ELECTRIC POWER RESEARCH INSTITUTE

# Open Vehicle-Grid Integration Platform – Unified Approach to Grid / Vehicle Integration

*Definition of Use Case Requirements*

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Technical Update, December 2015

EPRI Project Manager

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# PRODUCT DESCRIPTION

This technical report provides an update on the multi-year automotive / utility industry collaborative effort to develop and implement the Open Vehicle-Grid Integration Platform (OVGIP), a platform that would allow the utility industry to address the entire electric vehicle ecosystem through a singe, unified, and open interface. The focus of the past year's work was on developing use cases and security considerations to define the essential interface and functional requirements for the OVGIP Phase 2 development effort. The utility and automotive participants in this project qualified the use cases to provide value-added grid services to utility companies, Independent Service Operators (ISO), electric vehicle stakeholders, and 3rd party infrastructure and energy management service providers. This report further qualifies the attributes of the OVGIP to the utility industry and details its benefits for providing a centralized, sustainable, and progressive Vehicle Grid Integration (VGI) implementation system.

## Background

The Electric Power Research Institute (EPRI), along with several leading global automotive manufacturers and the utility industry, initiated a collaborative effort in September of 2012 to develop a unified platform for plug-in electric vehicle (PEV) and grid integration. Phase 1 of this effort spanned 2013 and 2014, culminating in a successful proof of concept demonstration in Sacramento, California at Sacramento Municipal Utility District (SMUD) headquarters in October 2014. The Phase 1 demonstration validated the feasibility of aggregated PEV load control by a utility through a central communications platform. Because of this success, EPRI and automotive OEMs are continuing to advance this technology and have initiated this Phase 2 work. Utility industry practitioners can apply the results published in this technical update to create their own procurement requirements for EV infrastructure-related equipment or services.

## Objectives

The research questions addressed in this phase of the OVGIP project were:

1. What are the diverse utility industry program requirements for charging management, demand response (DR), and associated pricing tariffs?

2. What type of information from PEVs, if available to utility system and program planners, could inform their decision making on reliability and capacity requirements?

3. What utility industry requirements are relevant to PEV customer engagement and PEV customer-centricity?

## Approach

EPRI and the participating automotive original equipment manufacturers (OEMs) spent a good part of the year documenting the utility industry requirements that will provide the technical basis for developing the actual aggregation platform for EV charging management. The automotive OEMs, the technology solutions developer Greenlots, and the utilities supporting the program vetted the requirements.

## Results

The requirements documented in this technical update in the form of use cases on PEV charging information management and affiliated grid services address the key questions of applicability, value, usefulness, and relevance from both the automotive industry and utility perspective.

## Applications, Value, and Use

EPRI members can use the content of this technical update in designing programs to facilitate the use of PEVs as a resource for managing grid stress at the distribution and transmission and bulk system levels. The use cases run the gamut from residential and workplace infrastructure environments to wide-area distribution system load management. They provide various ‘levers’ to the utility for influencing charging demand while taking into account the choice and participation requirements of PEV customers.

## Keywords

PEV
Integration
VGI (vehicle-grid integration)
Grid
Platform
Demand response

# EXECUTIVE SUMMARY

The concept of the Open Vehicle-Grid Integration Platform (OVGIP) was conceived at a gathering of several automakers in September 2012. The concept was the outcome of a discussion among the automakers about the fragmented Electric Vehicle (EV) to Smart Grid pilot demonstrations being conducted between various utilities, energy mangement system developers, and individual automakers. The discovery was that each pilots' functional requirements were very similar, if not the same. The automakers developed and implemented an application programming interface (API) with each entity for the purpose of using telematics as the communications medium for these individual pilots. Also, several of the automakers conducted pilots utilizing SEP 2.0 (IEEE 2030.5) and ISO/IEC 15118 layer application protocols through cloud based communications. The basic protocol used by the utilities was OpenADR2.0. for initiating load control event commands. The protocols can be agnostic to the physical layer so the question was, can the automotive OEMs, with interoperability between the APIs and standard protocols, concentrate through a single unified system to integrate their PEVs with the grid?

The OVGIP Phase 1 Proof of Concept Demonstration[1] and the research supporting the demonstration concluded there could be uniformity applied in implementing the functional features for PEV load mangement between the utilities and the automotive OEMs. The demonstration determined that a unified system platform can enable the automakers to interconnect with all utilities and energy management service providers through a single portal, alleviating the complexity and cost of implementing interfaces individually with the multitude of utilites and growing number of energy service providers. More importantly it was determined the OVGIP can be an effective enabler of business cases for aggregated load management services from PEVs because it allows utilities and energy service providers to communicate with all automakers' PEVs simultaneously through a singular uniform system,

The OVGIP Phase 2 Development Program is focused on the capability to support variable use cases scenarios and business models specific to each utility and stakeholder entity through applications that are to be developed within the OVGIP. The Use Cases provided in this technical update are foundational toward the development of these applications. They provide the basis for implementing the key protocols for communications and control of individual and aggregated PEV charging loads, and the interfaces to the primary entities involved in PEV load management.

The OVGIP Phase 2 Development Program involves coordination of the Use Cases between various stakeholder groups: 6 or more automotive OEMs, multiple diverse utilities across the U.S., EVSE Network Providers, EVSE manufacturers, building and residential energy management system developers/suppliers, and eMobility Operators (ISO/IEC 15118). The Use Cases are to be coordinated among these stakeholder groups to identify scenarios that are to be commonized around their technical and business requirements. Coordination and implementation of the Use Cases and scenarios will adddress the scalability and viability of the OVGIP for nationwide adoption.

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[1] *Open Vehicle-Grid Integration Platform - Phase 1 Development Update*. EPRI, Palo Alto, CA: 2014. 3002004037.

System and data security requirements are a critical element in the development of the OVGIP. The security requirements defined in Section 4 are prescribed by the automotive OEMs for interface with their back end vehicle communications servers. Each utility and stakeholder entity involved with the development of the OVGIP will have variations of applied security standards requiring evaluation and consideration. Other high level security standards and guidelines to be considered are:

- ISO/IEC 27019: Information technology — Security techniques — Information security management guidelines based on ISO/IEC 27002 for process control systems specific to the energy industry
- NISTIR 7628: Guidelines for Smart Grid Cyber Security
- NERC CIP 2-9: Critical Infrastructure Protection
- IEC 62351 series: Power systems management and associated information exchange – Data and communications security

A basic objective of the OVGIP is to provide a basis for deciding on a common set of protocol and security standards for vehicle grid integration. Industry convergence on a common set of the best standards will ensure the viability and sustainability of an open architecture for PEV managed charging. A common set of interoperable standards will further support competitive innovation; and avoid the business risk and probable stranded investment caused by obsolescence of existing technologies. The OVGIP will serve as a 'proving ground' for interoperability between communication protocols and a forum for the best standards to emerge

Other key objectives of the OVGIP Phase 2 Develeopment Program are a determination of the PEV metering association requirements for each Use Case, definition of the utilty data requirements for predictive PEV load behavior (Use Case 10): and the implementation of EVSE Networking Interfaces (Use Case 5) and Functionality (Use Case 9). Each Use Case has implications for Measurement & Verification (M&V) of energy utilization related to the PEV load management scenarios. It is the utility requirements that will define the physical and data link layer options for collecting M&V data on energy utilization either from the meter or other resource, such as the on-vehicle telemetry, and how the data is to be formatted and transferred. Also need to determine the basic data elements required by the uilities about PEV load behavior for predicting grid reliablity and capacity requirements; information that can be used to define constructive Demand Response (DR) and Demand Side Management (DSM) energy efficiency programs.

EVSE network providers are developing communications and control intelligence to support PEV infrastructure energy management functionality, but with a unilateral focus on the site host requirements which may conflict with the PEV driver requirements. Implementing the EVSE networking interface and functionality use cases into the OVGIP is to facilitate synergy and automation of the data and information exchange for PEV driver preferences and charging requirements between EVSE networks and PEVs. Provide the ability to identify and resolve potential conflicts. Additionally supports the ability for PEV Drivers to access EVSE infrastructure location, availability, pricing, and status information from the vehicle.

EPRI is the program manager for the OVGIP Phase 2 Development Program on behalf of the automotive OEMs, and is responsible to work with the IT solution provider to coordinate with the stakeholder groups in defining the application scenarios, requirements, and priorties for the use cases. The program plan is to develop, test, and demonstrate the use cases in participation with the automakers, utilities and appropriate stakeholders during calendar year 2016.

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# 1 INTRODUCTION

## Goal of Open Vehicle-Grid Integration Platform

The primary goal of the Open Vehicle Grid Integration Platform (OVGIP), in its second phase, is to design, build, test, and implement a common Original Equipment Manufacturer (OEM) Plug-in Electric Vehicle (PEV) interface architecture. To achieve this, it utilizes a single central platform containing the protocols, software controls, algorithms, data parameters, function sets, and cybersecurity. This effort intends to enable bi-directional communications between grid and vehicle to manage localized and aggregated PEV-integrated grid support services. The utility actors interfacing with the OEM PEVs can be any of the following: Utilities, Independent Service Operators (ISO)/ Regional Transmission Operators (RTOs), Electric Vehicle Supply Equipment (EVSE) Network Providers, Facilities and Home Energy Management Systems, 3rd Party Aggregators and so forth.

## Objective

The overarching objective of the OVGIP is to be the single common communications interface to all OEM PEVs for facilitating aggregated and local distribution PEV smart charging load management and control. The defining principle is to establish the primacy of the PEV Driver charging need for transportation within all charging infrastructure control environments. This requires the PEV Driver preferences, the PEV charge status, and the appropriate PEV calculated charging requirements to be communicated and given preferential consideration by the primary controlling resource within all controlled charging infrastructure scenarios. The PEV Driver should have the ability to opt in/opt out of any PEV grid service event based on their immediate transportation need. At the same time, the driver should be aware of any grid-related information including energy price tariffs, grid stress or any local constraints imposed by the local premise owner in a non-residential setting. This technical update documents various requirements accomplishing these objectives in the form of use cases.

## Utility Engagement

Utility understanding of these use cases and involvement in their implementation is a significant initiative for the OVGIP Phase 2 Development effort.

Utilities are at different stages of smart grid research and development, with PEV grid integration being only one element of their larger smart grid technology and communications strategic development considerations. Although only one element, it is a most significant element for consideration due to the anticipated growth in the magnitude of PEV charging load into the future, and the value intelligent PEV grid integration can provide to support grid efficiency, reliability, and resiliency.

Utilities, due to regulatory processes, have extended timelines for establishing new technology guidelines, verifying selected technologies, and acquiring regulatory agency funding and investment approvals for piloting and implementing the technologies. Participation in the OVGIP Program will afford the utilities, regardless of their present PEV integration strategic position, a basis for understanding the technologies, functions, and business models being developed, tested, evaluated, and implemented by the Automaker (OEM) Collaboration, EPRI and specific utilities. Also affords the utilities the opportunity to interject their thinking and foresight for categorizing future PEV integration functionality, control, and business models. Utilities can choose to leverage the OVGIP Program to evaluate the customer, commercial and industry value of their strategic concepts for PEV to grid integration.

Utility understanding of the technologies, communications interface requirements, and the value proposition for PEV integration through participation in the OVGIP Program will allow utilities to better strategize their respective PEV Smart Grid communications technology implementation plans. Utility programs and requirements can provide the basis for assessing ratepayer value, energy efficiency benefits, investment requirements, and timing.  EPRI, OEMs, and utilities collectively will determiine the appropriate standards applications; interoperability requirements, and data management requirements for enhanced situational awareness and near real time management of load capacity from PEV gird services.

### Energy Market Service Attributes

The OVGIP can provide significant benefit for engaging PEV battery load and storage capacity in energy market services to the ISO/RTO entities. The capability to actively aggregate load management of multiple automakers' PEVs across a bulk area network can provide beneficial volumetric capacity for ancillary and frequency regulation services. The OVGIP will provide the accessibility to the PEVs either directly as a certified 3rd party aggregator or through established aggregators, including utilities. The California Independent System Operator (CAISO) has released a final draft proposal of its Energy Storage and Distributed Energy Resource (ESDER) Stakeholder Initiative[2] which directly includes PEV load management as a viable distributed energy resource for ISO capacity market bidding transactions.

### Overview of this Document

Chapter 2 of the document defines the attributes of the OVGIP.

Chapter 3 provides a summary and description of the use cases being employed for the OVGIP Phase 2 development effort.

Chapter 4 provides the basic security guidelines for interface and integration with the automaker back end vehicle telematics servers/systems.

[2] California ISO Energy Storage and Distributed Energy Resources (ESDER) Stakeholder Initiative, Draft Final Proposal, November 2, 2015: url https://www.caiso.com/Documents/DraftFinalProposal-EnergyStorageandDistributedEnergyResources.pdf

# 2 KEY ATTRIBUTES OF VEHICLE-GRID INTEGRATION PLATFORM

## Overarching Guiding Principles of Open Vehicle-Grid Integration Platform

At the very beginning of Phase 2 development work, OEMs and EPRI spent time defining and developing the 'why', or the key drivers for this platform to ensure that they are used as the test for effectiveness of the end result. The following sections elaborate further on these key attributes and guiding principles:

## OVGIP as a Critical Charging Ecosystem Backbone

1. OVGIP is a critical component to charging infrastructure that ensures PEV drivers can meet their 'fueling' needs and enable utilities to access the data needed to intelligently manage PEV charging loads.
    a. OVGIP provides a standardize communication solution for integrating vehicles, charging stations and utilities
    b. The OVGIP allows utilities to use a single communication portal to communicate with all vehicles, simplifying the utility smart grid investments
    c. OVGIP incorporates all the communication functionality already embedded in vehicles, reducing the marginal cost of enabling smart charging
    d. The OVGIP allows individual OEMs to use any communication method to communicate with individual vehicles, avoiding costly obsolescence for PEV drivers
    e. OVGIP also protects utilities from costly obsolescence by ensuring that the auto OEMs and the utilities are developing communication architecture that can be updated by back-office software changes implemented by both – eliminating the need to upgrade infrastructure in the field
    f. All major OEMs participate in the OVGIP process – supporting the development of the communication architecture and working with utilities to capture their interests and priorities
    g. OVGIP is an iterative smart grid architecture – utilities can chose to enable some functionalities now without risk that future functionalities will not be backward compatible
2. The OVGIP includes a critical partnership with EPRI, providing deep technical expertise to validate communication architectures and a partner entity that can harmonize investment timelines between the electricity and automotive partners

## OVGIP as a Critical Enhancer of Return on Utility Smart Grid Investments

1. Utility infrastructure investments could leverage the OVGIP as the single communications backbone under all of their charging ecosystem investments.
    a. By including OVGIP in their proposals, utilities can ensure broad OEM support for these proposals as they are evaluated by regulators and other stakeholders.
    b. As a partner in these proposals, utilities can present proposals that are future proof and backed by the technical expertise and driver insight that OEMs possess.

2. Utility smart grid deployment could also leverage OVGIP features to maximize the return on the investments
    a. EPRI will provide a functionality assessment of each OEM and their vehicles, both now and their commitment for future functionality. Utilities that participate in the OVGIP can use this information as a guide to ensure that their long-term investment proposals will be supported by drivers in the future. No other forum or stakeholder can provide this.
    b. Auto OEMs will be able to lend strong support to utility investment proposals that align with OVGIP
    c. EPRI can validate that a utilities proposal aligns with future automaker OEM investments and validate the functionality level of each utility proposal.

## OVGIP as a Key Enabler of a Continuum of Utility Industry Charging Infrastructure Integration Initiatives

1. Utilities can engage with the OVGIP on a progressive basis. Each utility is at varying stages of sophistication in their planning and implementation of PEV integrated energy management services. Utilities can establish their priorties starting with customer data engagement and progressively initiate and enable programs as dictated by the volume growth and distribution impact of PEVs in their service territories. Table 1 reflects a progressive scenario for consideration by utilities.

**Table 2-1**
**OVGIP PEV Integration – Continuum of PEV Integration Sophistication**

| Programs of Interest ⇨ / Utility Priorities ⇩ | Vehicle / Customer Data, Information, and Customer Engagement | Direct / Aggregated DR, Pricing Programs, EV or EVSPs | Renewable Balancing | ISO / Market Interface, DSO Integration, Locational DR |
|---|---|---|---|---|
| Customer Data, Engagement, Planning | X | | | |
| EVSE Infrastructure Integration | X | X | | |
| Critical Peak DR (top 5%) Programs | X | X | X | X |
| Comprehensive Suite of DR Approaches | X | X | X | X |

Table 2 1 shows that a utility can derive a multiplicity of benefits spanning the entire continuum of utility requirements for the PEV charging ecosystem. These include providing customer data, information that provides an ability to manage charging load during critical peaks through direct Demand Response (DR) and pricing tariff broadcasts. OVGIP can provide a full suite of DR approaches that enable the PEV to be an aggregated Distributed Energy Resource for renewable balancing and capacity bids into applicable ISO markets. Also, the complexity of the programs offered by the utility can evolve because the OVGIP incoroporates a diversity of options for utilities to engage at each appropriate level.

# 3
# USE CASE REQUIREMENTS DESCRIPTION

## Premise

The Phase 2 Use Case structure is to provide a foundational set of interfaces and functionalities that will support implementation of present and future evolving PEV to grid services. The first premise of the Phase 2 Use Cases are to establish the interfaces to the potential controlling or primary resources for PEV charge management and control communications, such as the facility or home energy management system, the utility or Energy Service Provider (ESP), the EVSE network provider, ISO, and 3rd party aggregator. The second premise is to implement the specific protocol communications and control function sets for each of these interfaces to the PEVs, through the OVGIP, to receive, process, and respond to charging load control signals for Demand Response, Critical Peak Pricing, Dynamic Pricing, Demand Charge Mitigation, renewables integration, and localized distribution load management. The intended benefit of these Use Cases is to provide the foundational architectural framework that will accommodate integration and interoperability of all stakeholder PEV specific grid service communications / control applications, protocols, and business models.

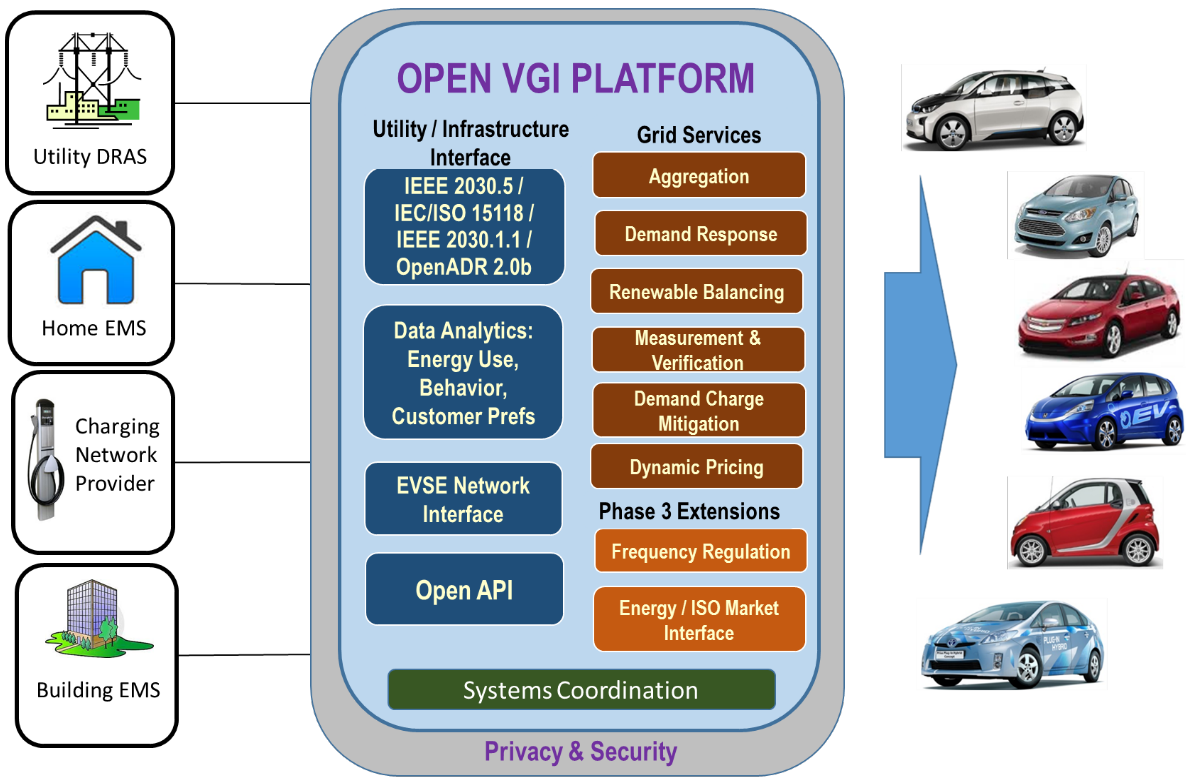


**Figure 3-1**
**Open Vehicle-Grid Integration Platform - Conceptual Architecture with All Key Actors**

The Phase 2 Use Case structure is to provide a foundational set of interfaces and functionalities that will support implementation of present and future evolving PEV to grid services. The first premise of the Phase 2 Use Cases are to establish the interfaces to the potential controlling or primary resources for PEV charge management and control communications, such as the facility or home energy management system, the utility or Energy Service Provider (ESP), the EVSE network provider, ISO, and 3rd party aggregator. The second premise is to implement the specific protocol communications and control function sets for each of these interfaces to the PEVs, through the OVGIP, to receive, process, and respond to charging load control signals for Demand Response, Critical Peak Pricing, Dynamic Pricing, Demand Charge Mitigation, renewables integration, and localized distribution load management. The intended benefit of these Use Cases is to provide the foundational architectural framework that will accommodate integration and interoperability of all stakeholder PEV specific grid service communications / control applications, protocols, and business models.

### Summary of Use Case Titles:

| Reference | Title |
|---|---|
| Use Case 1 | Automated Utility Electricity Rate Tariff Processing |
| Use Case 2 | Aggregated PEV Demand Response (DR) and Critical Peak Pricing (CPP) |
| Use Case 3 | Interface with Home Energy Management System (HEMS) or Energy Service Interface (ESI) |
| Use Case 4 | Interface with Building Energy Management System (BEMS) |
| Use Case 5 | Interface with EVSE Network Provider |
| Use Case 6 | Real Time Price (RTP)/ Signal Event Processing |
| Use Case 7 | Optimized Load Management (ISO/IEC 15118) |
| Use Case 8 | Vehicle Roaming |
| Use Case 9 | EVSE Network Provider Functionality TBD |
| Use Case 10 | Metering and Data Exchange TBD |

**Table 3-1**
**Use Case Definitions**

| Use Case | Brief Definiton |
|---|---|
| 1 | Download of authorized customer residential electricity rate tariffs to the PEV for automated scheduling of PEV recharging during the most economical periods of the day, |
| 2 | OVGIP interfaces with Utility, ISO, or ESP/Aggregator to receive and process DR Event and CPP signals to the individual OEM servers. The OEM servers are able to define the available aggregated load capacity of the PEVs plugged-in within the regional or locational parameters of the DR or CPP signal, and determines PEV opt in availability and capacity. |
| 3 | OVGIP interfaces with the HEMS to enable residential owner active load management of PEV charging in synchronization with other end load devices being managed by the HEMS. Alternatively addresses the PEV interface though an ESI in residences without HEMS capabilities. Enables customer engagement in residential DR and Dynamic Pricing programs |
| 4 | Enables interconnectivity to the PEV through the OVGIP with commercial building energy management systems. Integrates load management communications to engage the PEVs in the commercial entity's requirements for demand charge mitigation and other energy efficiency control measures. |
| 5 | Enables automated transfer of PEV driver preference and PEV charge status information with EVSE network providers that are the controlling resource for PEV infrastructure energy management. |
| 6 | Provide automated processing of RTP or other dynamic pricing signals through the OVGIP from the Utility or ESP or Aggregator to the OEM Servers to the PEV.. |
| 7 | Provide process for optimized PEV load management utilizing the ISO/IEC 15118 communications protocol. Addresses interoperability between the OVGIP and ISO/IEC 15118 prescribed eMobility operators. |
| 8 | Establishes the capability for the OVGIP to reconcile and confirm customer account authentication between multiple EVSE network providers. |
| 9 | OVGIP is to provide EVSE manufacturers and distributors with networking functionality to monitor and manage their EVSE location, status and utilization |
| 10 | Provide data management elements for utility planning operations' determinations about grid reliability and capacity requirements. Address requirement for Measurement and Verification of PEV charge consumption utilizing meter data, and the OVGIP role in retrieving, tracking, and communicating such data as required to verify PEV customer participation in utility and ISO energy service programs. |

Note: Association requirements are fundamentally addressed within each use case scenario. However PEV to customer meter association requirements, especially for measurement and verification purposes, are not specifically defined by the utility industry and may vary dependent on type or category of PEV load management program function to be initiated. Association requirements will require further definition for methodology, and applicability. A separate requirements document will be developed for Association. Use Cases will be updated appropriately based on applicability of requirements.

## Use Case 1 Automated Utility Electricity Rate Tariff Processing

**Scenario A:** Automated download of customer residential PEV relative electricity rate tariffs

Description**:** PEV owner's Utility Residential Electricity Rate Tariffs are accessible from the utility for automated download by the OVGIP to the OEM server to the PEV. Applies to single or multiple unit dwellings whereby PEV charging is associated to and measured by the whole house meter or residential unit meter for MUDs.

Objective: To create a universal electricity rate tariff repository. The intent is to enable the PEV owner to schedule the PEV recharging during the most economical period of the day, automatically. This will be based on the residential owner's selected residential/PEV electricity rate schedule (i.e. Whole House Standard Rate (Tiered?), Whole House TOU Rate, PEV Rate (separately metered PEV charging), Whole House with PEV TOU Rate, CPP with optional TOU Rate, etc.)

Preconditions:

- Residential owner has purchased or leased a PEV - has contacted their cognizant utility and has selected and established their residential rate tariff program
- Customer has enrolled for this automated download service with the utility and with the OEM Server Administrator, and has provided required permissions to access their specific residential account rate tariff information
- Utility has automated ability to provide customer specific rate tariffs to the OVGIP and provides updates as required (typically 1-3 times per year)
- OVGIP retains a depository of utility provided residential rate tariffs and has capability to transmit latest updated customer specific rate tariffs as required to the OEM server and in turn to the PEV
- Capability to associate PEV to the single residence or MUD unit meter in order to identify, verify, and access the Customer of Record electricity rate tariff

Primary Actors: Utility, OVGIP, OEM Server, Customer
Process:

- Customer arrives home and plugs in PEV to the charger (EVSE).
- Upon PEV plugging in the OEM server verifies customer enrollment permissions to access customer residential electricity rate tariffs.
- OEM Server requests customer's specific residential rate tariff be downloaded from the OVGIP, which is then downloaded to the PEV
    - OVGIP receives request from OEM Server and initiates access to the customer electricity rate tariff from the cognizant utility
    - Association between the PEV ID, the EVSE ID, and the meter or sub meter ID is required to identify the cognizant utility and to ensure proper customer account identification.
    - OEM server provides association information (PEV ID, EVSE ID, Meter ID) to the OVGIP to access customer account specific rate tariff. OVGIP will provide the customer associated residential information to the utility for cross referencing by the utility to the customer account to ensure the residential owner's latest established rate tariff is provided.
    - If no update or change to the residential rate tariff since the last charge session or download then no download required. PEV will retain latest updated tariff schedule

- The customer has the option to set the PEV charge mode to econo or most economic mode and the PEV will automatically execute charging during the lowest cost periods according to the specific electricity rate tariff schedule

Post Conditions:

- PEV association and customer enrollment is authenticated and appropriate customer residential rate tariff is downloaded to the PEV
- PEV ID does not match residential customer enrollment record – fault = no download – PEV charges according to PEV driver alternative settings
  - If PEV ID does not match with residential owner's designated PEV ID (visitor plugs in) it will cause a fault condition, and tariff is not downloaded. Visitor PEV will charge according to their PEV settings either immediately or time charge is needed
- No communications – PEV charge defaults to existing rate tariff schedule or PEV driver resets mode to charge immediately, delayed charge time, or time charge is needed.
- Error in association records, no match for customer account – fault = no download – PEV charge defaults to existing rate tariff schedule or PEV driver resets mode to charge immediately, delayed charge time, or time charge is needed. Follow up required to verify customer records versus association information

**Scenario B (Optional):** Customer Service to PEV owner to determine most economical residential electricity rate tariff with PEV charging

Objective: OEMs may provide service to assist new PEV customer in determining the most economical residential electricity rate tariff with PEV charging. Options are for example Whole House Standard Rate (Tiered?), Whole House TOU Rate, PEV Rate (separately metered PEV charging), Whole House with PEV TOU Rate, etc.) Primary objective is the ability to ascertain the most cost economical utility EV rate tariff per the specific customer's historical residential whole house electricity usage behaviors.

Preconditions:

- Utility has capability to provide automated access to customer historical whole house electric usage data. (i.e. Green Button Data)
- OVGIP has automated access to utility residential rate tariff schedule offerings
- Customer permissions are provided to the utility and to the OVGIP Administrator for access to their historical whole house electric usage data.
- OVGIP has capability to correlate historical data with estimated charge profiles or with actual historical data from PEV about charging behaviors

Primary Actors: Utility, OVGIP, Customer

Process:

- PEV customer registers for rate evaluation service (new and existing customers)
- Access to customer historical whole house usage data needs to be acquired from the utility (i.e. Green Button protocol access), and with customer permission, to determine customer daily consumption behavior based on meter data intervals of from every 15 minutes to 1 hour increments

- Comparison of the optional utility EV rates based on historical customer usage is required to determine overall lowest cost to customer for combined whole house and EV electricity consumption.
    - OVGIP calculates whole house electric usage consumption patterns by overlaying whole house interval usage data baseline with PEV home charging behavior patterns (either estimated or derived from PEV historical charge data).
    - PEV historical charge data can be acquired from the OEM server assuming verification of customer permissions are properly acquired and recorded.
    - Example: Customer works at home during the day. EV whole house TOU rate tariff provides low nighttime off peak rate but increases daytime on peak rate. Customer's daytime usage costs/kWh go up which offsets benefit of off peak EV charging savings. Better option for customer is to go to specific direct metered EV off peak charging rate, without increasing existing whole house rate.

Post Conditions:

- Utility does not provide automated whole house electricity usage data: requires utility customer service to provide rate evaluations to customer. – Understand alternatives with individual utilities for customer notification. Data on customer PEV charging behavior for utility evaluations of customer rate options may be provided by OVGIP and OEM Server per customer permissions.

## Use Case 2 Aggregated PEV Demand Response (DR) and Critical Peak Pricing (CPP)

**Scenario A**: Aggregated PEV Demand Response (DR)

Description: OVGIP is capable of receiving DR event signals from the utility or other Energy Service Provider (ESP)/Aggregation entity, and processing signals to the OEM Servers which are to identify vehicles plugged-in and available to opt-in to the DR event. Applies to PEV direct DR Program whereby there are no premise or host site intermediary energy management control functionality.

Objective: The OVGIP is capable of receiving Utility or ESP/Aggregator initiated DR Event signals and transmitting the DR Event signal to the individual OEM servers. The OEM servers are able to define the available load capacity of PEVs plugged-in within the regional or locational parameters of the DR event message, and determines PEV availability and capacity (Opt In/Out), based on customer preferences. OVGIP determines which OEMs to execute the DR command and reports aggregated PEV capacity to the requesting source.

Pre Conditions:

- Customers are enrolled in aggregation program with OVGIP and OEM Server Administration and have provided required permissions to access their PEV status information with prescribed opt-in/out and compensation provisions.
- Verify customer is not enrolled in Residential Whole House DR or Capacity Bidding Program – if so cannot enroll in PEV Direct DR Program
- Contractual requirements between Utility/ESP/Aggregator, OVGIP, and OEM for program requirements (thresholds/penalties/compensation/etc.) are established

- DR Program Baseline is established – options are per NAESB
    - Type I: Based on historical data on consumption behavior per hour by hour profile during day before or avg of several days before event.
    - Max Base Load: Based on historical data to determine flat rate of demand to remain at or below
    - Meter Before – Meter After: Actual measured load adjustment at time of event
    - Type II: Statistical sample for portfolio of customers where interval metering data not available.
- Established rules for qualifying PEVs based on SOC or kWh capacity thresholds and capable duration to meet the DR event parameters (increase/decrease load over specified duration of time)
- Association prescribed based on DR Program Baseline – PEV telemetry for measuring load adjustments may apply in all Baselines except Meter Before – Meter After.
- Utilities are indicating requirement for meter data verification (Meter Before – Meter - After Baseline) which requires direct association of PEV to EVSE to meter which in this scenario will necessitate that all EVSE are separately metered or sub metered.
- There are no intermediary EMS resource controls that may supersede or override or otherwise create double dipping issues for PEV driver direct participation in DR event under enrollment with OVGIP/OEM DR program

Process:

- Utility has need to dispatch PEV load (increase or decrease) in response to incidents of load versus supply imbalances such as intermittent over/under generation of renewables, excess peak load, voltage or frequency imbalances, etc.
- Utility or ESP provides dispatch or DR command signal (OpenADR, SEP2, and/or proprietary API specifying (based on applied protocol specifications) capacity/action (e.g., % or kW increase/decrease, start time, end time, and region/location/group (e.g., system wide/substation/feeder, zip code, GPS parameters/coordinates) for the DR Event.
- OVGIP verifies no conflicting or prioritized DR signals for same event are received from Residential EMS or C&I BMS or EVSE Network as the primary or controlling source – avoids double dipping. Refer to Use Cases 3, 4, and 5 respectively.
- OVGIP receives and acknowledges receipt of DR Event signal to the requesting source in compliance to the specific protocol. The OVGIP transmits the DR Event signal to the individual OEM servers via generic API or OEM proprietary API.
- OEM authenticates customer enrollment in DR Program.
- OEM server determines available PEV capacity based on quantity vehicles plugged in within the specified region, group, or location at the specified times. OEM server queries each plugged in vehicle to determine the customer's preset charging preferences (i.e. time charge in needed), and vehicle charge status/requirement (i.e. SOC, power required and time required to charge), then makes determination for PEV to Opt In/Out of event. Customer has option to manually opt-out at anytime.
- OEM reports available aggregated capacity information to OVGIP.
- The OVGIP receives the individual OEM DR capacity information and identifies the aggregated capacity from the collective OEMs.

- OVGIP exercises execution commands to the OEMs based on evaluation of % of total capacity each OEM is providing to optimize effectiveness and efficiency in the interests of the OEMs and their customers.
- The OVGIP is required to collect aggregated charge behavior data from each of the OEMs to facilitate the capability to calculate and report projected PEV DR capacity availability at minimum on a day ahead basis.
- OEMs are to have the ability to monitor available capacity (based on individual OEM telematics procedures) in 15 minute increments or less.

Post Conditions:
- DR event executed per requirements – settlement between OVGIP / OEM / Aggregator and Customer compensation fulfillment is finalized based on established measurement baseline
- OVGIP/OEM fail to meet threshold capacity requirement – penalties assessed per contractual terms with Aggregator/Utility/ESP
- PEV Communications failure – default is opt-out – PEV not included in DR Event

**Scenario B:** PEV Critical Peak Pricing Response

Description**:** OVGIP receives Critical Peak Pricing (CPP) signals from utility or other energy service provider (ESP) and processes CPP signals to the OEM servers to the PEV.
Objective: Provide automated processing of CPP signals by the OVGIP from the Utility or ESP or Aggregator to the OEM Servers to the PEV. The OEM servers are to define the PEVs plugged-in within the applicable region or group affected by the pricing signal and communicates the pricing event to the PEV. Intent is the PEV Driver will be able to set price thresholds in the PEV, and based on time charge is needed the PEV can determine to stop, curtail, or continue charging.

Pre Conditions:
- Customer is enrolled in CPP Program which may include optional TOU rate tariffs.
- Applies to Charge sites wherein PEV Driver is being billed at a price per kWh. Presumes EVSE is separately metered or sub metered. For Commercial EVSE locations the Conference on Weights & Measures HB44 EVSE metering requirements should apply .
- Does not apply wherein PEV Driver is being billed based on time or other non electricity consumption rate dictated by the site host in non-residential or commercial or workplace environments
- If site host (such as workplace, public, commercial, etc.) is passing through the impact of CPP pricing signals it receives to the PEV Driver, then there needs to be a method to notify the PEV Driver of the price signal and duration being prescribed by the site host providing PEV Driver option to stop or curtail charging for the specific time duration

Actors: Utility/ESP, OVGIP, PEV, Customer
Process:
- PEV Driver plugs in and is notified of any available CPP price signals applicable to that site.

- PEV Driver can preset pricing ($/kWh) thresholds so that charging is automated accordingly. The PEV can be set to an econo mode and based on time charge is needed and time required to charge, the PEV will set the charge session profile to charge at the lowest price periods throughout the charge session according to the CPP schedule for the day.
- Utility or ESP provides CPP event signal via OpenADR, SEP2, and/or proprietary API specifying (based on applied protocol specifications), price per kWh, start time, end time, and region/location/group applicable to the pricing event.
- Pricing signals may be provided day ahead, hour ahead, or in real time (5 min ahead) The pricing signal may be formulated as a day ahead price schedule identifying price per kWh for specific hours throughout the day +
- OVGIP receives and acknowledges receipt of the pricing event signal to the providing source in compliance to the specific protocol.
- The OVGIP transmits the CPP signal to the OEM servers via generic API or OEM proprietary API.
- OEM server identifies the PEVs plugged-in within the applicable region/location/group, and communicates the pricing event or day ahead CPP price schedule to the PEV.
- PEV determines opt in or opt out response based on customer PEV charge preference settings.
- Customer is notified by PEV of change in charge status and has option to change the opt in or opt out determination by the PEV and reset the preferences.
- OEM server provides total opt in capacity to the OVGIP which aggregates the OEM server responses and reports to the capacity to the controlling source such as the utility or aggregator
- PEV Driver sets preference for price threshold – PEV automatically determines to stop or curtail charging based on time charge is needed.
- Association required between PEV and EVSE and meter or sub meter to establish location of PEV within CPP event region/location/group. (Zip Codes/GPS Coordinates not typical for utilities)
- Notification of CPP event will be communicated to the PEV Driver via PEV display and Smart Phone APP providing PEV Driver opportunity to change or adjust charge preference, especially if pricing signal is 1 hour or 5 min ahead.

Post Conditions:

- Communications successful – PEV driver avoided high peak prices for charging
- No Communications – PEV Driver impacted by high peak pricing and penalties may accrue to aggregator for not meeting capacity threshold requirements

### Use Case 3 Interface with Home Energy Management System (HEMS) or Energy Services Interface (ESI)

**Scenario A:** OVGIP interfaces and communicates with Home EMS or ESI

Description: OVGIP interfaces and communicates with the Home Energy Management System, ESI, or other gateway within the residence for the purpose of residential owner monitoring and managing of the PEV charging load including response to DR and Dynamic Pricing signals.

Objective: The OVGIP receives load management information and signals from the residential energy management system (Home Area Network), ESI gateway or other home gateway device. (EVSE can be the gateway)

Primary Actors: OVGIP, Residential Energy Management System/ESI, OEM Servers, Customer
Pre Condition:

- The Customer can remotely change or update PEV on-vehicle charge settings through the residential energy management system
- The Utility, ESP, or 3rd Party Aggregator can send DR signals or Real Time Pricing information to the residence network or gateway via OpenADR2b.
- The basic assumption is the residence network communications protocol will be SEP2.0 to the OVGIP. OVGIP will act as a SEP2.0 client, receive the information or signals and process the signals/information to the individual OEMs servers via the generic or proprietary APIs.
- The OVGIP will interact with the OEM eMobility Operator acting as the OEM server for those OEMs with PEVs enabled for ISO/IEC 15118 protocol communications
- Customer has installed home energy management system (HAN), ESI gateway, or other gateway internet connected device for electrical load management services. (EVSE can be configured to be the gateway?)
- Customer is enrolled in a DR and/or Dynamic Pricing Program with the utility, ESP, or 3rd Party Aggregator and with the OVGIP/OEM Administrators (ability for OVGIP to know which OEM gets the command based on association – provision for shared enrollment processes)
- Enrollment options are
  - Residential Whole House DR (request to reduce whole house load for a specified duration) in which case the customer controls the PEV charging in sync with other home loads ( utility does not require association – M&V dependent on primary house meter)
  - Residential Dynamic Pricing (RTP) whereby customer receives RTP signal and opts in to suspend charging to avoid periods of high prices/kWh (utility does not require association -customer directly billed based on actual metered consumption during duration of RTP)
  - Bid Capacity Program whereby customer enrolls with 3rd Party Aggregator to participate in energy market DR capacity program
  - Residential PEV only enrollment requiring an ESI gateway in the home (home energy management system not required) and separately metered EVSE.
  - Residential Customer is the primary controlling source for PEV load management at the home and therefore commands from the home energy management system takes priority over all other externally sourced DR or Dynamic Pricing signals
  - Enrollment requires PEV ID, EVSE ID, and Meter ID for verification and authentication of enrollment and customer permissions.
  - OVGIP has established interoperable communications protocol with the HAN or ESI gateway. (expectation is protocol will be SEP 2 - IEEE 2030.5)

Process:

- Vehicle is plugged in at home.

- OVGIP initiates authentication procedure to verify proper association of customer PEV to his meter. (Should customer be able to control any PEV plugged in at their home, especially for DR or Dynamic Pricing scenarios?)
- Association process is required to identify PEV plugged in at the residence and is communicated to the OVGIP (association process TBD) to determine which OEM server is to receive the signal
- Customer can set charge preferences either in the vehicle or in the residence energy management system if applicable and as desired.
- Priority is given to the residence energy management system settings over the PEV on-vehicle settings.
- Customer sets charge preferences through the residence energy management system or ESI gateway, the information is transmitted to the OVGIP via internet using SEP2 communications protocol over TCP/IP.
- The OVGIP processes the setting changes to the individual OEM server via generic API or OEM proprietary API. OEM server via telematics sends charge setting commands to the PEV.
- Typical setting is time charge is needed. PEV calculates time and kWh required to charge complete by the specified time charge is needed and charges accordingly.
- Alternatively customer can set time delay charging or charging during lowest price period according to the TOU rate tariff schedule which is downloadable from the OVGIP (Use Case 1 Scenario A).
- Utility, ESP, or 3rd Party Aggregator (via OpenADR2b) provides DR command signal or RTP information to the residence energy management system or ESI gateway specifying DR event capacity/action (% or kW increase/decrease load), start time/end time or RTP information stipulating price/kWh by date, and start time/end time.
- Customer receives notification of DR and RTP events. Default is opt in. Customer has option to opt out at any time before or during the event.
- Residence energy management system or ESI transmits DR signal or RTP information to the OVGIP (via SEP2 or IEEE 2030.5 protocol)
- OGVIP receives the DR Event or RTP information from the residence energy management system or ESI gateway.
- OGVIP acknowledges receipt of DR Event signal or RTP information to the requesting source in compliance to the specific protocol function set.
- The OVGIP transmits the DR Event signal to the individual OEM servers via generic API or OEM proprietary API. OEM server acknowledges receipt of the DR Event signal.
- The OEM server determines available PEV capacity (based on time duration and kWh required to charge per the customer specified time charge is needed) and makes determination to Opt In/Out of event.
- The OVGIP transmits the RTP information to the OEM Servers via generic API or OEM proprietary API. The OEM server acknowledges receipt of the RTP information.
- OEM server processes the information to the PEV. PEV will suspend charging during the duration applied per the RTP signal
- Customer shall have access to charge status information with option to change charge setting at any time either through the residence energy management system or at the PEV.

- Note: As with Use Case 1, 2, and 4, there could feasibly be an issue with conflicts in the processing of DR event signals that could be simultaneously communicated to the vehicle via the utility B2B direct interface through the OVGIP versus the utility interface to other aggregators or devices. The OVGIP needs to sync the two to give the residence customer priority over control of the PEV in response to the DR event.

Post Condition:

- Association is authenticated and PEV is synced to energy management system for customer management of PEV charging load and response to DR and RTP event signals
- Association is not authenticated – PEV on-vehicle charge settings dictate charge profile. Customer has option to reset PEV through PEV on-vehicle display or Smart Phone APP
- No Communications - PEV on-vehicle charge settings dictate charge profile. Customer has option to reset PEV through PEV on-vehicle display or Smart Phone APP

### Use Case 4 Interface with Building Energy Management System

**Scenario A:** OVGIP Building Energy Management System interface and communications

Description: OVGIP interfaces and communicates directly with the Building Energy Management System within the facility for the purpose of monitoring and managing the PEV charging load.

Objective**:** OVGIP establishes two way communications with the BMS in order to integrate the PEV drivers' preferences and PEV charge power/time requirements/information in the BMS automated load control determinations

- OVGIP will adapt to the facilities' BMS communications protocol and establish an interoperable API to receive commands and information from the BMS to the individual OEM servers

Pre Conditions:

- BMS determines the load profiles for the individual electrical devices throughout the facilities and determines the balance between the loads based on device/equipment utilization factors/requirements, and demand charge thresholds
- Environments can be fleet, commercial, MUD, workplace, and public – at these sites is the ratepayer and controls the PEV charging infrastructure and provides charging services to employees, customers, renters, fleet, and to general public.
- PEV infrastructure is controlled as an integrated load feature of the facility or building centralized automated BMS
- EVSE infrastructure is separately metered in aggregate or individually sub metered – required to measure & verify execution of PEV load management control signals
- M&V/metering determinations are defined based on the terms of the facility enrolled grid service programs (localized or aggregated DR/CPP) and internal energy management strategy (Demand Charge Mitigation)
- Considers State adoption and application of HB44 Commercial EVSE requirements requiring separate metering
- Architecture for Interface and interoperability between OVGIP and BMS is implemented
- Establish interface and interoperability with BMS having a variation of internet protocols and industry standard communications protocols such as BACNET, Linux, Lonworks, XML, Device Net, SOAP, etc.

- Agreement on adoption of SEP2 protocol or established API?
- Association is established to associate BMS to the PEV (require PEV ID, EVSE ID, BMS ID/address, and/or meter ID)
- Enrollment required between OVGIP and Facility Owner – may entail terms for customer compensation or alternative pricing for relinquishing control to BMS

<u>Primary Actors:</u> OVGIP, BMS, OEM Servers
<u>Process:</u>

- PEV Driver plugs in to charge at a commercial or industrial complex or MUD whose electricity loads are managed by a central energy management system
- Association is determined between the facility BMS, EVSE, and the PEV – is reported to the OVGIP and to the OEM server – authenticate BMS/OVGIP enrollment
- PEV Driver sets time charge is needed. PEV calculates time and kWh required to charge complete by the specified time charge is needed or can be set to charge immediately. PEV starts charging accordingly.
- BMS is able to monitor PEV infrastructure load through metering – either aggregated or through separately sub metered EVSE
- Facility BMS receives an aggregated DR signal or CPP signal, or is projecting to exceed demand charge threshold requiring curtailment of load and determines PEV load is to be reduced.
    - BMS communicates curtailment command to OVGIP via established internet and API protocol - %, kW, duration, etc.
    - OVGIP transmits command to OEM servers
    - OEM servers identify PEVs plugged in at location per the association information
    - OEM server queries PEV for status - driver preference/PEV SOC/Time needed to charge/Power level required – determines opt in/out – transmits determination to OVGIP
    - OVGIP aggregates kW reduction response from OEM Servers and reports to BMS – BMS verifies reduction through internal metering
    - If customer compensation provided separate metering of EVSE/PEV required to verify customer compliance (Customer Compensation models TBD)
    - Facility owner has prerogative to override PEV preference to opt out based on critical grid or facility load conditions – PEV Driver requires notification and information on duration of interruption and PEV SOC status (PEV calculates revised charge profile (time will complete) based on charge restart time?)
- Facility BMS receives an aggregated DR signal to increase load (over generation of renewables) and determines PEV load is to be increased.
    - BMS communicates increase load command to OVGIP via established internet and API protocol - %, kW, duration, etc.
    - OVGIP transmits command to OEM servers
    - OEM servers identify PEVs plugged in at location per the association information
    - OEM server queries PEV for status - driver preference/PEV SOC/Time needed to charge/Power level required – determines opt in/out – transmits determination to OVGIP
    - Determines PEV is plugged in not charging or is in a curtailment mode at time signal is received consider using PEV for wide area dr if no active bms control

    - OEM Server has capability to remotely initiate PEV start charging or change mode to charge at highest power level immediately
    - OVGIP aggregates kW increase response from OEM Servers and reports to BMS – BMS verifies increase in load through internal metering
    - If customer compensation provided separate metering of EVSE/PEV required to verify customer compliance (Customer Compensation models TBD)
  - Facility BMS signals take precedence over external signals
  - Alternative mode is BMS directly monitors individual PEV charge loads for real time charge management and load projection capability
    - PEV Driver plugs in
    - Association is determined – PEV to EVSE to BMS – information reported to the OVGIP to the OEM Servers
    - OEM server identifies PEV plugged in and queries Driver preference, PEV SOC and PEV charge profile (time charge is needed, est charge time, est start time, power level)
    - OEM server reports information (including vehicle type) to OVGIP to BMS
    - BMS may send load management control signals for individual PEVs based on specifying PEV ID, EVSE ID, or meter ID per association information – this is appropriate for fleet load management and charge scheduling functions

Post Conditions:

- OVGIP successfully receives and processes commands and/or information to the OEM server from the BMS – PEV Opts In
- Opt Out of event – No action required
- Override command – PEV Driver notification required
- Failure to receive message/command - PEV charges according to PEV mode settings
- Communications failure – PEV charges according to PEV mode settings
- No association established - PEV charges according to PEV mode settings
- No authentication of BMS/OVGIP enrollment - PEV charges according to PEV mode settings

## Use Case 5 Interface with EVSE Network Provider

**Scenario A**: EVSE Network Provider is the controlling resource at the site requiring interface and communications between OVGIP and EVSE Network

Description: OVGIP interfaces and communicates with the location's EVSE Network Provider for the purpose of monitoring and managing the PEV charging load.

Objective: The OVGIP is to have bidirectional communications with the EVSE Network Provider and the capability to receive and process load management information and signals the location's responsible EVSE Network Provider.The communications relationship between the OVGIP and the EVSE Network Provider is to ensure the information about the PEV Driver's preferences and the PEV charge status and requirements (load request) are transmitted to the EVSE Network Provider and considered in the PEV load allocation determinations by the EVSE Network Provider. Emphasis is on ensuring the PEV Driver's transportation needs are met

Pre Condition:

- The OVGIP communicates with the EVSE Network Provider utilizing a variation of internet protocols, proprietary APIs, or standard communications protocols such as SEP2, ISO/IEC 15118, OCPP, etc.
- The EVSE Network Provider is the primary resource for PEV infrastructure energy management control at that particular location (fleet, commercial, public, workplace, residential, MUD, etc.). The EVSE Network Provider, as the infrastructure energy control point, provides DR, demand charge mitigation, load shedding, renewables ramp support, etc. to the site host
- PEV Driver has the option to opt in/out of any event except during critical grid conditions determined by the site host. PEV Driver shall be provided notifications when PEV charge preferences are over ridden by the site host in these circumstances
- Process through association and authentication identifies the EVSE Network Provider as the primary source for load management at that site.
- EVSE Network Provider communicates price factors for charge session – time based or price per kWh. Includes differential pricing for opting in or opting out of EVSE Network Provider communicated DR or load management events.
- Prioritization is given to the EVSE Network Provider signals at these sites where the EVSE Network Provider is verified to be the primary source for infrastructure load management, and takes precedence over any external DR or other load management signals
- Association capability is required consisting of PEV ID, EVSE ID, and Meter ID to ensure the ability for the OEM to identify which PEV is plugged into which EVSE, and the associated meter for measurement and verification of charge session consumption and cost, or hourly cost (Reference HB 44 for commercial EVSE applications)
- Customer have provided permission to OVGIP to access their PEV for purposes of charge load management either through e

Primary Actors: OVGIP, EVSE Network Provider, OEM Servers

Process:

- PEV is plugged in to charge at a site or location that has a charging infrastructure managed by an EVSE Network Provider. Site can be fleet, workplace, commercial, public, residential, or MUD.
- Association is performed to identify PEV to EVSE to Meter. Information is provided to OVGIP to the cognizant OEM
- PEV Driver preferences via the PEV charge settings (time charge is needed, immediate, or delayed charging) are communicated to the EVSE Network Provider. Time charge is needed requires PEV calculation for power level and time required to charge (i.e. flow reservation) which provides a basis for the EVSE Network Provider to know the full charge time required to meet the customer's need.
- EVSE Network Provider provides the price factors for the charge session: price per hour or price per kWh, and differential price for opt in versus opt out, unless charging is provided free to the PEV Driver.
- EVSE Network Provider receives DR or demand charge mitigation load management signals from site host energy management system and communicates event parameters to

the OVGIP to the OEM servers –based on PEVs identified through the association process.

- EVSE Network Provider may receive DR or CPP or RTP signals from the utility or 3rd Party Aggregator which will be communicated to the OVGIP in the format dictated by the EVSE Network Provider protocol
- The OVGIP will receive the signals or messages and communicate them to the cognizant OEM servers based on the association information identifying which vehicles are plugged in at the specified site
- PEVs are queried for updated SOC information and required charge profile information to meet the PEV Driver's needs/preferences , which is provided to the EVSE Network Provider for prioritization of individual PEV charging
- DR event information is received by the OVGIP to the OEM server to the PEV, and the PEV, based on current charge status and charge requirement, determines to opt in/out of the event and the OEM server through the OVGIP communicates determination to the EVSE Network Provider
- EVSE Network Provider will verify capacity response from the individual EVSE meters or the aggregated charging primary meter or other validated telemetry for measurement of capacity reduction
- The EVSE Network Provider sets individual EVSE charging limitations based on the information from the individual OEM servers about the associated vehicle's type, time charge is needed, charge power required (kWh), and time required to charge versus curtailing or shutting off all EVSEs at the same level simultaneously
- If the EVSE Network Provider required capacity reduction is not met it can selectively shut down charging to the least affected PEVs previously opting out. Notification of this over ride must be given to the PEV Driver through the OVGIP to the OEM server to the customer
- *Note: Need to determine who executes the shut down of charging – the PEV or the EVSE Network through the EVSEs. The premise should be the PEV executes the shut down based on the opt in determination. This means the EVSE Network Provider will be operating similar to an energy management system*
- EVSE Network Provider will receive DR signals, CPP signals, RTP signals from Utilities, ESPs, or 3rd Party Aggregators primarily as a result of an enrollment by the site host (residential, fleet, MUD, commercial, public, etc.) to participate in these programs
- These signals are to be passed through to the OVGIP to the OEM servers to the PEV. The PEV will make automated opt in/out decisions based on current status and charging profile required to meet time charge is needed settings.
- The PEV will execute the event command based on decision to opt in
- Customer will have the option to opt out at anytime unless critical grid conditions prevail. Customer should be notified of conflict to their preferences
- Measurement & verification of capacity response to the system wide DR and CPP events will be through the site primary meter or the aggregation of the EVSE separate meters
- Residential customers will have enrolled with the EVSE Network Provider and the M&V will be based on the EVSE separate meter
- In circumstances where individual PEV Drivers are offered direct incentives to participate in the site host DR and load management programs, such as at workplace and

MUDs where customers daily charge separately metered EVSEs will be required. Association is required to qualify the individual customer performance compliance.

Post Conditions:

- OVGIP and EVSE Network Provider effectively communicate and execute the process to meet the needs of the site host and the PEV Driver
- No Communications – default is opt out and PEV charges according to PEV on-vehicle settings.  PEV Driver at risk of higher fee for opt out
- EVSE Network Provider executes over ride – customer notification must be provided
- Association failure or error – PEV charges according to PEV on-vehicle settings. Service call of APP required to establish payment provision

### Use Case 6  Real Time Price (RTP) Signal Event Processing

**Scenario A:** OVGIP interfaces and communicates with Utility or EVSP for processing of Real Time or Variable Pricing Signals

Description**:** OVGIP receives Real Time Price (RTP) signals from utility or other energy service provider (ESP) and processes RTP/CPP signals to the OEM servers to the PEV.

Objective: Provide automated processing of RTP or other dynamic pricing signals by the OVGIP from the Utility or ESP or Aggregator to the OEM Servers to the PEV. The OEM servers are to define the PEVs plugged-in within the applicable region or group affected by the pricing signal and communicates the pricing event to the PEV. Intent is the PEV Driver will be able to set price thresholds in the PEV, and based on time charge is needed the PEV can determine to stop, curtail, or continue charging.

Pre Conditions:

- Customer is enrolled in RTP or Dynamic Pricing Program
- Applies to Charge sites wherein PEV Driver is being billed at a price per kWh. Presumes EVSE is separately metered or sub metered. For Commercial EVSE locations the Conference on Weights & Measures HB44 EVSE metering requirements should apply .
- Does not apply wherein PEV Driver is being billed based on time or other non electricity consumption rate dictated by the site host in non-residential or commercial or workplace environments.
- If site host (such as workplace, public, commercial, etc.) is passing through the impact of RTP pricing signals it receives to the PEV Driver, then there needs to be a method to notify the PEV Driver of the price increase and duration being prescribed by the site host providing PEV Driver option to stop or curtail charging for the specific time duration

Actors: Utility/ESP, OVGIP, PEV, Customer

Process:

- PEV Driver plugs in and is notified of any available RTP price signals applicable to that site.
- PEV Driver can preset pricing ($/kWh) thresholds so that charging is automated accordingly. The PEV can be set to an econo mode and based on time charge is needed and time required to charge, the PEV will set the charge session profile to charge at the lowest price periods throughout the charge session according to the RTP/CPP schedule for the day.

- Utility or ESP provides RTP event signal via OpenADR, SEP2, and/or proprietary API specifying (based on applied protocol specifications), price per kWh, start time, end time, and region/location/group applicable to the pricing event.
- Pricing signals may be provided day ahead, hour ahead, or in real time. The pricing signal may be formulated as a day ahead price schedule identifying price per kWh by specific hours throughout the day OVGIP receives and acknowledges receipt of the pricing event signal to the providing source in compliance to the specific protocol.
- The OVGIP transmits the RTP signal to the OEM servers via generic API or OEM proprietary API. OEM server identifies the PEVs plugged-in within the applicable region/location/group, and communicates the pricing event or day ahead price schedule to the PEV.
- PEV Driver sets preference for price threshold – PEV automatically determines to stop or curtail charging based on time charge is needed.
- Association required between PEV and EVSE and meter or sub meter to establish location of PEV within RTP event region/location/group. (Zip Codes/GPS Coordinates not typical for utilities)
- Notification of pricing event will be communicated to the PEV Driver via PEV display and Smart Phone APP providing PEV Driver opportunity to change or adjust charge preference, especially if pricing signal is in real time.
- There is no compensation to the customer other than avoidance of high peak load prices.

Post Conditions:

- Communications successful – PEV driver avoided high peak prices for charging
- No Communications – PEV Driver impacted by high peak pricing

### Use Case 7 Optimized Load Management (ISO/IEC 15118)

**Scenario A**: OVGIP provides interoperability for processing price tariffs per the ISO/IEC 15118 protocol.

Description: OVGIP receives energy and pricing signals from utility or other energy service provider (ESP) and processes tariff table through the web application to the eMobility Operator

Objective: OVGIP processes Utility or ESP tariff tables to the eMobility Operator which is to be provided to the SECC to the EVCC as part of the EVSE/PEV negotiation process for determining charge session profile under the provisions of the ISO/IEC 15118 protocol

Pre Conditions:

- OVGIP has established internet based API with the eMobility Operator
- PEV and EVSE are configured with integrated 15118 protocol communications stacks with PLC physical layer for bidirectional communications
- Association is implemented utilizing the features of the PLC physical layer link

Primary Actors: OVGIP, Utility/ESP, eMobility Operator

Process:

- Utility or ESP sends pricing signals and tariffs to the OVGIP.
- The OVGIP transmits the pricing signals and tariff table to the individual eMobility Operators.
- PEV driver plugs in and sets a departure time
- Association between the PEV and EVSE occurs through PLC link whereby both are equipped with digital certificates – automatic digital authentication and identification procedure between the PEV and the EVSE occurs.

- The eMobility Operators process the pricing signals and tariff table received from the OVGIP to the respective EVSEs.
- PEV receives an updated tariff table during a bi-directional communication between PEV and EVSE that considers the DR and CPP events.
- Requirement is at the start of charging a price tariff is provided
- The outcome of the negotiation between the PEV and EVSE, depending whether or not the PEV accepts the new pricing tariff table, results in an updated charge profile

Post Conditions:

- Updated tariff tables submitted by the OVGIP to the eMobility Operator is accepted by the PEV
- PEV rejects updated tariff table – SECC with EVCC negotiates to determine acceptable tariff
- Communications failure – PEV charges to PEV mode settings

### Use Case 8 Vehicle Roaming

**Scenario A**: OVGIP provides clearing house functions for tracking Roaming transactions of PEV between eMobility Operators and/or EVSE Network Providers.

Description: OVGIP interfaces with charging infrastructure/ eMobility operator and utility backend for the purpose of allowing the PEV driver to roam through EVSE networks. Applies to Business System architectures for ISO/IEC 15118.

Objective: Establish the capability for the OVGIP to reconcile and confirm authentication between EVSE network providers and multiple eMobility Operators.

- The OVGIP is to communicate through broadcast signals with eMobility Operators to validate customer contracts when the associated EVSE or charge point provider does not recognize the PEV contract ID.
- The OVGIP determines the cognizant eMobility Operator and provides information to the EVSE associated eMobility Operator to allow charging.
- OVGIP provides clearing house function to reconcile the customer costs between eMobility Operators at the end of the month to be able to include in customer's bill.

Pre Condition:

- OVGIP has established clearing house capabilities to reconcile and authenticate customer Customer has an existing contract with an eMobility Operator and has plugged into another eMobility operator's EVSE network.
- OVGIP has customer cost recording function – costs received from non COR eMobility Operator
- OVGIP has established interface and bidirectional communications with network of eMobility Operators and can process queries and information with each
- EVSE Network provider or charge point system operator has established internet communications with OVGIP to be able to transmit unrecognized contract ID information

Primary Actors: OVGIP, eMobility Operators, EVSE Network Providers

Process:

- Customer plugs into out of network EVSE

- EVSE network does not recognize the PEV contract ID
- EVSE network provider transmits unrecognized PEV contract ID to OVGIP
- OVGIP sends broadcast query to all registered eMobility Operators to confirm the PEV contract ID accounts for roaming between eMobility Operators EVSE networks.
- Upon validation from eMobility Operator, OVGIP transmits confirmation to site EVSE Network Provider to authorize charging
- EVSE Network Provider provides customer billing information to OVGIP
- OVGIP, at end of month, transmits customer cost information to cognizant eMobility Operator for customer direct billing.

Post Condition:

- OVGIP clearing house function verifies customer contract ID and reconciles customer account with cognizant eMobility Operator
- Cannot validate contract ID – Customer charges and pays site eMobility Operator on separate billing

**Scenario B**: OVGIP provides clearing house function for inter utility roaming transactions and/or EVSE Network Providers

Description: PEV roams between utility service territories but wants all PEV charging costs credited to primary residential utility account

Objective: Provide customer ability to enroll in multiple utility and EVSE Network Provider PEV charging programs and consolidate into customer's primary residence utility account. Provide clearing house function for collecting customer data on PEV charging sessions from across multiple EVSE networks and utility service territories

Pre Conditions:

- Customer has ability to register once for multiple utility and EVSE network charging programs or subscriptions through OVGIP with primary residence utility
- OVGIP provides clearing house function to be able to collect data on customer PEV charging costs, site, date, time, duration, meter ID, submeter ID, etc.; and to associate customer account detail with utility and/or EVSE Network Provider back end systems to reconcile customer billing with their primary residential utility account
  - Ability to reconcile independently between EVSE Network Providers for subscriptions programs and utilities for applied rate tariff programs
  - This may preclude the ability to provide customer fulfillment processes for customer performance and compensation for DR, energy market, aggregation, etc. programs.
- Utilities have implemented back end accounting systems to engage clearing house transactions and subtractive billing calculations
- OVGIP has established relationships with 3rd party sub meter owners to provide the MDMA services between them and the utilities, with direct access to meter data

Primary Actors: Utilities, OVGIP, EVSE Network Providers, Customers

Process:

- Customer plugs into site outside of residence

- OVGIP confirms authentication of customer enrollment in clearing house program through PEV ID – verify service territory or EVSE network Provider registered in enrollee record
- OVGIP performs association to site EVSE and Meter/sub meter and is able to identify customer primary residential utility account in active data files
- OVGIP records charge session information into OVGIP customer enrollment register which is indexed to utility residential customer account.
- OVGIP at end of month or required intervals reconciles customer charge session profile and cost data received from EVSE Network Providers and non residential utilities or meters and reconciles to customer resident utility account and between EVSE Network Providers

Post Conditions:

- Cannot verify enrollment – PEV charges according to J1772 _ require customer service operation to reconcile customer enrollment record issues
- No communications – PEV charges according to J1772_
- Cannot verify customer utility resident account – PEV charges _ OVGIP reconciles after the fact with utility and/or customer for account reconciliation

### Use Case 9 EVSE Networking Functionality

**Scenario A**: OVGIP provides EVSE Network functionality for interfacing and interacting with EVSEs from multiple manufacturers and distributors.

Description: OVGIP is to provide EVSE manufacturers and distributors with networking functionality to monitor and manage their EVSE location, status and utilization. Networking functionality is to provide customer resource management for authentication and authorization of customer account IDs and recording of customer charge session electricity consumption.

Objective: EVSE networks have the ability to plug in EVSEs from different manufacturers. Site hosts have the ability to replace EVSEs and/or the network provider in a plug and play manner, without losing their OVGIP access or functionality. Swapping out of EVSE(s) in an OVGIP participating site should be transparent to OVGIP and to the EV drivers.

*Note: Further development of this use case requires involvement of EVSE manufacturers, which is in progress during the publishing of this report.*

### Use Case 10 Metering and Data Exchange

**Scenario A:** OVGIP provides Meter Data Management Agent services to 3rd Party PEV charging sub meter owners

Description: State regulatory bodies in the U.S. have initiated proceedings to allow use of 3rd party owned sub meters specifically for PEV charging measurement. Under the guidelines for 3rd Party ownership the owner is responsible to engage with a meter data management systems (MDMS) to provide the association data binding the PEV/EVSE sub-meter to a premise or primary meter and the related electric consumption data from the sub-meter to the utility for subtractive billing processing.

Objective: Access and exchange energy usage data, as a proxy of PEV energy use, using: (a) premise or primary meter, and (b) PEV/EVSE sub-meter. Use meter data for monitoring energy-use, measurement and verification (M&V) of DR settlement, characterizing baseline, and real-time monitoring of customer response. Utility networks (e.g., AMI, GreenButton/ESPI, SEP 2.0) shall be used to access premise or primary meter data. Sub-meter energy usage data shall be accessible using GreenButton/ESPI standardized data format for ease of access and integration with utility's back-end MDMS. Utility DR reporting standards (e.g., OpenADR 2.0b) shall be supported for ease of access and integration with utility's back-end DR management systems (DRMS). The data exchange shall be in adherence with utility's privacy and security requirements.

Note: Further development of this use case requires assessment of utility and aggregator M&V requirements applicable to each use case, which is in progress during the publishing of this report.

# 4

# SECURITY GUIDELINES AND REQUIREMENTS

These security guidelines predominantly address the automaker requirements for interfacing and communicating with their individual vehicle telematics communication system servers. Other considerations for security will include the specifications and standards prescribed by the utilities, ISOs, and other key PEV energy management stakeholders for interface between the OVGIP and their load management network systems.

## Controls

The following identifies the Information and Cyber Security guidelines required for the implementation of the OVGIP.

*Information Security Program*

A. Third Party must ensure all employees and Contract Workers working with Information are aware of and conform to 's Third Party Information Security Policy and Controls and legal and regulatory requirements pertaining to Information (e.g., SOX, PCI, Export Control, etc.).

B. Third Party must implement or provide evidence of an Information Security Program which includes:
   1. Approved and maintained Information Security Policies and Controls
   2. Ownership and accountability for Information Security
   3. Senior management support and commitment
   4. Security awareness and education
   5. Process to monitor compliance
   6. Identification and management of information security risks

C. Any instances of non-compliance with Third Party Information Security Policy and Controls must be remediated by the Third Party. Third Party must consistently demonstrate non-compliance is unacceptable.

*Password Controls*

A. The password configuration must be a mix of uppercase, lowercase and numeric characters, where technically feasible. Use of special characters is authorized.

B. The minimum password length is eight (8) characters.

C. All user account passwords must be configured to expire at least every 90 days. This requirement does not apply to application to application accounts or external-facing customer accounts.

D. Account passwords must be configured with a history file to remember and prohibit password reuse of the last five (5) passwords.

E. All manufacturer passwords must be changed from their default values.

F. User Accounts must be locked-out or suspended after a maximum of six (6) failed sign-on attempts.

G. A user's identity must be verified before their password is reset.

*Logical Access Control*

A. All access to the system must be authenticated. This includes console access, individual accounts, administrative accounts, and any system accounts used to interface into other systems.

B. System access IDs must not be used by end users to log on to any system.

C. All accounts must be assigned to a specific, traceable and uniquely identifiable individual.

D. Access to Information must be granted on need-to-know basis and consistent with contractual agreements.

E. All accounts and access rights must be reviewed at least semi-annually to determine if access is appropriate based on job function. Evidence of this review must be retained for a minimum of one year.

F. User access must be revoked when access is no longer required.

G. User Accounts that are inactive for more than six months must be suspended. This requirement does not apply to application to application accounts or external-facing customer accounts.

H. Third Party vendor must ensure segregation of duties through the use of role-based access controls to reduce the risk of unauthorized access, modification or misuse. Such segregation applies to:
I. Accounts with privileged or administrative access
J. Production and non-production environment accounts

K. Third Party must obtain Business Liaison approval prior to sharing any Information or granting access to information to any external entities including Contract Workers/Suppliers or sub-contractors.

L. At 's request or upon completion of the agreement, the Third Party will remove all access to  Information or, at 's request, will delete 's Information and certify such deletion to .

**Network and Logical**

SECRET Information must be logically (i.e.: virtual segmentation) or physically separated from other non- Information.

**Encryption**

A. Passwords, SECRET, and SENSITIVE PERSONAL INFORMATION (except business contact information) must be encrypted in transmission and at rest.

B. Data must be encrypted if required by law using a solution that meets the legal and regulatory requirements for data encryption.

C. Encryption key management practices must be in place to ensure the confidentiality of Information.

D. Keys must be protected from unauthorized use, disclosure, alteration, and destruction.

E. If a private key is compromised, all associated certificates must be revoked.

F. Keys must have a defined lifetime after which they are securely destroyed.

G. The minimum key length requirements for all systems that process Information requiring encryption are (unless otherwise required by local law):

H. Minimum 128 bit symmetric keys

I. Minimum 2048 bit public (asymmetric) keys

J. credentials must be encrypted in storage and transmission. Therefore using unsecure protocols such as FTP and Telnet are not permitted.

*Network Controls*

A. Network connections must be managed to control access to systems containing Information (e.g., firewalls, DMZs, Zones, and encryption).

B. All Third Party networks must implement access control mechanisms, bi-directional monitoring and protection of the network perimeter (e.g., firewalls, packet filtering technologies such as intrusion detection systems or intrusion prevention systems).

C. Network access control devices must not allow access by default; “deny all” shall be the default state. Networks, addresses, protocols and ports must be specifically authorized before access is permitted between Third Party networks and any other networks.

D. Network connections between Third Party and must be to specific systems (i.e. IP addresses).

*Wireless Controls*

A. Third Party must have access controls for authentication and authorization for all wireless network segments that process or transmit Information (e.g., LDAP directory and Active Directory).

B. Third Party wireless networks must protect communications of Information and must be Wi-Fi Protected Access II (WPA2 or above) compliant.

## Physical Security

A. Third Party must protect physical locations from where  Information or -owned equipment is located but limited to:
   a. Physical intrusion, unlawful and unauthorized physical access
   b. Heating, ventilation or air conditioning problems
   c. Power failures or outages (i.e., Uninterrupted Power Service)
   d. Fire
   e. Theft and
   f. Natural disasters (reasonable protection)

B. Access to areas where Information is stored or -owned equipment is located must be controlled and restricted to authorized persons using reasonable physical access and authentication controls (e.g., access control cards, video camera monitoring, etc.)

C. Audit trail of all physical access, including times, must be securely maintained.

## Vulnerability Management

A. Third Party must have a policy and process in place to identify and remediate vulnerabilities in a timely manner. Vulnerability management must include infrastructure and applications.

B. Third Party must scan infrastructure and applications for security vulnerabilities every 90 days at a minimum.

C. Third Party must deploy and test all applicable security patches to ensure the patch does not inadvertently introduce operational issues.

D. Third Party must implement validated patches into the production environment in accordance with the severity and risk of the vulnerability.

E. Patching cycles for security vulnerabilities without compensating controls must be completed in no more than 90 days for the most critical vulnerabilities as defined by the software vendor.

F. Patching cycles for security vulnerabilities without compensating controls must be completed in no more than 365 days for the medium to low vulnerabilities as defined by the software vendor.

## Anti-Virus Configuration

A. Any systems hosting Information must have anti-virus software with current signatures. The anti-virus signatures must be updated daily at a minimum.

## Incident Response

A. Third Party must establish, maintain and execute a plan to respond to Security Incidents that include:
  a. A process to collect and review significant IT security events.
  b. A plan to detect and triage IT security events and determine which events constitute a Security Incident.
  c. A communication plan to promptly notify when a Security Incident has occurred.
  d. A process capable of restoring operations and minimizing any impact to

B. Upon discovering a Security Incident, Third Party must contact their Business Liaison and file a report via the Global Reporting and Investigations Tool (GRIT) or Awareline within twenty-four (24) business hours including the relevant and known information about the Security Incident.

C. Within two weeks of completion of a security incident investigation, the Third Party must provide Business Liaison with an executive summary which includes:
  a. Timeline of the Security Incident to show when significant events related to the Security Incident occurred
  b. The suspected perpetrators of the Security Incident
  c. The infrastructure or Information affected
  d. Financial impact or loss due to the Security Incident (or potential impact)
  e. Description of the Security Incident

D. As a result of notification of a Third Party Security Incident:
  a. may perform a non-invasive IT security assessment within mutually agreeable time after each Security Incident.
  b. may conduct follow-up activities as required to confirm the Third Party corrective actions have been implemented.

E. Any Significant Risks identified must be disclosed to Business Liaison within 14 days.

## Data Classification and Retention

A. The Information Life Cycle Management (ILM) requirements related to data retention may apply to suppliers or external resources who create or manage Information based on contractual agreement. Upon notification by, the Third Party must retain information related to a Litigation Hold until the hold is lifted.

B. Third Party must label, manage, and dispose of Information according to the data and ILM classifications provided by. In the absence of classifications provided by, the Third Party must verify requirements with the Business Liaison.

## Media Reuse or Disposal

A. All Information must be protected against unauthorized disclosure during the disposal process:

a. All media must be securely erased electronically by overwriting or degaussing, or physically destroyed prior to disposal or reassignment to another system. Media cleansing/wipe products and processes must comply with NIST SP 800-88 standard, “Guidelines for Media Sanitization” (or its successor) or equivalent industry standards.

b. At ’s request or upon completion of the agreement, the Third Party will return all copies of ’s Information to or, at 's request, will destroy ’s Information and certify such destruction to .

c. Media in paper form will use a permanent destruction method to protect the confidentiality of ’s Information, and any sub-contractors performing this function must be able to provide a destruction record confirming Information has been destroyed.

## External Audit and Compliance

A. All data demonstrating compliance to this policy, contractual obligations and regulatory or legislative requirements must be retained for at least 12 months or in accordance with applicable laws and regulations.

B. SSAE-16 or ISAE-3402 audit reports are required for SOX systems as specified in contractual agreements (“Internal Controls Exhibit – Sarbanes Oxley [Exhibit 2.2]”).

C. Third Parties who handle SECRET or SENSITIVE PERSONAL INFORMATION must provide a Type II Statement on Standards for Attestation Engagements ("SSAE-16 Type II”) or Type II International Controls for Assurance Engagements (“ISAE-3402 Type II") audit report as prescribed by the American Institute of Certified Public Accountants, covering at least a six-month period for the current year, annually, and includes evaluation of all control requirements as outlined in this document and contractual agreements.

a. Other equivalent independent audit reports may be acceptable to for non-SOX systems as long as they:

b. Include the evaluation of all control requirements as outlined in this document and contractual agreements

c. Verify both the design and the effectiveness of the controls

d. Are performed by an independent professional audit firm

D. Third Party processing, storing or transmitting payment cardholder data on behalf of must have a current compliant Payment Card Industry (PCI) Attestation of Compliance (AOC) or Report on Compliance (ROC) performed by a PCI Qualified Security Assessor.

E. Third Party must notify of any significant changes to the systems or processes supporting Information prior to the change, unless a delay would present a risk to maintaining the service provided.

F. Third Party will provide permission to perform a routine, non-invasive assessment of Third Party environment to ensure compliance with the Third Party Information Security Policy and Controls and other contractual agreements. This will be performed:
   a. Not more than once per calendar year, unless a Security Incident occurs
   b. On a date and time mutually agreeable to Third Party and
   c. In accordance with the agreed contract

G. Third Party will provide a written assertion of compliance to Policy and Controls and contractual agreements annually.

H. Third Party must provide an agreeable corrective action plan with remediation date to address the root cause of the identified Significant Risk.

I. Third Party must remediate any identified risks in a timely manner agreeable to both parties based on the severity of the risk.

## Communications

A. Information must not be released to the public through media interviews, publications, seminars or conversations, or disclosed in public forums, posted on the Internet (including social networks), or communicated in any other manner without approval in writing from the Information Owner.

## Change & Release Management

A. EXPORT CONTROLLED, PERSONAL INFORMATION, CONFIDENTIAL, or SECRET Information must not be stored in or moved to any non-production environment or unsecure location.

B. Information can only be copied or moved to a non-production environment that complies with this Policy, including the enforcement of access controls based on the need-to-know principle.

C. Third Party must have documented Change Management processes which include:
   a. Requirements analysis
   b. Management approval
   c. Development
   d. Testing
   e. Evaluation of performance and risk
   f. Emergency change

## Configuration Management

*Logging*

1. Network devices and applications which process or transmit Information should be configured to log unauthorized activity.

2. Log data must be protected against tampering and unauthorized access.

*Security Baselines*

1. Systems and applications which process or transmit Information must have documented baselines for system configurations with appropriate hardening to enhance security.

*Availability Management*

1. Third Party must have an Availability Management plan which includes:
   a. Backups and restorations
   b. Disaster recovery
   c. Business continuity

2. Third Party shall maintain a backup strategy and plan to meet restoration requirements communicated by Business Liaison. The plan shall include:
   a. Backup verification
   b. Annual restoration test
   c. Protecting backup media from unauthorized disclosure, alteration or destruction through the use of encryption or physical access controls. Note: encryption requirements will apply based on data classification.

3. Third Party shall maintain a disaster recovery plan to meet restoration requirements communicated by Business Liaison. The plan shall include:
   a. Communication Plan
   b. Recovery time objective
   c. Annual testing
   d. Alternate recovery locations

4. Third Party will maintain a business continuity plan for restoring to its normal business functions.

*Problem Management*

1. Third Party must have a Problem Management process that:
   a. Identifies root cause to prevent further incidents
   b. Posts incident root-cause analysis
   c. Develops and implements future preventative measures and controls through appropriate control procedures
   d. Retains known occurrences and resolutions that allow for reactive problem management

## Definitions

**Third Party**: A person, company, business, organization, or group that 1) conducts business with, provides goods or services to, directly or indirectly, or is a customer of General Motors or 2) is a competitor of General Motors . Third Party includes but is not limited to dealers, Alliance Partners, consultants, professional service providers and business partners. These entities may create, collect, manage, process, access, store or transmit Information or represent in the course of business.

**Information**: All information, physical and electronic or otherwise, relating to the business of and created or acquired using its resources or interacting with personnel. Information exists in many forms, including but not limited to product plans, vehicle designs, product prototypes, strategy documents, business records, pricing information, financial or technical data, marketing information and text, sound or image files.

**Information Owner:** The business process leader(s) or manager(s) with responsibility for management of Information.

**Business Liaison:** A employee who has been designated as the owner of the relationship and acts as the contact between the Third Party and. The Business Liaison will represent a department, site or group for which goods are procured or services are performed and will maintain open communications with the Third Party.

**Security Incidents**: A breach or imminent breach of IT security defenses that may negatively impact systems or information. These may include but are not limited to: fraudulent activity, unauthorized disclosure, unauthorized modification, identified vulnerabilities and intrusions or incidents of impaired or denied availability to the computing and communications environment supporting.

**Significant Risks:** Risks that have a high-probability and are likely to have a significant impact.

**SECRET:** Classification assigned to Information that, if disclosed, would compromise a strategic business initiative and cause substantial damage to the competitive position of a business unit (e.g., product line or financial position) or to as a whole.

**PERSONAL INFORMATION ("PI"):** Classification assigned to Information that may be used to identify an individual and may be subject to data protection laws and regulations that may restrict or prohibit the use, sharing or transfer of that information generally across borders or with anyone without a specific need to know under appropriate protections. Personal Information's legal definition can vary by location.

**SENSITIVE PI:** is a subset of PERSONAL INFORMATION. It is defined as first name or initial and last name in combination with one of the following:

- A social security number or other government-issued identifier such as a tax identification number or driver's license number
- Financial account information (account number, credit or debit card numbers or banking information)

- Date of birth (month, day and year)
- Medical information (including health information)
- As defined in the local jurisdiction (e.g., mother's maiden name)

**CONFIDENTIAL**: Classification assigned to Information that, if disclosed, would likely cause damage to the competitive position of.

**Contract Worker:** A person who performs services for pursuant to an agreement between and the person's employer. A Contract Worker is not a employee and remains subject to the control and employment terms of the Contract Worker's employer.

**User Account**s: All user and administrative accounts used for interactive logons (i.e., user ID and passwords).

## Export Control Restrictions



**The Electric Power Research Institute, Inc.** (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI also provides technology, policy and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI's members represent approximately 90 percent of the electricity generated and delivered in the United States, and international participation extends to more than 30 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; and Lenox, Mass.

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