

**Vehicle Use Case Task Force  
E: General Registration & Enrollment Process**

## 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

## **Vehicle Use Case Task Force**

### **E: General Registration & Enrollment Process**

#### **1.1 Use Case Title**

E – Utility Use Case

Customer enrolls in PHEV program and completes initial setup for PEV – Utilities communications

#### **1.2 Use Case Summary**

Customers are interested in fueling vehicles with electricity. Electric Vehicles (EV), Plug-in Vehicles (PEV) and Plug-in Hybrid Vehicles (PHEV) are emerging transportation options for consumers. Electric utilities desire to support these emerging loads with electricity at “off peak” times when energy costs are low and generation and power delivery assets are underutilized. PEV manufacturers are interested in working with utilities to develop customer rates/programs which could provide consumers with an increased incentive to purchase a PEV. To enable utility customer rates/programs specifically to customers with PEVs, the utility must offer special services for these customers. These services include the ability to enroll, register, and initially setup communications between a PEV and the utility (one-time setup), the ability to repeatedly re-establish communications for each PEV charging session (repeat communications/re-binding), the ability to provide PEV charging (and other) status information to customer information channels (e.g. web, display devices), and the ability to correctly bill PEV customers according to their selected rates/programs.

#### **1.3 Use Case Detailed Narrative**

The Utility may offer the Customer a PHEV tariff that provides a low rate for off-peak charging and a higher rate for on-peak charging. The utility must provide services to support energy supplied to customer PEV. These services include enrollment into a PEV program, PEV communications session binding, PEV energy billing, and PHEV information services. The utility will implement an enrollment system for Customers with a PEV including registration and commissioning. The utility’s Energy Services Communication Interface (ESCI) shall allow for the establishment of a communications session (communications binding), at a premise location each time a PEV plugs in for charging. Energy supplied to the PEV is reported to the utility for billing and presentation to the Customer. Information related to utility PEV programs, energy usage, and PEV charging status/information will be made available to the Customer for viewing via a website or other customer provided display equipment. This use case covers general information for the following five scenarios:

- 1) U1: Enrollment Process to Time of Use (TOU) Program
- 2) U2: Enrollment Process to Direct Load/Device Control (DDC) Program

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- 3) U3: Enrollment Process to Real Time Pricing (RTP) or Hourly/Periodic Pricing Program
- 4) U4: Enrollment Process to Critical Peak Pricing (CPP) or Hourly/Periodic Pricing Program
- 5) U5: Enrollment Process to Active Load Management Program

- These programs apply to routine or prearranged customer, vehicle usage & charging events.
- It is expected that the enrollment process would identify the customers normal charging pattern, specific details on the vehicle(s) operated that could be matched with anticipated load info to predict minimum effects on the grid.

#### **1.4 Business Rules and Assumptions**

- PEV Customer has an account with utility and electrical service at a premise served by the utility.
- PEV and utility have communications capabilities, enabled by utility provided Energy Services Communication Interface (ESCI).
- The customer awareness of the utility and vehicle programs is prompted by both the utility providers and the vehicle manufacturers.
  - The utility offers PEV programs and services for its customers and will provide the necessary support processes for enrollment, communications, and billing
  - The Vehicle manufacturers would provide information to the customer about fuel and/or emission gains of the vehicles offered and promote the utility and convenience of connecting to the grid
- Utility shall maintain information on all Customers and PEVs enrolled in the PEV programs, including demand side management programs, associated PEV IDs, customer IDs, and premise IDs
- In the absence or failure of PEV-utility communications, or if PEV ID validation fails, PEV charging will always proceed; however, without the incentive rates and with all energy charges accruing to the premise customer according to the premise customer's default rate/service plan.
- The actual PEV charging processes, including scenarios for intra- and inter- utility roaming, are covered in use case P2.
- End Use Measurement Device (EUMD) is always available for PEV charging. If not available, charging will proceed without incentive rates and with all energy charges accruing to the premise customer. This may or may not prevent certain charging status indicators / metrics being available to customer for presentation/display purposes.
- EUMD function can be inclusively located anywhere in a zone from the PEV and the branch circuit panel connection.

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- To allow for possibility of the EUMD being a part of/within the PEV, PEV is a sub-meter to the primary utility billing meter at any premise (as opposed to being a separate service account with dual meter socket adapter)
- The PEV & Utility will communicate to implement one or more the previously described Utility programs (details of which are covered in PR)

## 2. Actors

These are the actors or objects in these Use Cases. Sequence diagrams are included to visualize the steps these actors take in the energy transfer process.

<i>Actor Name</i>	<i>Actor Type (person, device, system etc.)</i>	<i>Actor Description</i>
Clearinghouse	Organization	Organization that provides global PEV account services. Maintains information necessary to facilitate account validation and billing transaction when Customer is charging PEV at a location not served by the Utility that the Customer is enrolled with.
Customer	Person	Customer is the operator of a PEV and an electric customer of the home utility. Customer enrolls in an electric utility PEV program and has selected a PEV rate tariff. Customer is responsible for connecting PEV to an Energy Portal for charging.
Customer Account	System	Customer Account is assigned to Customer to collect charges for billing of energy usage
Customer Energy Management System	System	Customer Energy Management System can provide communication interface to PEV for communication of PEV status information (e.g. charging state, state-of-charge, charging rate, time to complete charge) on Customer viewable displays.
Electric Vehicle Supply Equipment (EVSE)	Device	PEV connects to the grid using an Electric Vehicle Supply Equipment (EVSE). Electric Vehicle Supply Equipment (EVSE) is the physical electrical cord and connectors that are specified by applicable SAE standards (e.g., SAE 2293, J1772, J2836 & J2847.) that provide transfer of electrical energy from energy portal to PEV. This can be 120V or 240V AC depending upon connection. Two type of connection include 1) EVSE cordset and 2) Premise Mounted version. The Premise EVSE would not include the charger for AC (Level 2) energy transfer described in J1772. This would expect the charger to be included with the vehicle. If the EVSE included a charger, DC (Level 3) energy transfer is expected and the vehicle would not include the charger since it was within the EVSE. This EVSE that includes the charger may also be capable of AC energy transfer at both 120V (Level 1) and 240V (Level 2) levels as described in J1772. It is expected to have the cordset stay with the vehicle and used in both home and public applications. The

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<i>Actor Name</i>	<i>Actor Type (person, device, system etc.)</i>	<i>Actor Description</i>
		<p>cordset would be used for convenience charging that is expected to connect to either a 15A or 20A 120V outlet. Vehicles that include a 1.5 kW or 2 kW on-board charger could use this cordset connected to the respective 15A or 20A outlets (Energy Portals - EP) but also connect to the grid using the premise mounted EVSE. The premise mounted EVSE is expected to be higher power levels using a 240V supply. The premise EVSE would be used for higher power levels than a Cordset EVSE and is expected to be permanently connected to a 240V premise source that is capable of delivering up to 80A. Vehicles with larger on-board chargers may primarily connect using the premise mounted EVSE but also use the cordset to obtain lower power levels from the Energy Portals EVSE may or may not have communication capability. EVSE may or may not have EUMD and/or ESCI communications capability.</p> <p>Details of the EVSE and it's Pilot circuit is described in SAE J1772. The pilot circuit is used to wake up the vehicle, then it's PWM generator establishes the initial signals to the vehicle from the EVSE.</p> <p>The sequence of events are further described in the steps of Use Cases S1, 2 &amp; 3.</p>
Energy Portal (EP)/Smart Energy Portal (SEP)	Device	Energy Portal is any charging point for a PEV. At a minimum, the Energy Portal is a 120V, 15A outlet but can also be a 240V Electric Vehicle Supply Equipment (EVSE) outlet connected to the premise circuit.
Energy Services Communication Interface (ESCI)	System	<p>Energy Services Communication Interface (ESCI) The ESCI is the communication device between the vehicle and the utility</p> <p>ESCI The Energy Services Communication Interface (ESCI) shall exist at the customer premise and be capable of securely communicating between the Utility and PHEV to facilitate exchange of demand side management information</p> <p>PEV shall be capable of communicating to the Utility through an ESCI</p> <p>ESCI shall report all PEV charging session information and energy usage to Utility ESCI communicates with and exchanges information between utility, PEV, and End Use Measurement Device (EUMD). ESCI shall provide PEV charging session information to the utility – PEV ID, interval kWhr consumption. 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).</p> <p>ESCI shall employ appropriate security policies when communicating demand side management program-related messages</p>
End Use Measurement Device (EUMD)	Device	<p>End Use Measurement Device (EUMD) is the device that measures and communicates energy usage information payload to Energy Services Communication Interface (ESCI).</p> <p>PEV EUMD shall provide PEV charging session info – PEV ID, Premise ID, interval kWhr consumption.</p> <p>PEV EUMD Receives configuration information (e.g., interval for metering kWhr consumption) from utility.</p>

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<i>Actor Name</i>	<i>Actor Type (person, device, system etc.)</i>	<i>Actor Description</i>
		EUMD function can be located anywhere in a zone from the PEV and the branch circuit panel connection End Use Measurement Device shall employ appropriate security policies when communicating demand side management program-related messages End Use Measurement Device (EUMD) is always available for PEV charging. If not available, charging will proceed without incentive rates and with all energy charges accruing to the premise customer. This may or may not prevent certain charging status indicators / metrics being available to customer for presentation/display purposes
ESCO	Organization	competitive supplier of commodity service
Guest	Person	Guest is a friend or family member who has permission to use a Customer Premise for charging a PEV. May be liable for PEV charging costs depending upon Customer preferences set up within PEV program.
PEV, EV, PHEV	System	Plug-in Electric Vehicle (PEV). Plugs into an Energy Portal (see actor definition below) at a premise to charge vehicle. Capable of two-way communications with the utility through the Energy Services Communications Interface (ESCI).
Roaming Utility	Organization	Electric Service Provider that is supplying energy to PEV when PEV is outside of the Customer's Utility service territory
Utility	Organization	Utility typically refers to a collection of systems, business functions, and organizations' which make up the electric utility that include the Customer Information System (CIS), the Advanced Metering Infrastructure (AMI), Rates and Revenue Services, etc.

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

Primary scenario is the enrollment process. This is precluded by an awareness process and includes collecting information pertaining to the customer, their vehicle and operating and charging plans.

#### 3.1 Scenario Description

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**Scenario: Customer enrolls in PHEV program (Basic Enrollment) and completes initial setup for PHEV– Utilities communications**

This scenario describes the most common sequence (basic process) of the utility enrolling a PEV customer into a utility program/service specifically for customers with PEVs. As described in the main Narrative section, the customer is enrolling in a PEV program/service that may provide for the opportunity to fuel a vehicle at a lower cost during off-peak periods based on one of the utility programs enumerated in the main Narrative section. This scenario involves both enrollment of the PEV and steps needed to establish an initial communications session with the utility.

Triggering Event	Primary Actor	Pre-Condition	Post-Condition
<i>The Customer acquires a PEV and contacts the Utility to enroll in a PEV program</i>	<i>Customer</i>	<i>Customer has a PEV and wishes to enroll in PEV program; Utility offers PEV Programs to its customers. Customer connects the vehicle to premise</i>	<i>The Utility has successfully enrolled a Customer PEV in a PEV Program and PEV has established initial communications session with the utility.</i>

#### 3.1.1 Steps for this scenario

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Step #	Actor	Description of the Step	Additional Notes
1	Customer	Customer initiates request to enroll PEV in a PEV Program by contacting Utility and provides Customer and PHEV information (i.e. Customer Account information, PHEV ID, etc.).	Customer uses phone, Internet, or other communications channel.  Preference for PEV is PEV VIN #
2	Utility	Utility authenticates Customer, Customer account, and Premise information, and collects PEV information including PEV ID.	
3	Utility	Utility presents Customer with PEV Program information and PEV Program selections.	

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Step #	Actor	Description of the Step	Additional Notes
4	Customer	Customer selects PEV Program and Service Plan, sets PEV program parameters (i.e. guest charging, allow roaming, etc.). The Customer and PEV are now enrolled in a utility PEV program.	
5	Customer	Customer connects at their premise location.	The connection could be using either EVSE cordset or Premise EVSE. In this scenario we will consider that PEV is connected through EVSE cordset
6	PEV/ Energy Services Communications Interface (ESCI)	PEV and Energy Services Communications Interface (ESCI) initiate a secure communications session.	Implementation could have PEV or ESCI as initiator of session.
7	PEV	PEV ID is transmitted to ESCI.	Unique PEV ID will ultimately support portability of charging, among other purposes.
8	ESCI	ESCI maintains communication session and security between PEV and Utility. ESCI transmits request for validating PEV ID to Utility, includes Premise ID.	
9	Utility	Utility identifies and authenticates PEV ID and Premise ID.	PEV binds with utility
10	Utility	Utility transmits confirmation message via ESCI to PEV indicating successful binding with premise ESCI. Confirmation message includes authentication parameters for PEV.	Authentication parameters would include utility rate program information.

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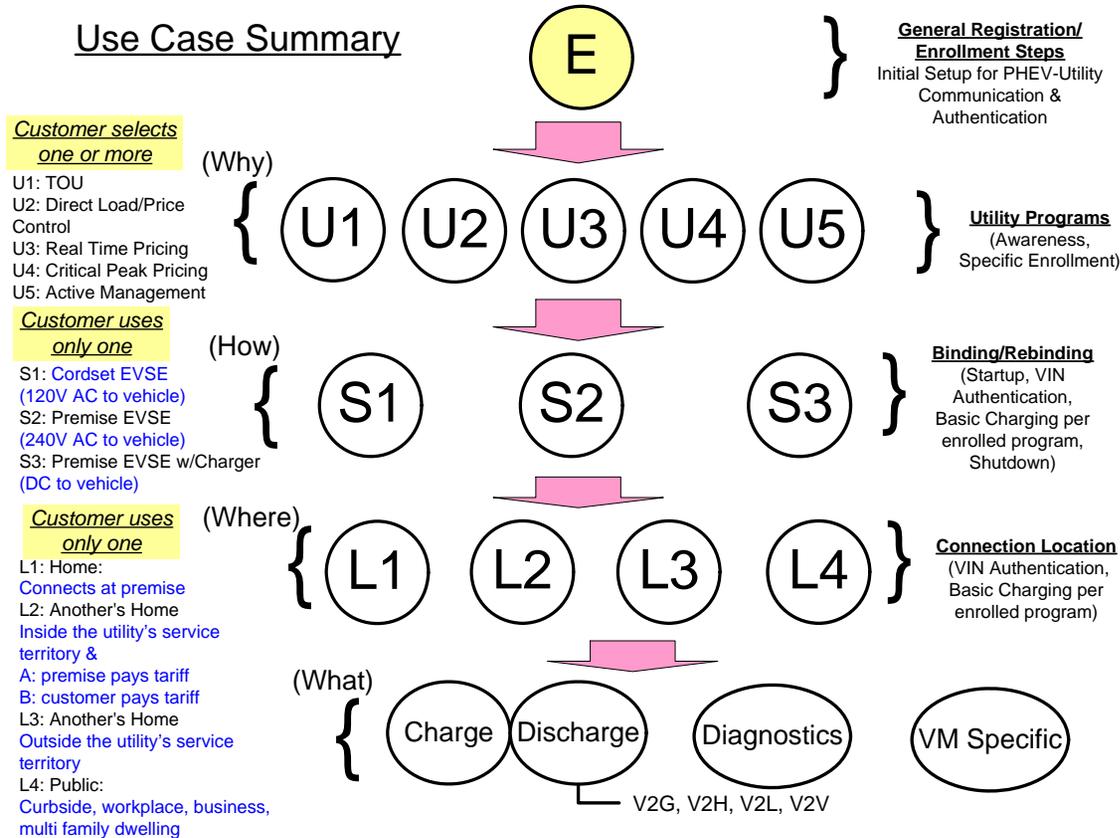
<b>Step #</b>	<b>Actor</b>	<b>Description of the Step</b>	<b>Additional Notes</b>
11	PEV	PEV receives confirmation message and sets authentication parameters.	
12	PEV	PEV transmits via ESCI message to Utility acknowledgement of receipt of valid confirmation message and setting of authentication parameters.	
13	Utility	Utility transmits message via ESCI to discover EUMD at Customer Premise; message includes authentication parameters for EUMD.	Authentication parameters would include utility rate program information (e.g. interval size, etc.).
14	EUMD	EUMD receives discovery message and sets authentication parameters.	
15	EUMD	EUMD transmits via ESCI message to Utility acknowledgement of receipt of valid discovery message and setting of authentication parameters.	
16	ESCI	ESCI transmits confirmation message to PEV indicating successful communication session binding of PEV to Utility, meaning that charging can proceed according to enrolled PEV program.	Authentication between Utility and PEV is now complete and charging can proceed according to the enrolled PEV program criteria
17	PEV	PEV prepares for charging based on Customer-selected preferences and enrolled PEV program. Charging may be delayed based upon Customer preferences or grid reliability criteria (e.g., off-peak economy charging, demand response event underway, short, randomized charging delay to promote grid stability, etc.)	

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### 4. Requirements

This use case is the 1<sup>st</sup> in a series. It identifies the initial awareness and enrollment process the Utility and the Vehicle Manufacturer will offer to the customer. The subsequent use cases (U1 thru U5) describe the specific details of the five categories of programs.



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**4.1 Functional Requirements**

<b>Func. Req. ID</b>	<b>Functional Requirement</b>	<b>Associated Scenario # (if applicable)</b>	<b>Associated Step # (if applicable)</b>

**4.2 Non-Functional Requirements**

<b>Non-func. Req. ID</b>	<b>Non-Functional Requirement</b>	<b>Associated Scenario # (if applicable)</b>	<b>Associated Step # (if applicable)</b>

**4.3 Business Requirements**

<b>Bus. Req. ID</b>	<b>Business Requirement</b>	<b>Associated Scenario # (if applicable)</b>	<b>Associated Step # (if applicable)</b>

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**5. Use Case Models**

The enrollment process will include capturing the following customer, vehicle and usage information. This is to be used by the utility to predict the energy needs of the customer and plan for optimized charging of the plug-in vehicles.

**5.1 Customer Information**

	TOU	DDC	RTP	CPP	Active Management
1) <u>What Program do you desire?</u>	<input type="checkbox"/>				
	10,000	15,000	20,000	Other	
2) <u>What is your expected annual mileage/vehicle?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	Miles

**5.2 Vehicle Information**

1) <u>What is your VIN?</u>	<input type="text"/>			
	5 kW	10 kW	15 kW	Other
2) <u>What is your EV/PHEV Battery Capacity?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> kW
	1.5-2.0 kW	3-5 kW	10 kW	Other
3) <u>What is your EV/PHEV Charger Size?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> kW
	20 Miles	30 Miles	40 Miles	Other
4) <u>What is your PHEV Charger Depletion Range?</u> <u>City Rating</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> Miles
	15 Miles	25 Miles	35 Miles	Other
5) <u>What is your PHEV Charger Depletion Range?</u> <u>HyWay Rating</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> Miles

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**5.3 Usage Information**

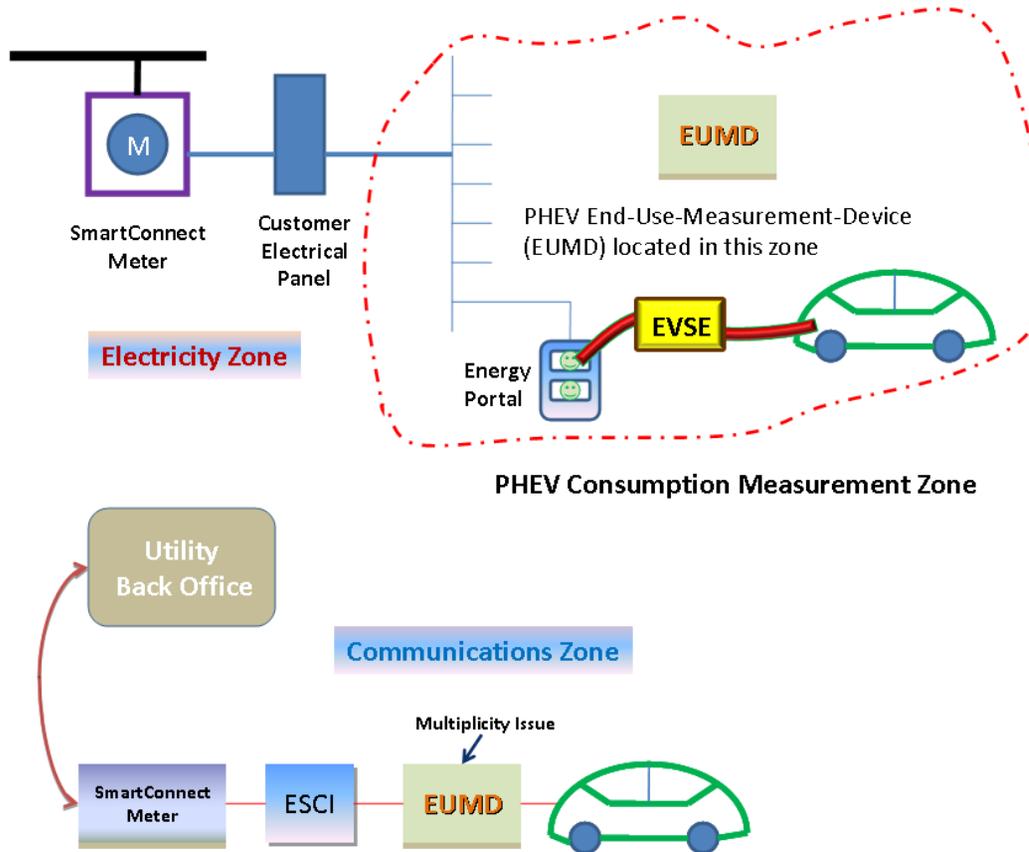
	15A Outlet	20A Outlet	40A Wall Unit	Other	
1) <u>What is your connection method at home?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	
	25%	50%	75%	Other	
2) <u>What is your expected initial SOC at home?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	%
	4PM	6 PM	10PM	Other	
3) <u>What is your expected connection time at home?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	AM/PM
	6 AM	8 AM	Noon	Other	
4) <u>What time do you expect a complete charge at home?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	AM/PM
	Yes	No			
5) <u>Do you expect to charge at work?</u>	<input type="checkbox"/>	<input type="checkbox"/>			
	20 Miles	30 Miles	40 Miles	Other	
6) <u>What is the distance from home to work?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	Miles

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### 5.4 System Diagram

Using EVSE Cordset – See Use Case S1



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### 5.5 System Diagram

Using Premise Mounted EVSE – See Use Case S2 & S3

