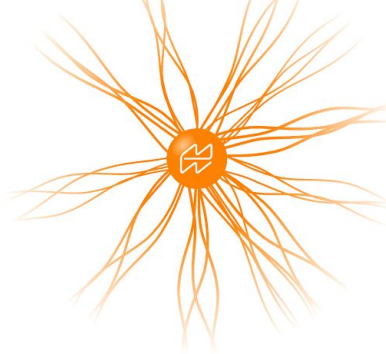


ISO 15118 - Aggregator Perspective

Alec Brooks
August 7, 2017

eMotorWerks Communications Approach

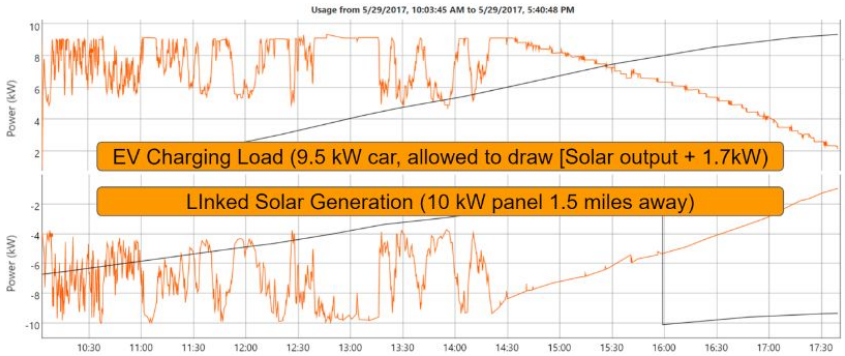
- eMotorWerks is committed to smart, networked charging stations
  - EVSE product line rapidly moving toward 100% networked with revenue-grade metering
- Communications protocols
  - We have developed our own communications protocols between EVSE and JuiceNet Cloud to support our users and VGI deployments - lowest latency, flexible data payload, utility data transmission requirements, etc.
  - Will support applicable standard protocols based on customer demand or mandates

eMotorWerks VGI Experience

- CPUC Submetering Pilot Phase 1 & 2
  - Utilize embedded meters for separate retail rate billing for EV charging
- Rule 24 / 32 Non-Utility Demand Response
  - Curtailment of EV charging based on wholesale market prices
- JuiceNet Green
  - Charging scheduled to minimize GHG emissions
- JuiceNet for Solar
  - Synchronizes EV charging to on-site or off-site solar generation

JuiceNet/JuiceBox Capabilities

- OpenADR 2.0b
- Aggregation of groups of EVSEs
- Interval metering for submetered rates and billing
- External API available for partner applications (~20 partners building apps)
- Charging control
  - User Defined
    - Amount of energy needed
    - Time based
  - JuiceNet Defined
    - Price based
    - GHG based
    - Renewable resource (solar) availability



eMotorWerks
SMART [GRID] EV CHARGING

ISO 15118

- eMotorWerks is implementing 15118 to meet market demand
- Add-in circuit board to standard JuiceBox Pro adds digital communication between EVSE and vehicle using 15118 communications stack
  - Will also be available for deployment in eMotorWerks' JuiceNet partner EVSEs
- However -- the current implementation of the ISO 15118 has some shortcomings that limit its usefulness for VGI applications

Limitations of Current 15118

- Energy data supplied by vehicle is inadequate to convey vehicle drivers' needs and flexibility
  - Driver sets range/or SOC requirement and departure time
  - Reported to EVSE as energy amount and time until departure
- This approach was developed many years ago when EVs had very short range
- 15118's energy data is not well suited to today's long range EVs. Different data is needed to convey the flexibility that comes with long range - examples:

"I have plenty of charge right now but don't mind charging more at the right price	"I would like to be at 50% SOC by 4pm, but I will take more, up to 90% SOC, if it prevents solar curtailment	"I don't need to charge and I don't know when I am leaving. I Will accept charge whenever it helps prevent curtailment of renewables

Battery State of Charge missing from 15118

- 15118 does not communicate battery state of charge to the EVSE -- just a ‘required’ amount of energy
- In order to take advantage of vehicle charging flexibility for applications like integration of renewables to prevent curtailment, it is necessary to know more than the just a required amount of energy.
- Need measures like battery capacity, SOC, required energy and optional energy
  - Cabin heating and cooling while connected to EVSE makes it difficult to know at the beginning of a charge session how much energy is need to reach any particular state of charge.
- Near term potential workaround - with EV driver’s permission, allow energy service providers to access missing information through telematics

To maximize VGI potential, EVSP Aggregators have to augment 15118 with predictive algorithms, driver self-reporting and telematics data (if accessible)

Final Thoughts

- California's existing fleet of PEVs is about 300,000 vehicles
- Starting from Zero deployed vehicles with ISO 15118 for AC charging
- 15118 is helpful for VGI aggregation, but not sufficient on its own
- Nearly all current PEV's have telematics, with access to SoC data.
- Is there a policy structure that could incentivize EVSP and Automaker collaboration for cloud-to-cloud communication in parallel with 15118 implementation?