

American Honda Motor Co., Inc. extends support for the agency proposal presented on the October 30 WebEx, and has signed on to the joint utility, automaker, and other stakeholder letter of support. We would like to take the opportunity to comment on a different subject matter covering thoughts on deliverable two. While the subject of deliverable two was not discussed extensively on the October 30 WebEx, it has important effects on the other deliverables, the agency future proofing proposal, and future rulings by the CPUC.

Thoughts on Deliverable 2

Analyzing cost-benefit in the VGI space is very challenging because both sides (grid/vehicle) of the analysis are not clear or data is not available. American Honda has compiled a few thoughts on the subject to help the agencies and stakeholders come to a consensus on where VGI has the biggest potential value.

For any existing grid service that a vehicle can perform, existing participants¹ are currently performing that service. For a vehicle (or an aggregate of vehicles) to displace the existing participants, the vehicle-grid service must have one of the following characteristics:

1. **Economical:** more cost effective for the vehicle to provide than existing participants
2. **Subsidized:** such that the vehicle can undercut existing participants' economics
3. **Mandated:** through law or ruling, forcing other participants out due to their ineligibility

Thus, for any existing grid service, there exists data (public or private) which shows the existing cost of providing that service. An analysis of value for vehicles providing grid services would therefore start with an assessment of the costs of grid services today.

Wholesale Market Energy and Ancillary Service Participation

The California Independent System Operator (CAISO) publishes quarterly reports on market issues and performance.² These can be used to get a snapshot of the current challenges of wholesale grid operation in California.

In the 2017 Second Quarter report, wholesale energy prices are covered in extensive detail. A few key details are highlighted below:

- Wholesale market incremental energy costs are extremely non-linear in nature, increasing rapidly in price with peak load
 - The incremental costs to go from 35,000 MW to 40,000 MW of system load can cause wholesale prices to spike nearly ten times normal levels (Figure 1.3)
- 5-minute and 15-minute spot market price spikes occur less than 1.0% and 1.5% (respectively) of all intervals for April 2016 – Jun 2017 (Figure 1.9 and 1.10)
 - Many of these occur during system peak time in the early evening

¹ Participants may be physical devices such as generators, or “virtual” devices such as demand response programs

² <http://www.caiso.com/market//Pages/MarketMonitoring/MarketIssuesPerformanceReports/Default.aspx>

- Average system marginal energy price³ for April 2016 – Jun 2017 varied between \$18/MWh to \$35/MWh (Figure 1.1)

In the 2017 First Quarter report, extensive coverage of overgeneration caused by solar (the so-called “duck curve”) is covered in detail. This primary occurs in the spring, when there is not enough load to take the high amount of energy available on the system. Prices in the 5-minute market were negative for 30% of the mid-day hours through January – March 2017 (Figure 1.6). This is an order of magnitude higher occurrence than the price spikes seen during the second quarter.

The 2016 first and second quarter reports covers costs of regulation (also known as frequency control), which spiked during a four month window that year. Even the highest price seen, which was around \$23/MW for regulation up and \$24/MW for regulation down, this corresponds to \$0.023/kW - \$0.024/kW, three orders of magnitude lower than typical demand charges for commercial utility rates. Nominal prices before the spike were less than \$8/MW.

At a high level, wholesale energy markets appear lucrative for both avoiding peak prices and charging during pricing lows. Vehicles avoiding charging at high wholesale prices could save the wholesale market upwards of \$1/kWh wholesale energy costs. Similarly, charging during the day in the spring could allow drivers to pay low prices or even be paid to charge, with the major benefit of increasing renewable energy penetration.

However, the nature of wholesale markets can be volatile and appear to give the best grid value by avoiding peak times- something utilities have already attempted by offering Time of Use rates to customers, which encourages charging during off peak hours. In order to respond to pricing spikes during the off peak hours, the communications hardware required to participate economically must be low cost, as the number of times needed to respond (and therefore payout) would be low. Additionally, it appears some of the best times to charge vehicles can be during the midday, when many vehicles are parked at work. Therefore, workplace charging that can coordinate with the wholesale market also looks valuable.

Local Level Participation

As has been discussed by Honda at various points during the VGI Working Group process, there is value in tuning power requirements of the vehicle or aggregate of vehicles, primarily in the commercial sector. The value in this area is primarily around paying less to the utility in the form of reduced demand (power/kW) charges and avoiding local electrical upgrades. Two major ways vehicles can respond include:

- Delaying, suspending, or slowing charging during local (downstream of the meter) peak electrical demand (which may be different from utility peak demand)
- Stations coordinating power requirements to make maximum use of a given feed, panel, or transformer
 - This allows more stations to be installed on a given utility connection, as the site may be oversubscribed (more nameplate station power than available utility power)

³ Marginal electricity costs are the costs for the incremental last kilowatt-hour (kWh) of electricity produced. A utility's marginal cost can be higher or lower than its average price, depending on the relationships between capacity, generation, transmission, and distribution costs.

Honda believes there is significant VGI value at the local level. Demand charges provide a clear signal to customers that draw large amounts of power. These large power demands require higher power equipment to serve the peak electrical load and can trigger distribution and local system upgrades. Uncoordinated vehicle charging could cause a coincident peak demand with existing vehicle load. The VGI value would be avoiding causing this coincident peak, and would be measured by multiplying the charging load power by the demand charge of the tariff the stations are under.

Since vehicles are often parked for longer periods of time, they could negotiate with the site (through a variety of protocols or methods) for the best time to charge. Sites could have many more charging stations than a feed could normally support if the station load was unmanaged. This is critical for “destination center” type locations because for drivers to count on the site for mobility needs, station availability must be high, possibly on the scale of hundreds of stations at a large site (such as a large shopping center). Such a site would require an enormous grid connection if unmanaged, but could make better use of funding with a smaller grid connection if the site were power managed at the local level.

Solving Grid Challenges that Vehicles Could Cause

As electric vehicle adoption increases, there are some problems that Honda perceives being an issue at scale if not addressed properly:

- Time of Use causing a “mini peak” around the TOU off-peak start time, caused by timers in vehicles or stations which are set to begin charging around the same time
- Local load management at the final transformer level for residential load- the so-called “Neighborhood Effect” where multiple EVs on one residential transformer could cause overloading if all the vehicles were charging around the same time

These challenges stem from the lack of “randomness” that is normally seen by other loads. For example, many residential air conditioners may be running on a hot day, but the thermostats of each AC unit are independent such that each air conditioner is not cycling on and off at the exact same time. With time of use periods encouraging off peak charging at a fixed time each night, many drivers could set the same start time on their vehicle or station timer, causing local or even system-wide issues.

Both of these challenges can be solved “on paper” by introducing artificial randomness in the vehicle charging start time and coordination of vehicle clusters. However, there is currently no market mechanism, incentive, or means for these problems to be addressed. Therefore, these challenges are ripe for pilot testing and experimentation with utilities, automakers, EVSE manufacturers, and academia.

Automaker Costs to Provide VGI

As has been discussed at various points throughout the working group, automakers, including Honda, cannot provide costs to implement additional hardware or software on the vehicles. Additionally, we see several different communication approaches being expressed by other automakers within the working group. Therefore, we recommend removing the vehicle side costs portion from the analysis and focus more on what areas of VGI have the most financial incentive. It would then be up to the automakers, EVSE providers, and other stakeholders to go after those areas in a cost effective manner.

Recommendations for Completing Deliverable 2

- **In collaboration with the CAISO, study the nature of wholesale price volatility, specifically:**
 - **How often do price spikes occur outside peak times, when vehicles on a TOU rate are likely to be charging**
 - **How many electric vehicles charging during the middle of the day would be necessary to absorb overgeneration and negative wholesale pricing**
 - **How vehicles could change the nature of such spikes or dips with vehicles responding at scale (10,000 vehicles or more)**
 - **Determine what ancillary services could be cost effective for vehicles to provide**
- **In collaboration with utilities, study utility distribution costs and opportunities, specifically:**
 - **How distribution costs scale at various power levels and the breakdown cost of upgrading service for unmanaged load**
 - **What existing distribution challenges vehicles could help mitigate**
 - **What new distribution challenges vehicles can cause, such as local transformer overload, and what grid-side costs would be associated with mitigating them assuming the vehicles remained unmanaged**
 - **This allows for vehicle side programs to get a baseline on the value of providing these services directly**

American Honda sees Deliverable 2 as an opportunity for technical experts at the CAISO, CA IOUs, and others within the utility community to weigh in on the existing grid utility costs. The result of this deliverable should be a report that covers the above topics in detail. By getting a clear picture of value, stakeholders can internally decide their most economic cost approach to tapping into that value, and provide solutions that align with the commission's goals.

Sincerely,

Jeremy Whaling, American Honda Motor Co., Inc.