2021 DOE Vehicle Technologies Office Annual Merit Review

Argonne NATIONAL LABORATORY

ELECTRIC VEHICLE SMART CHARGE ADAPTER TCF (ANL)

Jason D. Harper
Argonne National Laboratory
June 25, 2021

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Project ID: elt271

Overview

Timeline
- Start: October 2018
- End: October 2021
- 85% complete

Budget
- Total Project Funding: $1.18M
  - DOE Share: $590k
  - Partner Share: $590k

Partners
- Qmulus LLC
- Zen Ecosystems/Enersponse

Barriers/Challenges
- 80% of PEV drivers charge at home on non-networked (dumb) Electric Vehicle Supply Equipment (EVSE)
- Networked/smart EVSE are needed to meter, monitor and or control EV charging, but EVSE replacement costs are high
- There is not an industry consensus on EVSE to infrastructure communication protocols, creating issues for EV aggregators and Utilities to interface with EV/EVSE

Relevance

Objective:
Commercialize EVSE agnostic adapter that converts EVSE (L1/L2) to networked/smart EVSE that allows metering, monitoring and control.

Enabling Technology Development
- Smart Charge Adapter Hardware and Firmware
- Web Application
- Mobile Applications (iOS and Android)

Impact:
Smart management of EV charging reduces grid constraints, defers upgrades, and increases grid resiliency.

Source: Argonne

Milestones

Milestone	Description	Criteria
20 Fully Tested Mk II SCAs	Contract Developer will provide ANL 20 Mk II SCAs for testing in lab and pilots	Each SCA must pass test plan to proceed with pilots
Beta Qmulus Cloud Platform (QCP)	The QCP includes production web application front-end, backend, and mobile applications (Android and iOS).	The platform must pass verification testing before being deployed in pilot programs
Pilot Phase 2A Completion	Argonne Campus Pilot	Successful 1 month field trial, collecting feedback and data
Pilot Phase 2B Completion	Zen Ecosystems/Enersponse Pilot	Successful 2 month field trial with Zen/Enersponse customers, collecting feedback and data
SCA Mk III Design and Verification	Fix issues and optimize for manufacturability	Final Mk III (production) design
Submit for UL Certification	Tooled Mk III SCAs submitted for UL testing	Manufacture production worthy SCAs and setup testing with NRTL

Source: Argonne

Approach – Hardware

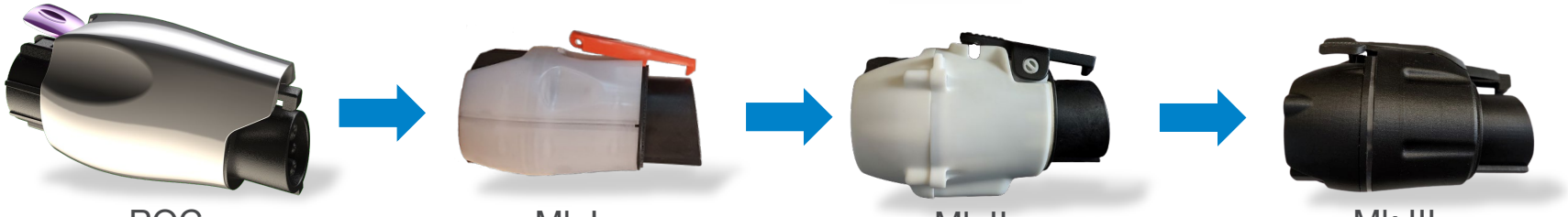
Design, Build and Test Universal Smart Charge Adapter (SCA)

- Build upon Mk I design to design/create Mk II for pilot programs
- Feedback from MK II led to Mk III design (commercial form)

Feature 01 — **Metering**
0.5% Accurate Interval Meter: Energy, Power, Current, etc.

Feature 02 — **Monitoring**
Wi-Fi communication for real time updates and management

Feature 03 — **Control**
Start, stop, increase, or decrease the charge rate (hardware agnostic)



POC
Dec. 2015

Mk I
Feb. 2017

Mk II
May 2019

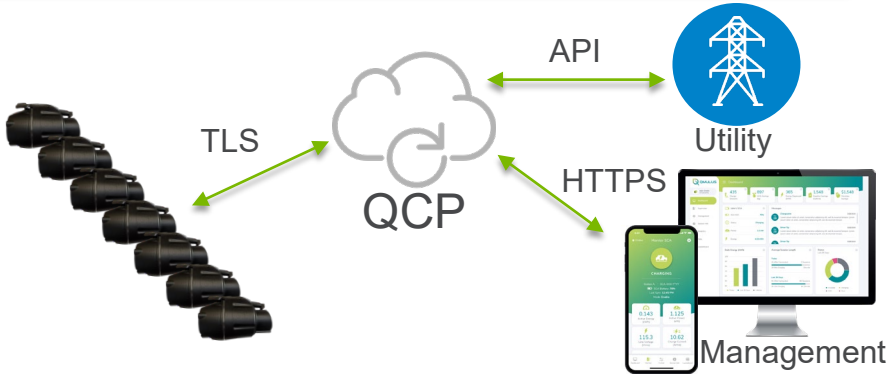
Mk III
Oct. 2020

Source: Argonne

Approach – Software

Design, Develop and Test Web and Mobile Applications: Qmulus Cloud Platform (QCP)

- Monitor and Manage EV Charging
- SaaS Platform
- Provides Insights and Notifications
- 3rd Party API for Utility/Aggregators

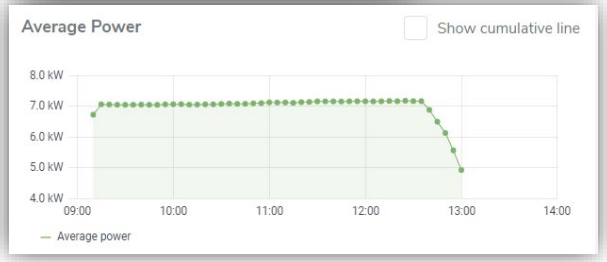


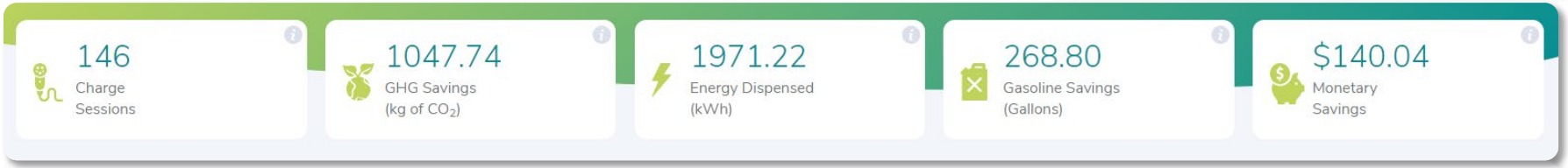
Source: Argonne

Argonne NATIONAL LABORATORY

Accomplishments and Progress

- SCA Hardware: 20 Mk II units manufactured and tested. Mk III units designed, 5 prototypes manufactured and tested.
- Web Application: Beta production web application platform deployed
- Mobile Applications: Beta Android and iOS SCA mobile apps developed
- ANL Pilot: Nov 2020 - Present
  - 8 SCA units being utilized by ANL employees at their residence
  - 4 Units deployed on stations at Smart Energy Plaza at ANL





Source: Argonne

Collaboration and Coordination

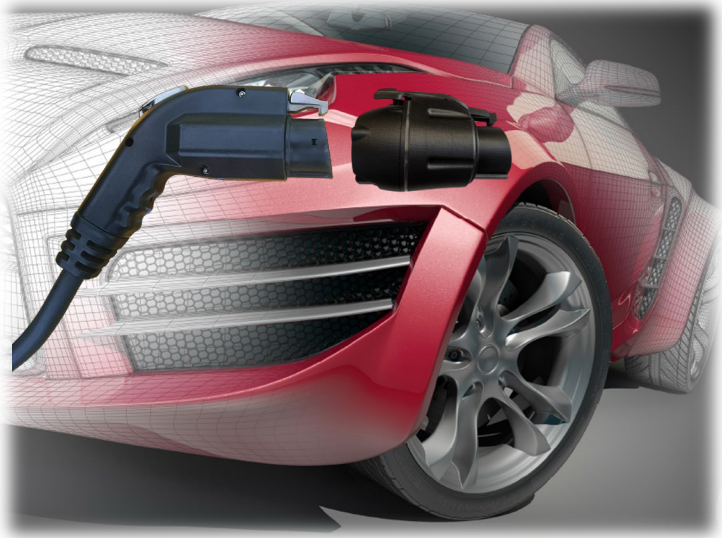
Qmulus
Commercialization Partner

Zen Ecosystems
SCA Pilot Partner

Enersponse
Demand Response Aggregator Partner

PDT Astronics
Hardware Development Partner

Farshore
Software Development Partner



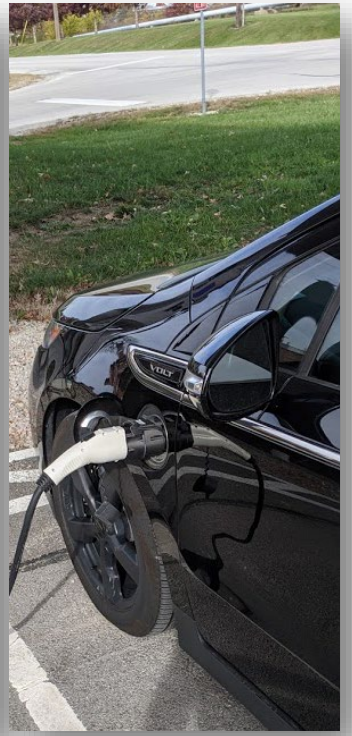
Source: Argonne

Proposed Future Research

Zen Ecosystems/Enersponse Pilot (FY21)
- OADR 2.0b integration/DR demo
- 2 month Field Trial

Tooling (FY21)
- COVID delays with partners

UL Certification (FY22)
- Dependent upon manufacturing tooled devices



Any proposed future work is subject to change based on funding levels.

Source: Argonne

Summary

Accomplishments

Production Design of Smart Charge Adapter

- Proof of concept to Production
- Enables integration of non-networked EVSE into Smart Grid

Beta Qmulus Cloud Platform

- SaaS Platform with Web application user management system
- Mobile applications for Smart Charge Adapter (Android and iOS)

Successful ANL Field Trial

- 7 month field trial with SCAs exposed to elements and workplace EV drivers
- Successful operation and data collection

Future work

Complete Zen/Enersponse Pilot, testing Demand Response capability of SCAs

Manufacture Tooled Production SCAs and Submit for UL testing

Any proposed future work is subject to change based on funding levels.