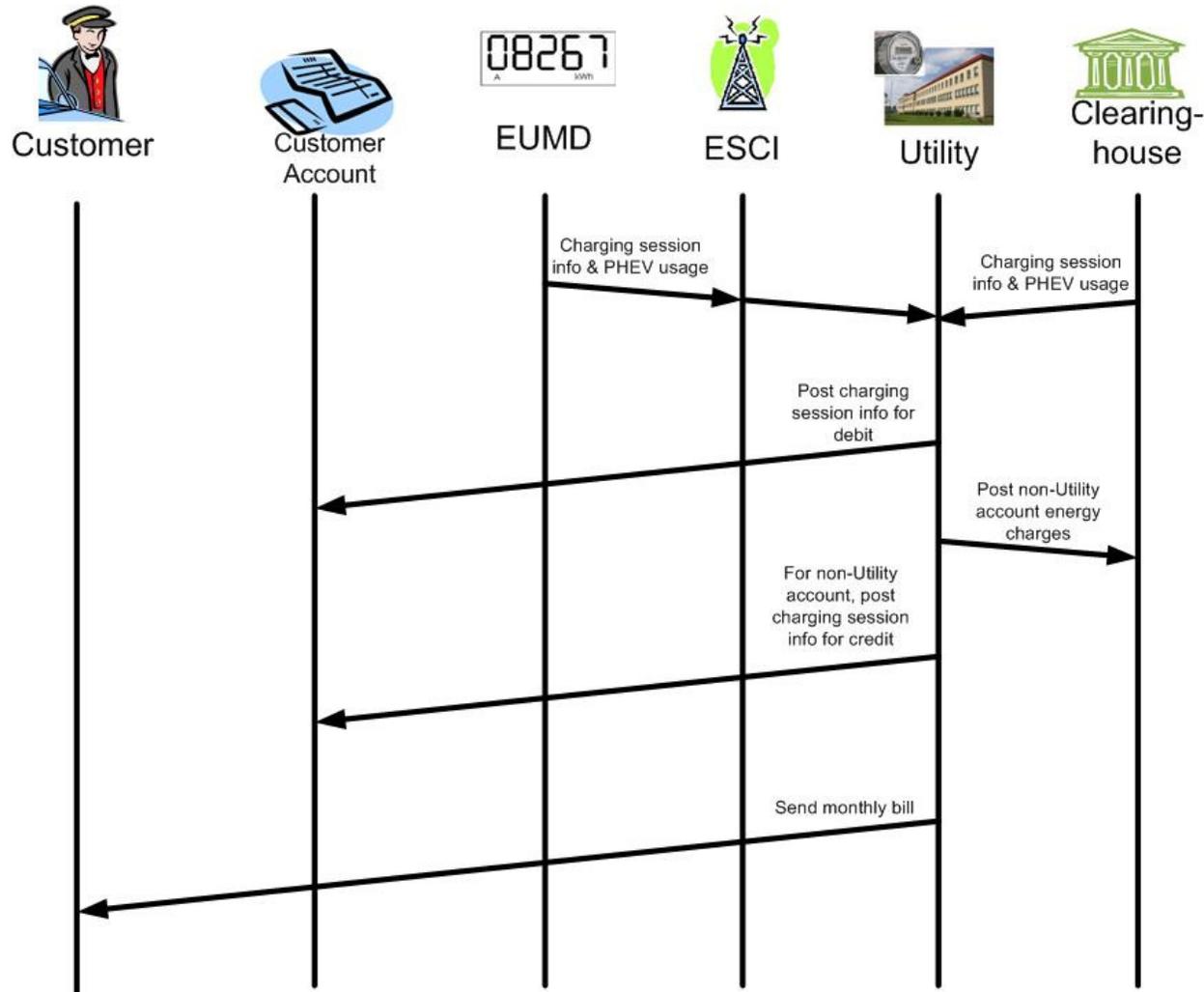
### 5.2.1 System Diagram



**5.2.2 Sequence Diagram: Scenario 1**



**5.2.3 Sequence Diagram: Scenario 2**



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## 6. Use Case Issues

*Capture any issues with the use case. Specifically, those unresolved issues that help the use case reader understand the constraints or unresolved factors that have an impact of the use case scenarios and their realization.*

<i>Issue</i>
<i>Describe the issue as well as any potential impacts to the use case.</i>

## 7. Glossary

*Insert the terms and definitions relevant to this use case. Please ensure that any glossary item added to this list should be included in the global glossary to ensure consistency between use cases.*

<b>Glossary</b>	
<b>Term</b>	<b>Definition</b>
Tariff	Energy cost schedule to customer. Can be time-of-day, flat rate, seasonal rate, critical peak price rate, etc.
PEV	Plug-in Electric Vehicle. Includes all vehicles that have ability to receive electrical energy from the utility.
EUMD	End use measurement device used to assess revenue.
ESCI	Energy Services Communication Interface
Charging	Act of electrically charging a battery on-board a PEV.
VIN	Vehicle Identification Number

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## **8. References**

*Reference any prior work (intellectual property of companies or individuals) used in the preparation of this use case.*

## **9. Bibliography (optional)**

*Provide a list of related reading, standards, etc. that the use case reader may find helpful.*