Vehicle-Grid Integration Communications Protocol Working Group

Work Plan

Revised by Interagency VGI Team: July 24, 2017

Table of Contents

- Objective
- Scope
- Policy Context
- Strategy
- Expectations of Active Participants Contributing to Deliverables
- Stakeholder Viewpoints to be Examined
- Tasks and Deliverables
- Meeting Trajectory
- Appendices
    - A: Exemplary Criteria for Standards
    - B: Supporting Documents
    - C: Schedule of Meetings and Tasks

Objective of VGI Communications Protocol Working Group:

The California Public Utilities Commission (CPUC) California Energy Commission (CEC), California Air Resources Board (ARB), California Independent System Operator (CAISO), and Governor's Office of Business and Economic Development (GO-Biz) are sponsoring a working group to provide a recommendation on whether the CPUC should require a communications protocol or protocols in the electric vehicle service equipment (EVSE) and associated infrastructure that investor-owned utilities (IOUs) support with ratepayer funding.[1] To answer this question, this working group will evaluate whether any existing communications protocol(s) are necessary to enable Plug-In Electric Vehicle-Grid Integration (VGI) to be deployed economically and at scale. Effective and economic VGI, if deployed at scale, is expected to lower the overall costs of vehicle ownership or increase the perceived value for the customer in order to incentivize electric vehicle adoption.

As state agencies, our overall goal is to reduce emissions both by incentivizing the switch from fossil fuel vehicles to zero-emission vehicles and by integrating those vehicles with the electric grid efficiently.

Scope:

The Working Group will examine existing communications protocols and will not attempt to create a new protocol. As part of the group, we will have some more policy-focused discussions and some more technical/engineering-focused discussions. Since we need different types of experts for different parts of this process, we have developed a schedule to help stakeholders plan their participation accordingly.

This group will focus on the light-duty vehicle sector.

The CPUC regulates the IOUs[2] and has no jurisdiction over automakers or EV service providers. If the

[1] In some proposed projects, the IOUs directly procure and own the EVSE; in other proposed projects, the IOUs qualify EVSE models that a customer can purchase and install. If CPUC were to require a communications protocol, it would apply in either case.

[2] There are six electric IOUs in the state: San Diego Gas & Electric, Southern California Edison, Pacific Gas and Electric, PacifiCorp, Liberty, and Bear Valley.

CPUC decides to adopt a communications protocol(s) for the IOU investments based on the Working Group recommendation, it does not preclude the use of other additional communications protocols.

There may be other policies or pilots the CPUC and other state agencies can implement to advance VGI more broadly. While participants may identify these during the course of the Working Group, this working group is not expected to make recommendations for policies or pilots beyond what will apply to the EVSE and associated infrastructure that IOUs support with ratepayer funding. Rather, the consideration or implementation of such recommendations are more appropriately addressed under the state's work under the VGI Roadmap, which is currently being considered under the CEC's Integrated Energy Policy Report proceeding.

Policy Context:

The CPUC initiated this discussion of communications protocols because we are currently reviewing IOU proposals to accelerate transportation electrification in California over the next five years. Many of the IOU proposals include projects to install EV charging infrastructure and we are examining how to ensure their investments enable EV adoption and do not result in stranded assets. In our evaluation of these utility proposals, we are considering whether we need to require any protocol(s) for the utility procurement or qualification of EVSE. Because CPUC's jurisdiction is over the IOUs and their investments, the type of protocol(s) CPUC could potentially require for utility investments is one that goes through the EVSE. While there are many additional ways the CPUC can facilitate VGI, for the purposes of this working group, we are focusing on a whether we should adopt a communications protocol(s) for IOU investments in EVSE and supporting infrastructure to speed EV adoption and further enable EV grid services at distribution and transmission levels.

To evaluate the specific question of the necessity of communications or "intelligence" within the EVSE to enable VGI, we need to understand the broader network architecture required by various VGI use cases. We are examining a more comprehensive set of VGI requirements and the general value of those VGI products for the CPUC to ultimately answer a very specific question regarding the need for a communications protocol(s) on the EVSE to unlock the value of VGI.

The CPUC will incorporate the final recommendation of this Working Group into the record of one or more electric vehicle proceedings (A.17-01-020 et al., R.13-11-007, A.17-06-031, A.17-06-033, A.17-06-034) to receive further stakeholder feedback on the recommendation and determine whether to adopt the Working Group's recommendation.

The Working Group outputs will also help inform the ARB SB 454 Electric Vehicle Charging Open Access Act activities and allow the CEC to understand how to better characterize electric vehicle load and infrastructure flexibility as part of its energy and transportation demand forecasting efforts and CEC's investment Alternative and Renewable Fuel Vehicle Technology Program and research and development programs.

Strategy:

This interagency-led Working Group will identify and assess opportunities in which VGI can create value from multiple market participants' perspectives, the functional requirements necessary to capture that value, and the communications protocol(s) or other mechanisms that meet those requirements. The working group will allow participants to review, understand, and discuss the technical details of existing

communications protocols. The group will not create new communications protocols.

Expectations for Active Participants Contributing to Deliverables:
The Working Group expects that subgroups will form to assist in the development of material needed to answer the questions identified below and use the supporting documents to avoid duplication of prior work. The Facilitator will assist these subgroups in establishing a reasonable and timely review process to determine the level of agreement among stakeholders for delivered products.

Observers are welcome to attend as they are available and interested.

Stakeholder Viewpoints to be Examined:

i. EV user (driver/rider)
ii. Electric Vehicle (EV) Original Equipment Manufacturer (OEM)
iii. Distribution System Operator (DSO or Utility) and Independent System Operator (ISO)
iv. Site Host (for Charging Stations)
v. Electric Vehicle Service Equipment (EVSE) Operator or Service Provider (EVSP)
vi. EVSE Original Equipment Manufacturer
vii. VGI Resource Aggregator (for retail or wholesale energy services)
viii. Non-Participating Ratepayer or Society

Tasks and Deliverables:

Deliverable 1: Map VGI Use Cases and Requirements to Existing Communications Protocols
By referring to existing standards documentation that are relevant to California and the United States and learning from international markets where possible, identify the use cases for which VGI can provide value, the functional requirements necessary to achieve those use cases, and the network architecture(s) that meet those requirements. The VGI value could be delivered to the customer, distribution, and wholesale grid services as identified in the VGI Whitepaper and others as needed. Devices and actors within these network architectures may or may not utilize standards to facilitate VGI services.

Sub-working groups

1. Terms and Definitions

VGI Working Group participants will create a standard list of terms and definitions to be used within the work and deliverables of this working group, so that all Working Group participants use the same terminology. The sub-working group will review the submitted terms and definitions, and align any similar terms and identify consensus definitions where necessary. The sub-working group will present their consolidated glossary to the full working group.

2. Use Case Identification

VGI Working Group participants will submit proposed use cases for consideration and label them with the categories identified in the VGI Roadmap:

a. Unidirectional power flow (V1G) with one resource and unified actors
b. V1G with many resources and aggregated resources
c. V1G with fragmented actors
d. Bidirectional power flow (V2G)

Use cases may fit into more than one category. Once participants have submitted the categorized use cases, the Use Case Identification sub-working group will evaluate them for accuracy.

Using a standard Excel template, the use case submitters will then identify the functional and non-functional communications requirements and any other requirements necessary to achieve the use case(s) and the communication pathway(s) needed to meet those requirements. Participants can also specify alternative ways to achieve the use case requirements that do not require a communications protocol. Communication pathways include:

a. Network Service Provider (NSP)[3] to Building Management System (BMS)
b. NSP to EVSE
c. NSP to Electric Vehicle (EV)
d. NSP to Customer
e. BMS to EVSE
f. BMS to EV
g. BMS to Customer
h. EVSE to EV
i. EVSE to Customer
j. EV to Customer

As part of the template, use case submitters will identify which communication pathway(s) are necessary meet their use case's requirements, as well as which communication pathway(s) could be used to meet the requirements, but are not necessary to achieve the use case. A small team of participants, led by Stephanie Palmer of ARB, will review all of the completed templates for accuracy and consistency and consolidate them into one final Excel file.

Figure 1: Entities included within the provision of electricity or information during a charging event.

(Note: Arrows are not comprehensive.)

[3] "Network Service Provider" in its use here is broadly defined and may encompass any provider of a communication to an EV, including an EV OEM, EVSP, Grid Operator, Aggregator, etc.

3. Mapping Communications Protocols to Use Case Requirements

Using the final list of use cases, requirements, and communication pathways identified by the Use Case Sub-Working Group, the Mapping Sub-Working Group will map existing communications protocols to the requirements and communications pathways. Participants will first brainstorm all existing protocols that should be mapped. This sub-working group will require the participation of experts for each standard that is examined to explain exactly how the standard meets the use case requirements.

Based on the results of the three Deliverable 1 sub-working groups, state agency staff will develop a summary of deliverable 1 and present this to the entire Working Group for feedback. The summary will identify which communications protocols must or can be used to achieve each use case.

Deliverable 2: Costs and Benefits of Choosing a Protocol to Enable VGI

Building upon the analysis created for Deliverable 1 above, stakeholders will broadly assess the costs and benefits associated with choosing one or more communications protocols. First, the group will identify categories of costs and benefits associated with each use case. Then we will compare standards against one another based on which use cases (and resulting costs and benefits) they provide. We will develop sub-working groups as necessary. Deliverable 2 will require two main tasks:

1. Identify costs and benefits of each use case and communications protocol. Consider the benefits and costs from both a grid and customer perspective. We acknowledge that costs of a protocol and benefits of a use case may evolve over time.
    a. Costs. Define costs, including opportunity costs
        i. Identify costs of each use case and categorize them (cost to EV user, cost to grid, cost to site host, etc.). If available stakeholders may contribute verifiable quantitative estimates for elements in the architectures.
        ii. For each standard(s) or alternative communications path(s) that must or can be used to achieve the use case, how does the adoption or absence of the standard affect the costs of the use case? What factors will increase or decrease these costs?
    b. Benefits. We will not attempt to assign an exact numerical value for the benefits associated with different use cases, as we do not think that exercise would be useful or timely in helping us complete the Working Group activities. Benefits are not limited to services for which a market currently exists and can include achievement of the qualitative criteria and policy objectives.
        i. List benefits of each use case and categorize them (benefit to EV user, benefit to grid, benefit to site host, etc.)..
        For each standard(s) or alternative communications path(s) that must or can be used to achieve the use case, how does the adoption or absence of the standard

affect the benefits of the use case? What factors will increase or decrease these benefits?

2. Assess whether a communications protocol, a combination of protocols, or an alternative to a protocol generates the greatest benefits for each use case and in consideration of the set of use cases as a whole.

Deliverable 3: Policy Recommendation

Provide recommendations on the market or policy actions needed to more appropriately value, procure, or put into operation VGI resources.

a. Is there a consensus recommendation for the CPUC on standard(s) to be used in the SB350 TE infrastructure investment proposals currently under review? This recommendation should be focused on the communication pathway over which the CPUC has jurisdiction: on the EVSE. Should this recommendation be aligned across other agency EV infrastructure programs?
b. If there is not a consensus recommendation, do individuals recommend other actions to ensure the utility infrastructure investments will support and accelerate TE in California?
c. Identify additional action items on standards or other issues identified in the course of the working group and identify appropriate avenue for future research or demonstration.

Meeting Trajectory:

To assist working group participants' ability to schedule their participation and in consideration of the technical and multi-disciplinary nature of this task, the interagency staff proposes that the working group meetings generally follow the following sequence:

1. Exposition of issue and proposals to solve problem, identification of preparatory items for in-person working session
2. In-Person workshop, alternating between San Francisco and Sacramento, stakeholder presentations, discussions and working sessions
    a. Follow-up in deliverable-specific subgroup break-outs working teams
3. Report-Out from Sub-working groups and Submission of Documents for Review
4. Feedback and Discussion, Resolution of Issues

Please see Appendix D for full meeting and task/deliverable schedule.

Appendix A: Exemplary Criteria for Standards

These proposed criteria summarize the Exemplary Criteria for Standards per Appendix B as well as comments expressed by parties at the December 7 multi-agency workshop on VGI, and the April 24, 2017 VGI Working Group meeting.

Meet EV Drivers' Needs & Preferences

- A driver's mobility, need for simplicity, and privacy is preeminent (ACR 1)[4]
- A vehicle's charging behaviors is consistent with the battery management system and mobility requirements are not externally curtailed by an entity without consulting the driver (ACR 2)
- Enables EV drivers and site hosts the flexibility to gain value or save money

Seek to minimize overall costs and maximize overall benefits for customers from Achieving Greenhouse Gas and Air Pollution Reductions with TE

- Guarantee and hasten opportunities for the return of ratepayer investments in research and development (R&D) (ACR 11)
- The standard is adaptive to automakers' design and manufacturing requirements which are, ultimately, global in nature. Regulations incorporating standards should strive to recognize existing progress and avoid duplication (ACR 8)
- Minimize grid impacts and costs to all utility customers

Enable Grid Value that is Safe, Reliable, Secure, & Scalable

- Functions enabled through the standard's implementation are fully scalable: a) In electrical system terms, from an individual vehicle, to an array of EVSE, to facility circuity, to a campus/microgrid, to distribution, and to regional transmission systems, and b) In magnitude to accommodate millions of vehicles of different makes and models (ACR 3)
- Reliability and functional requirements meet those of the California Public Utilities Commission's adoption of Utility Electric Rules, Federal Energy Regulatory Commission as implemented by the CAISO, or the best practices of the North American Electric Reliability Corporation (NERC) (ACR 4)
- Meets safety requirements
- Meets and maintains the highest levels of cybersecurity

Enable the Future Development of the VGI Ecosystem

- Technologies and equipment deployed through the standard's implementation are resilient to evolving use cases in the automotive, electricity, and communications industries including: high-power charging, wireless charging, vehicle-to-grid, autonomous, connected, electric and shared (ACES) vehicles, higher-speed wireless and wire-based communications (ACR 5)

[4] ACR X denotes the criteria was listed as "Exemplary Criteria" in Appendix B of the September 14, 2016 ACR on SB 350 TE applications (pg. B5-B6)

- Technologies and equipment deployed prior to the standard's implementation can voluntarily be re-equipped to increase functionality and compatibility to the adopted standard to the cost-effective extents possible (ACR 6)
- Transportation Network-specific use cases and services will be leveraged and account for Geospatial Information System (GIS) data including charging infrastructure utilization, road infrastructure utilization, route navigation, demand sequencing and queueing, traffic flow, and trip dispatch (ACR 7)
- Enables flexibility to address dynamic data exchange and functional requirements from multiple stakeholders/actors
- Uses open approaches to standards to foster innovation, customer choice, and competition to enable coexistence and interoperability for diverse services and technologies.

Coordinate Across Policy Stakeholders and Related Technologies

- Synchronize the timing of public and private investments in developing vehicle, infrastructure, and network or data management products with timelines established in California policy and regulations to efficiently meet climate change mitigation and adaptation goals. (ACR 9)
- Leverage the technical capability of the State agencies, and the research and interests of the national labs of the U.S. Department of Energy and independent research institutions and standards making organizations (ACR 10)
- Consistency with Rule 21 SIWG DER Integration Principles to enable IOU-side uniformity and unanimity with other approaches to aggregated & distribution system level grid management, and clarity for third parties providing aggregated grid services

Appendix B: Supporting Documents

Agency-Led Documents - Required Reading:

- CPUC Energy Division, Vehicle-Grid Integration: A Vision for Zero-Emission Transportation Interconnected throughout California's Electricity System, 2013. ("VGI Whitepaper")
- CAISO et al., California Vehicle-Grid Integration Roadmap: Enabling vehicle-based grid services, 2014. ("VGI Roadmap")
- CPUC, Appendix B to the Assigned Commissioner Ruling Regarding the Filing of Transportation Electrification Applications Pursuant to Senate Bill 350, 2016 ("Appendix B")
- CEC and CPUC Joint Workshop, Vehicle-Grid Integration Communications Standards – Interagency Presentation, 2016
- CEC, Annual Multi-Agency Update on Vehicle-Grid Integration Research, 2014, 2015, 2016
- CPUC, California Statewide PEV Submetering Pilot – Phase 1 Report, 2016.
- Vehicle-Grid Integration Communications Protocol Working Group, CPUC and CEC Staff Straw Proposal, 2017 ("Straw Proposal")

Stakeholder-Led Proposed Documents:

- IEC / ISO Standards
    - ISO 15118-1:2013, Road Vehicles - Vehicle to grid communication interface -- Part 1: General information and use-case definition
    - ISO 15118-2:2014, Road vehicles -- Vehicle-to-Grid Communication Interface -- Part 2: Network and application protocol requirements
    - ISO 15118-3:2015, Road vehicles -- Vehicle to grid communication interface -- Part 3: Physical and data link layer requirements
- SAE Standards / Technical Information Reports / Recommended Practices
    - J2836/1 Use Cases for Communication Between Plug-in Vehicles and the Utility Grid
    - J2847/1 Communication between Plug-in Vehicles and the Utility Grid
    - J2836/2Use Cases for Communication Between Plug-In Vehicles and Off-Board DC Chargers
    - J2847/2 Communication Between Plug-In Vehicles and Off-Board DC Chargers
    - J2836/3 Use Cases for Plug-In Vehicle Communication as a Distributed Energy Resource
    - J2847/3 Plug-In Vehicle Communication as a Distributed Energy Resource J2931/1 Digital Communications for Plug-in Electric Vehicles
    - J2931/4 Broadband PLC Communication for Plug-in Electric Vehicles
    - J3072 Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems

http://www.sae.org/search/?qt=j2836%2F1&sort=relevance&sort-dir=desc&display=list&content-type=%28%22STD%22%29

- IEEE 2030.5 IEEE Adoption of Smart Energy Profile 2.0 Application Protocol Standard
    - https://standards.ieee.org/findstds/standard/2030.5-2013.html
    - California Smart Inverter Working Group (SIWG) and California Smart Inverter Profile (CSIP) - http://sunspec.org/ieee-2030-5-common-california-iou-rule-21-implementation-guide-smart-inverters/
- OpenADR 2.0b Specifications - https://standards.ieee.org/findstds/standard/2030.5-2013.html
- NIST IR 7628, volumes 1, 2 and 3 - http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf
- SMUD
    - SAE 2014-01-0344: Electric Grid Integration Costs for Plug-in Electric Vehicles: Jeff Berkheimer, Jeff Tang, Bill Boyce, Deepak Aswani, SAE International Journal of Alternative Power, 3(1), 2014, doi: 10.4271/2014-01-0344
    - EVS29 EPRI's 'Hotspotter' Tool: Identifying Potential Utility System Overloads in a Growing EV Market: Jamie Dunkley, Deepak Aswani, Arindam Maitra, Jason Taylor, Rajesh Radhakirishnan, Dwight MacCurdy.
    - Bill Boyce Presentation on April 18, 2016 to the CEC's IEPR / IRP workshop
- DOE/EPRI Electricity Storage Handbook in Collaboration with NRECA http://prod.sandia.gov/techlib/access-control.cgi/2015/151002.pdf
- Rocky Mountain Institute, The Economics of Battery Energy Storage, 2015
- ElaadNL, EV Related Protocol Study, 2017 ("Protocol Study")
- EPRI Public Documents:
    - Open Vehicle-Grid Integration Platform: General Overview Product ID 3002008705
    - Open Vehicle-Grid Integration Platform: Systems Approach to Standards and Interoperability Product ID: 3002008866,
    - Open Vehicle-Grid Integration Platform – Unified Approach to Grid / Vehicle Integration: Definition of Use Case Requirements Product ID: 3002005994 https://www.epri.com/#/search/Open%20Vehicle-Grid%20Integration%20Platform:%20General%20Overview/?to=1483020750731&from=1310345249268

- NIST/SGIP Catalog of Standards - http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPCoSStandardsInformationLibrary

- *Others to be added later*

Appendix C: Schedule of Meetings and Tasks

Identifier (Deliverable. Meeting#), Date, Location	Objective and Purpose Draft Agenda Topics	Needs Identified	Follow Up Assignments for Participants or Agencies	Applicable Excerpts from Supporting Documents
0.1 *4/24/17* *In-person* *San Francisco*	• *Introductions* • *Level setting* • *Present and receive Feedback on straw proposal* • *Initial identification of stakeholder interests in use cases and business*	• *Clearer understanding of scope* • *Clearer understanding of process* • *Common understanding of terms*	• *Sponsoring agencies will:* • *Present a work plan to WG* • *Identify foundation documents and research*	• *N/A*
Deliverable 1: Map VGI Use Cases with existing Communication Protocols to Network Architectures				
1.1 *5/15/17* *WebEx*	• *ElaadNL Presentation on EV Protocol Study* • *Feedback and agreement on work plan* • *Establish subgroup composition, form of deliverables, and communications and documentation*	• *Confirm and self-assemble subgroup teams and establish timeline for work deliverables* • *Participants propose for consideration other documents, definitions, or Criteria*	• *<u>WG participants to</u>:* • *Additional key definitions* • *Begin discussing Deliverables 1c, 1d, 1e, 1f in Subgroups* • *Presenters for 1a and 1b*	• *Protocol Study Sections 4, 5, Appendix B* • *VGI Whitepaper Part 2 and 3* • *VGI Roadmap Section 2, 3.2, 3.3, 4.3* • *Presentations from Research Reviews*

1.2 5/30/17 WebEx	• *Dean Taylor (SCE) presents progress on terms and definitions + Q/A discussion* • *Mike Bourton (Kitu) presents progress on use cases + Q/A discussion* • *Agencies Present Network Architecture* • *Present Current Work Plan*	• *Confirm and self-assemble subgroup teams using the Google Group mailing list* • *Extend deadlines for use cases (June 2)* • *Extend deadline for definitions (June 2)*	• *<u>WG participants to:</u>* • *Finalize key definitions, criteria* • *Continue subgroup dialogue in solving Deliverable 1 questions* •	• *Appendix B Part 2*
1.3 6/12/17 All Day Sacramento	• *Subgroup present on use cases* • *Subgroup present on definitions* • *Working Session: Discuss subgroup focus area questions*	• *Participants supply evidence documents on discussion topics* • *Be prepared to discuss technical requirements for each focus area* • *Identify subgroups to present on 6/26/2017*	• *<u>WG participants to:</u>* • *Begin outlining proposed findings, agreements, disagreements to be in draft solution for WG's consideration*	
1.4 6/26/17 WebEx	• *Status update from use case sub-working group* • *Presentation of proposed working group focus changes from Joint IOUs and OEMs* • *Presentation of use case*	• *Participants to discuss use case status and proposals from Joint IOUs and OEMs* • *Use case submitters needed to self-identify requirements and communications pathways necessary to*	• *<u>WG participants and agencies to:</u>* • *Identify gaps in past discussions* • *Prepare presentations or bring supporting documents to be discussed at next meeting* • *Agencies to work on draft outline*	

	requirement and communication pathways template • *Proposal/creation of new sub-working group to map use case requirements to network architectures*	*achieve their use cases* •	*for deliverable 1 summary*	
1.5 7/10/17 WebEx Kickoff of Standards Mapping Sub-working group	• *Agencies present draft outline of Deliverable 1 summary* • • *Review and discuss applicable standards to be considered in sub-working group* • *Discuss standards mapping methodology and specificity*	• *Confirm and identify a leader for mapping sub-working group* • *Subgroups review and comment on draft outline*	• *<u>WG participants to:</u>* • *Review and comment on draft Deliverable 1 outline* • *Volunteer for sub-working group* • *<u>Agencies will:</u>* • *Complete Draft Summary of Deliverable 1 for WG's consideration*	
2.1 7/24/17 WebEx	• Presentation of updated workplan and clarification of working group's objective • Status update on terms/definitions • Status update on mapping sub-working group	• Offer feedback on updated workplan • Offer feedback on Deliverable 1 outline • Identify participation needs for completing Deliverable 1	•	• Protocol Study Sections 6, 7, Appendix A • VGI Whitepaper Part 4 and 5 • VGI Roadmap Section 3.1, 4.2 • Appendix B

	•			• Presentations from Research Reviews
2.2 8/7/17 San Francisco	• Last technical discussion on Draft Summary document for Deliverable 1 • Kickoff Deliverable 2: Identify Opportunity Costs and Benefits from Stakeholders' Perspectives • Agencies present on Cost and Benefits • Presenter on Cost and Benefits** TBD • Confirm subgroup teams and establish timeline for work deliverables	• Continue to work in subgroups to answer questions 1 and 2	• <u>WG participants and agencies to:</u> • Identify gaps in past discussions • Develop any new sub-working groups needed to add market analysis to technical analysis completed in Deliverable 1. ○ Deliverable 2 question 1: Evaluate the implications of requiring/not requiring single or multiple protocol(s) ○ Deliverable 2 question 2: Provide a framework to characterize the value associated with the network architecture	
Deliverable 2: Identify Opportunity Costs and Benefits from Stakeholders' Perspectives				
2.3 8/21/17 WebEx	• Subgroups present on progress of Deliverable 2 question 1 • Fill in any identified gaps in discussion	• Participants supply evidence documents for position • Identify Gaps in any past discussions	• Begin outlining proposed findings, agreements, disagreements to be included in Deliverable 3	

2.3 9/5/17 WebEx	• Agencies present draft outline summary for Deliverable 2 • Tee up discussion for Deliverable 3: Value Proposition and Identification of Enabling Policy	•Subgroups review and comment on Deliverable 2 draft outline • Create any sub-working groups needed to complete Deliverable 3	• Stakeholders send in any final comments on deliverable 2 • Stakeholders prepare for working session discussion of Deliverable 3 questions	
Deliverable 3: Value Proposition and Enabling Policy				
3.1 9/18/17 Sacramento	• Deliverable 2 Draft summary document comments • Agencies present on policy context of Deliverable 3 • Presenter ** TBD • Working session Deliverable 3 questions	• Draft summary outline for Deliverable 3	• Suggestions for potential organizational actions or pilot projects to test the ability of standard(s) to accelerate VGI • Suggestions for policymakers on what standard(s), if any, should be required in the SB 350 TE infrastructure investments currently under review • Prepare presentations on position for Deliverables 3 a-b related Questions	• Appendix B • VGI Whitepaper Part 5 • VGI Roadmap Section 4.2
3.2 10/2/17 WebEx	• Stakeholders present on Deliverable 3 questions	• Comments on positions on industry actions or policy • Supporting documentation	• <u>Agencies prepare:</u> Draft summary for deliverable 3 • <u>WG participants:</u> Draft recommendations and prepare summary presentations	•

3.3 10/16/17 San Francisco	• Stakeholders present final recommendations on Deliverable 3 • Discuss any divergence in positions • Discuss topics that will be included into the summary for Deliverable 3 • Agencies present draft outline for Deliverable 3 summary	• Draft Summary for Deliverable 3.1 (Is there a consensus recommendation for the CPUC on standard(s) to be used in the SB350 TE plans) for WG consideration	• Agencies compile recommendations and summary on Deliverable 3	