Deliverable 2
Costs & Benefits

Vehicle-Grid Integration Communications Protocol Working Group

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California Energy Commission

California Public Utilities Commission - San Francisco
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Deliverable 2 example and proposal (from 8/7 CEC PPT)


<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Costs</th>
<th>Inc/Dec Factors</th>
<th>Benefits</th>
<th>Inc/Dec Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
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<tr>
<td>Host</td>
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<td>PEV OEM</td>
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<tr>
<td>EVSE OEM</td>
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<td>Operator</td>
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<tr>
<td>VGI Aggregator</td>
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<tr>
<td>DSO/LSE/CCA/ISO</td>
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<tr>
<td>Ratepayer/Society</td>
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</table>

2. Repeat for [Comm. Protocol 1-X], or alternative, for Use Cases [1 – X]

3. Juxtapose use case implementations, delineate opportunity costs

- Subgroups?
- Divide and Conquer:
  - Type of implementation: Comm. Protocol, alternative, or null *(Suggested)*
  - Use Cases
  - Costs
  - Benefits
Connection to Deliverable 1

• Use Cases → extracted Requirements

• Standards → mapped to meet Requirements
  • Standards or Alternatives
    1. IEEE 2030.5 (SEP 2.0)
    2. CHAdeMO (IEEE 2030-1-1)
    3. CNMP (IEEE P 2690)
    4. ISO 15118
    5. OpenADR 2.0b
    6. OCPP v1.6
    7. SAE J3072 / SAE J2847 / SAE J2931 / SAE J1772
    8. Telematics

• Launch point for Deliverable 2, Question 1
Subject Matter Expert Teams
Designing Implementations

- Automaker
- EVSE Manufacturer
- VGI Aggregators
- Grid Operator

Standard 1

...
List Cost Categories necessary to implement one use case

1. Standard 1
   1. EV charge controller
   2. EVSE charge controller
   3. ...

2. Categorize costs given other stakeholders needed to complete use case.

3. How does adoption or absence of standard affect cost? List factors increasing or decreasing costs.

4. Repeat for other use cases. Indicate costs added or saved when implementing other use cases
   1. If applicable. If subsequent implementations do not change cost structure, do not list.
List Benefit Categories achievable from implementing one use case

1. **Standard 1**
   1. Demand charge management
      1. Quant. if available
   2. Frequency regulation
      1. Quant. if available
   3. …

2. Categorize benefits accrued to stakeholders.

3. How does adoption or absence of standard affect benefits? List factors increasing or decreasing benefits.

4. Repeat for other use cases. Indicate benefits added or lost when implementing other use cases
   1. If applicable. If subsequent implementations do not change cost structure, do not list.
Note: Listing Costs & Benefits

• In the absence of knowing what existing (billing, metrology, communication) supporting systems or grid service markets or available or needed to complete service, list them.
  • Can be removed later if determined to be available.
  • Unavailable items can be noted as policy issues.

• Costs
  • Note assumed counterfactual charging system.

• Benefits
  • Working Group will be gathering Business Practice Manual and utility contract terms required for deliverability.
  • Can include qualitative, non-grid service benefits.
Deliverable 2 Questions 1 & 2

• Answers to Question 2 flow from analysis and synthesis of Question 1.
  • Juxtapose costs & benefits of implementations
    • Distinguish for use cases only with material changes in equipment structure or stakeholders involved
  • Combine and eliminate duplications in categories
  • Identify commonalities and options for net benefits

• Next Steps
  • Today: Identify SME teams designing implementations of standards and alternatives
  • Build upon cost/benefit presentations from 8/7 and more detailed instructions and outline
  • 9/5: Present on progress
Questions or Feedback?

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Questions to keep in mind...

- What benefits are accrued with certain information and what is foregone without it?
  - How is adoption enabled or hindered?
  - What will encourage private investment?
  - What future use cases are stifled without intelligence?
- What are the implementation costs if levelized over “widespread” scale?
  - Sensitivity to thousands of units? Millions?
- How can the efficiencies of an international automotive market be leveraged?
- What advanced technologies are concerning? How do risk tolerances differ among stakeholders?
What is the **incremental cost** to develop a standards-based smart charging system?

Integrated circuit: chipsets, modem, radios, powerline communication, memory, processor

Conformance and interoperation testing and certification

Ordering, supplier tooling, manufacturing, per-unit pricing

Vehicle and/or equipment-based charge controller

Requirements to implement a protocol(s)

Use of open source or programming original code

*What are the reasonable counterfactual ("base cost") assumptions for the market?*
Stakeholder costs can yield private and social benefits

Ratepayer or Society

- Lower air pollution and GHG, economic growth, market efficiency
- Advanced rate enrollments, avoided upgrades, increased load factor & renewables use, flexibility services

DSO/ LSE/ CCA/ ISO

- Eased enrollments, grid services, measurement & verification, faster settlements, increased revenues
- Lower energy costs, higher asset utilization, increased charging carrying capacity, attracted tenants & retained employees, value added services

VGI Aggregator

- Delightful customer experiences, decreased costs, simplicity, increased sustainability
- Higher sales, interoperability, scale economies, efficient investments

Public investment in R&D, customer rate-base

- Billing and settlement system upgrades, EVSE investments

Software development, customer acquisition

- Smart charging systems ($/EV, $/EVSE or $/year,...)

Host

- PEV OEM
- EVSE OEM
- EVSP or Operator

User
Achieving benefits for California relies on PEV charging data

Data should be

- Accountable
- Specific
- Verifiable
- Fungible
- Secure

Other non-policy uses for this data will exist!

<table>
<thead>
<tr>
<th>Select Agency ZEV Activities</th>
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<tbody>
<tr>
<td>Reliable operation of the grid by <strong>scheduling</strong> PEV demand</td>
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<tr>
<td>Locating electric vehicle <strong>charging stations</strong></td>
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<tr>
<td>Open, <strong>authenticated</strong> access to public charging sessions</td>
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<tr>
<td><strong>Charge control</strong> per Time-Of-Use or Dynamic rates</td>
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<tr>
<td>Provision and settlement of <strong>grid ancillary services</strong> as DERs</td>
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<tr>
<td>Accurate <strong>receipt of commercial sale</strong> of electric fuel</td>
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<tr>
<td><strong>Monitoring traffic</strong> flows/congestion, road capacity, and tolling</td>
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<tr>
<td>Validating <strong>Credit Generation</strong> for Low Carbon Fuel Standard</td>
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<tr>
<td><strong>Analyzing utilization and maintenance</strong> of deployed networks</td>
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<tr>
<td>Improving load and generation <strong>forecasting and grid planning</strong></td>
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<tr>
<td><strong>Allocating construction</strong> costs to drivers proportionate to use</td>
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<tr>
<td>Target future <strong>strategic investments</strong> in charging networks</td>
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<tr>
<td>Track <strong>deployment, petroleum &amp; emissions</strong> reduction goals</td>
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<tr>
<td>Meet energy efficiency and <strong>fleet procurement</strong> targets</td>
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</tbody>
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Revised per CEC/CPUC December 7, 2016 Vehicle-Grid Integration Communications Standards Workshop