

# BCIT NRCan EVID Project Workshop Session 3: MURB Demonstrations

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# Agenda:

- BCIT's testing sites for MURB solutions
- Selection of MURBs
- Riverbend Co-op
- Anchor Pointe
- Siena of Portico
- OCPP
- Conclusions



# BCIT's testing sites for MURB solutions

- In order to create EV charging solutions for MURBs, we needed to create testbeds at BCIT to prove the technology. We did this at these BCIT locations:
  - Energy OASIS
  - Downtown Campus
  - Center for Applied Research & Innovation (CARI)
  - Aerospace Technology Campus
  - AFRESH Home



# Energy OASIS

- Acronym for Open Access to Sustainable Intermittent Sources
- NRCan-funded project completed in 2014
- 250 kW of solar panels on two large parking canopies
- 500 kWh Lithium Ion Battery Energy Storage System (BESS)
- Advanced Energy Management System
- Two DCFC stations + 10 Level 2 EVSEs



# Energy OASIS

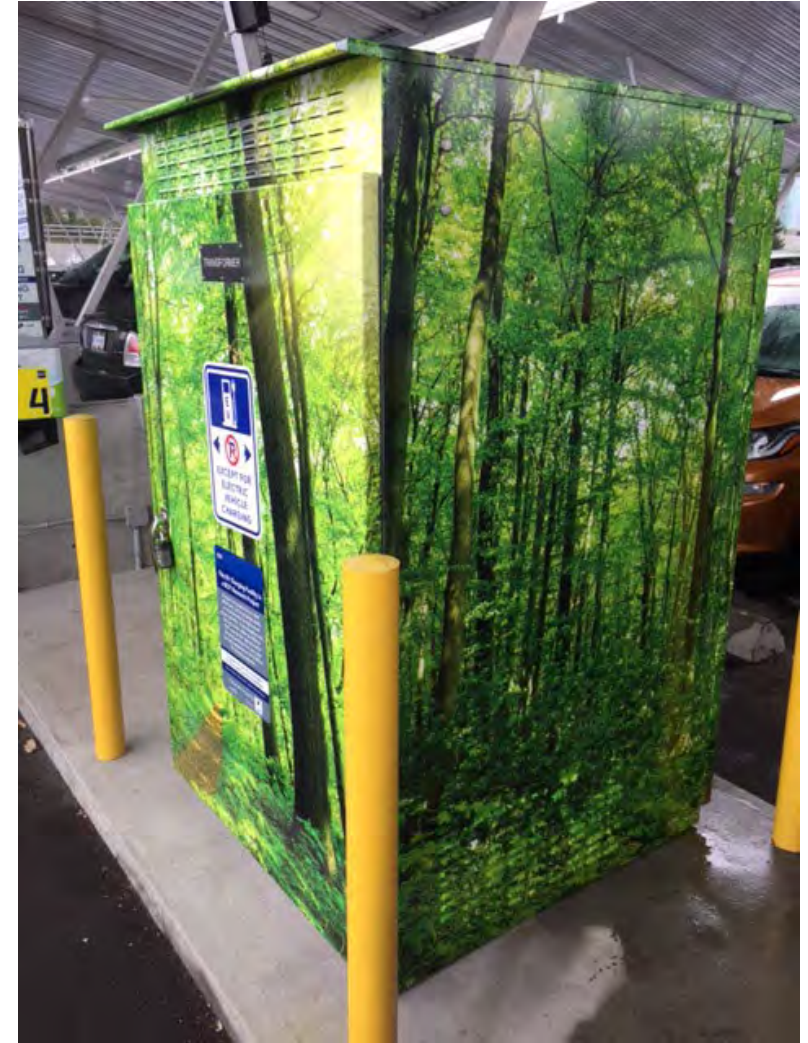
- Used our two DCFC stations, and our 10 Sun Country Highway Level 2 stations to integrate with, and test with our OCPP compliant Network Management System (NMS)
- Used the 10 Level 2 stations to test the Energy Management features of our NMS
- Able to successfully demonstrate the ability to manage the load of up to 10 concurrently charging EVs





# Energy OASIS

- EVEMS uses Load Management with Monitoring strategy
- Inside the electrical kiosk is a Schneider EM4805 meter that measures load on all 10 EVSE electrical feeds
- EVEMS monitors aggregate load to ensure it does not exceed system capacity
- System is “fail-safe” in that if comms go down, EVSEs stop, then resume charging once comms are restored



# Downtown Campus

- Installed five energy-managed EVSEs from FLO | AddÉnergie
- Circuit capacity could support two dedicated circuit EVSEs, but with energy management, installation supports five EVSEs





# CARI

- Installed four energy managed EVSEs from project partner IBX variablegrid
- Also installed two non-energy managed EVSEs from project partner FLO | AddÉnergie
- The four variablegrid EVSEs share a 50 Amp feed
- The two FLO | AddÉnergie EVSEs are used to test OCPP interoperability & integration





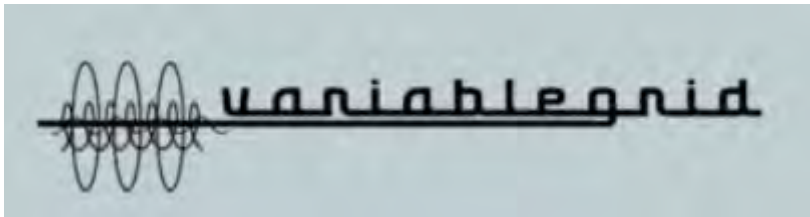
# Aerospace Technology Campus

- As part of a previously funded NRCan project, we installed six energy-managed FLO | AddÉnergie EVSEs
- Used existing parking lot lighting circuits
- Streetlights are included in the energy management strategy



# AFRESH Home

- As part of a previously funded NRCan project, installed three energy-managed Level 2 chargers from IBX variablegrid
- Load Management with Monitoring strategy, with monitoring at the panel





# Real MURBs

- While the BCIT installations allowed us to implement and test solutions we felt would work in a MURB scenario, we needed to test in real MURBs...





# MURB Selection Process

- Web and email marketing campaign
- Expressions of Interest collected
  - Online form submission
  - AGM and approval timeline align with project
- Agreement with eligibility requirements
  - Project covered costs of Engineering study and design
  - Purchase + install of 6 EV chargers.



# MURB Selection Process

- Over 100 applications were received and reviewed
- One of the main selection criteria was whether the strata had already had an AGM where installation of EV charging had already been approved
- Agreements were signed, with caveats that allowed BCIT to exit if sites were found to be unsuitable during engineering feasibility study



# Riverbend Coop

- Housing co-operative located in New Westminster BC
- 72 housing units
- Parking garage has 96 stalls, including visitor parking





# Riverbend Co-op

- Six Level 2 chargers (EVSEs) from Sun Country Highway installed
- Sun Country Highway uses BCIT's CSNMS software for this install
- Load management with monitoring strategy, with monitoring at the panel
- OCPP 1.6J solution



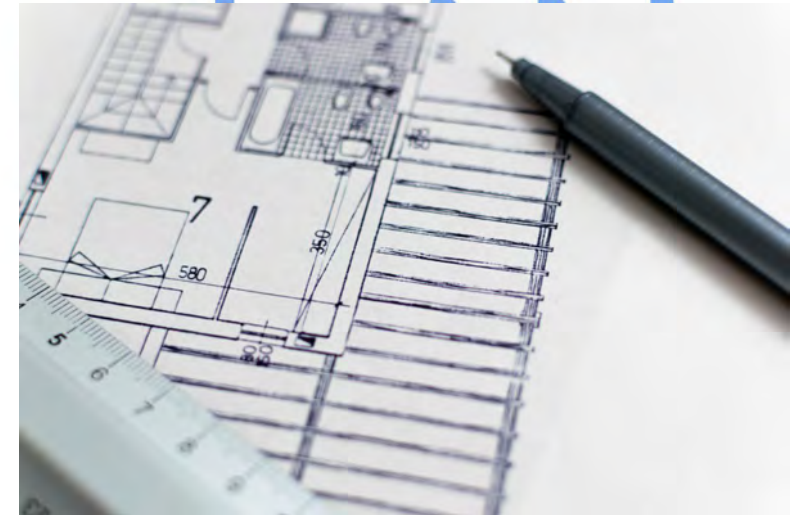
# Riverbend Co-op

- The housing co-op has the authority to allocate parking stalls to owners
- Many strata-owned condos do not have this flexibility



# Riverbend Co-op

- BCIT contracted AES Engineering to develop an Electrical Engineering plan to electrify 100% of the parking stalls.
- BCIT funded upgrades to the electrical infrastructure in order to allow for future growth





# Riverbend Co-op

- AES Engineering's drawings provided to Riverbend Co-op so they can add Energy Managed EVSEs to their parking garage as needed.
- BCIT's EVEMS monitors electrical load at the panel to ensure there is no overload.



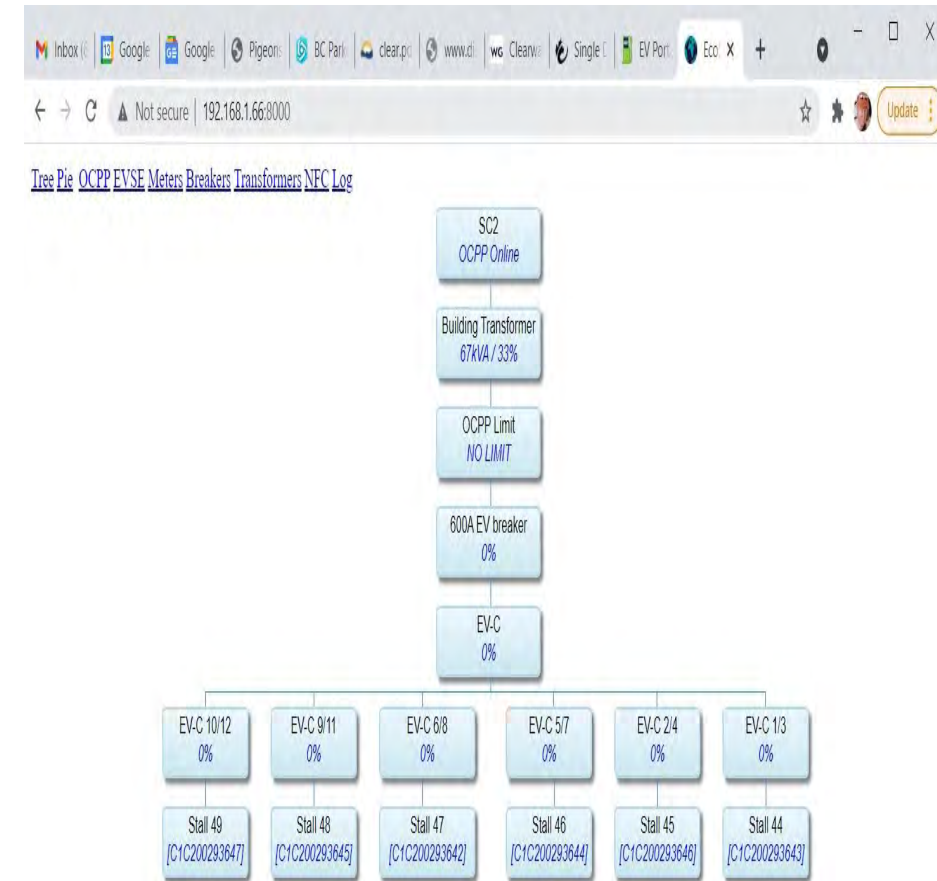
# Riverbend Co-op

- Electrical upgrades contracted to PowerPros Electrical
- Installed a new 600 A distribution board off the main board
- Feeds a new 225 A panel board
- Feed six dedicated 40 A circuits to EVSEs



# Riverbend Co-op

- Installed new City of New Westminster electrical meter
- Installed new Dent meter to measure main panel load, and each individual EVSE circuit load
- BCIT's EVEMS software monitors these loads to ensure panel capacity is not exceeded





# Riverbend Co-op

- Communications is hard wired CAT6 Ethernet cable from BCIT's EVEMS to each EV charger
- Used Riverbend's existing internet connection to avoid any additional monthly fees



# Riverbend Co-op

- Performed EVEMS testing on Sept 28, 2021
- Used two Tesla Model 3s, one Model X, one Model Y, one Chevrolet Bolt, and one BMW i3



# Riverbend Co-op

- Tested one charger at a time, then gradually added concurrent charging sessions until all chargers in use simultaneously
- Confirmed full 32 A demand on each charger
- EVEMS charging limit set to 60 A at 3 phase panel, confirmed each charger drops to 16 A demand





# Riverbend Co-op

- EVEMS charging limit set to 20 A at 3 phase panel
- Observed three chargers reduced to 8 A demand, and three chargers set to 'waiting' state
- Each phase reduced to 13 A draw



# Riverbend Co-op

## Comms failure test:

- With all EVSEs charging at full 32 A, network cable was unplugged
- Observed all six EVSEs dropped to 0 A draw
- When network cable reconnected, all but one EVSEs resumed charging at 32 A draw
- Appears to be a bug with some EVs where they sometimes do not resume charging after a charge has been interrupted



# Anchor Pointe

- Hi-rise condominium located in New Westminster BC
- 110 suites
- Parking garage has 155 residential stalls plus 7 visitor stalls





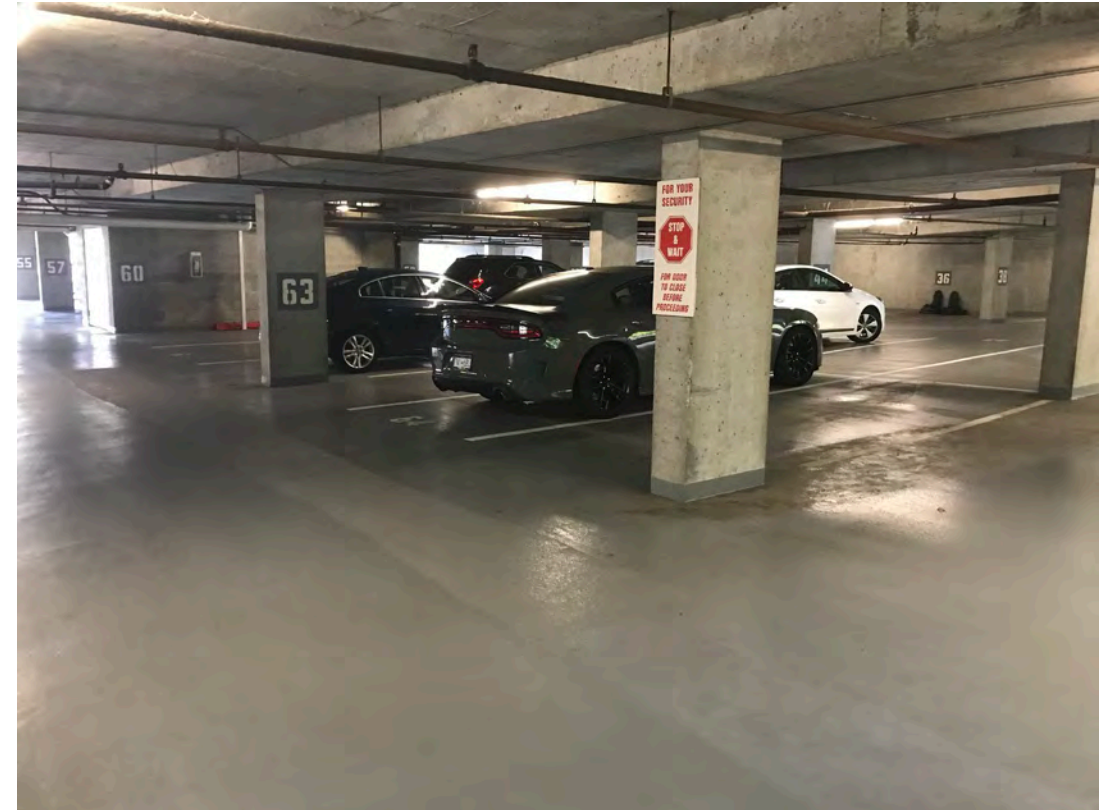
# Anchor Pointe

- Eight Level 2 EVSEs from SWITCH installed
- SWITCH's NMS software used
- Load Management with Monitoring solution, with monitoring on the circuits
- OCPP 1.6J solution



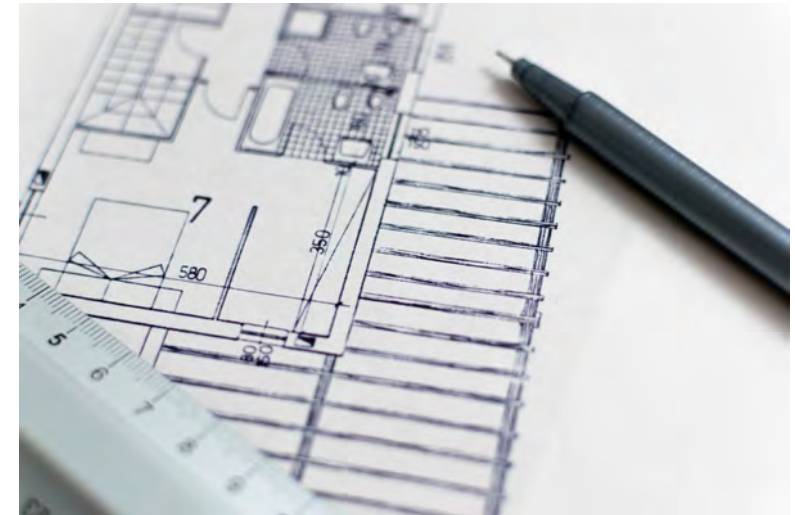
# Anchor Pointe

- Similar to Riverbend co-op, Anchor Pointe also has the ability to allocate parking stalls to owners
- Again, most strata-owned condos do not have this flexibility



# Anchor Pointe

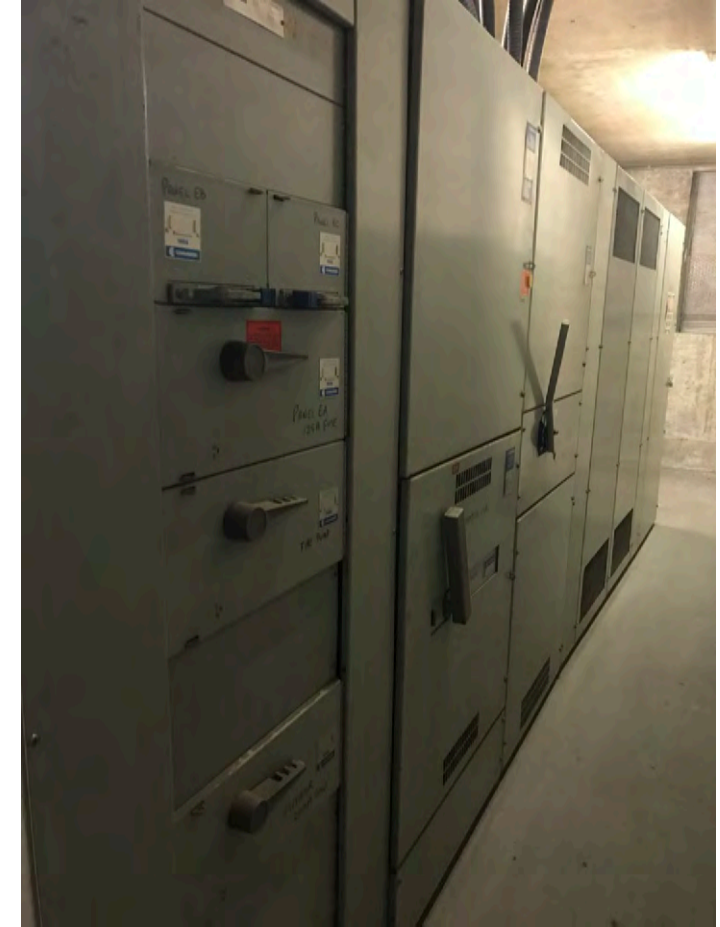
- BCIT contracted AES Engineering to develop an Electrical Engineering plan to electrify 100% of the parking stalls.
- BCIT funded upgrades to the electrical infrastructure in order to allow for future growth





# Anchor Pointe

- Electrical upgrades contracted to Mott Electrical
- Installed a new 1200 A distribution board off the main board, with a new 1000 A breaker
- Feeds a new 225 A panel board, which in turn feeds three 40 A circuits to the EVSEs



# Anchor Pointe

- One circuit powers four EVSEs, one powers three, and one powers one
- In future, plan will be to connect six chargers on each circuit
- 3 additional 225 A circuit breakers installed for future growth



# Anchor Pointe

- Communications is a mix
- Link to SWTCH's backend in Ontario is via cellular
- Gateway device pulls cellular signal from outside, converts to Ethernet, then to wifi antennas that talk to the SWTCH chargers





# Anchor Pointe

- Performed EVEMS testing on Sept 7, 2021
- Used three Tesla Model 3s, one Model X, one Model Y, one BMW i3, and one Nissan Leaf



# Anchor Pointe

- At time of test, at total of six EVSEs were installed. BCIT added two more at a later date
- 3 chargers on 2 separate circuits
- Tested one charger at a time, verifying each charger capable of delivering ~32 A



# Anchor Pointe

- Tested 2 EVSEs on each circuit simultaneously
- Observed charging rate reduced to ~16 A per charger
- Tested all 6 EVSEs charging simultaneously
- Observed charging rate reduced to ~10 A per charger





# Anchor Pointe

- Reduced circuit # 2's maximum power draw to 20 A, and started the 3 EVSEs on that circuit charging
- Observed two EVSEs charging at ~7 A, and third EVSE was waiting/in queue



# Anchor Pointe

- Simulated comms failure by placing large metal board in front of comms gear
- Before comms failure, EV was drawing 32 A
- During comms failure, EV charge rate dropped to 10 A
- EV resumed 32 A after comms restored



# Siena of Portico

- Hi-rise condominium located in Vancouver BC
- 78 suites, and 14 townhouses
- Parking garage has 129 stalls





# Siena of Portico

- Six Level 2 EVSEs from four different vendors installed, namely Siemens, Blink, Phihong, and Lite-On
- ChargeLab's NMS software used
- Load Management with Monitoring strategy
- OCPP 1.6J solution



**SIEMENS**



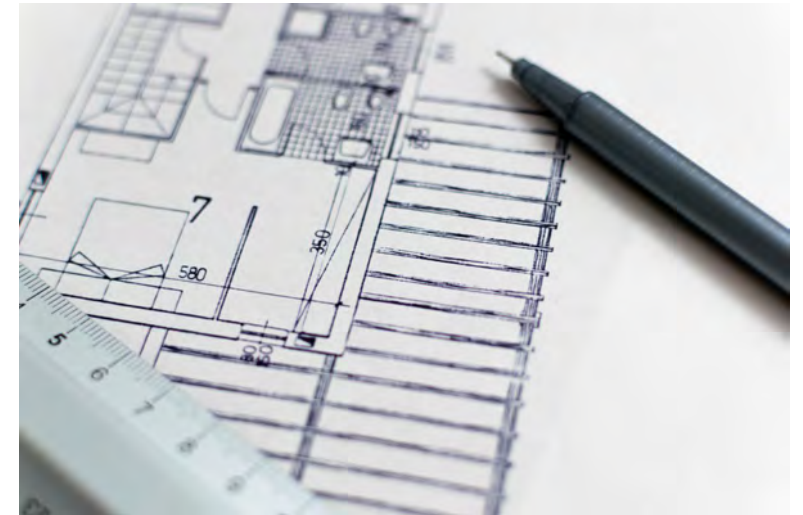
# Siena of Portico

- Unlike Riverbend co-op, Anchor Pointe, parking stalls are part of an individual suite's title.
- Example – owner of suite 203 has legal title of stall 67.
- This is the typical situation for most strata buildings.



# Siena of Portico

- BCIT contracted AES Engineering to develop an Electrical Engineering plan to electrify 100% of the parking stalls.
- BCIT funded upgrades to the electrical infrastructure in order to allow for future growth





# Siena of Portico

- In order to allow maximum flexibility, BCIT installed special busway system
- Allows EVSEs to easily be moved from one stall to another
- If a new EV owner moves in, it's easy to add a new charger
- Busway 'tap-offs' have integrated circuit breakers



# Siena of Portico

- Busway is an innovative solution for MURBs, commercial parking lots, etc.
- While eventual goal is to electrify entire parkade, this approach allows maximum flexibility as owners migrate toward that goal



# Siena of Portico

- Funding did not permit us to electrify the entire parking garage
- AES' plan basically divided the garage into 4 quadrants
- We were able to run the bus duct to one of the quadrants





# Siena of Portico

- Until entire parkade is electrified, this solution requires a level of cooperation among owners
- Some owners have been willing to swap stalls with other owners to access charging



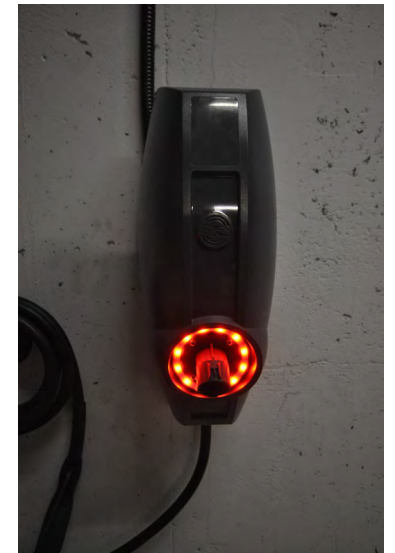
# Siena of Portico

- Installation at this site is 99% complete, but there have been some firmware issues with some chargers
- Expected to be completely operational by end of this week



# Siena of Portico

- Testing so far has been limited to testing individual chargers
- Four of the six EVSEs are operational
- EVEMS testing should happen later this month





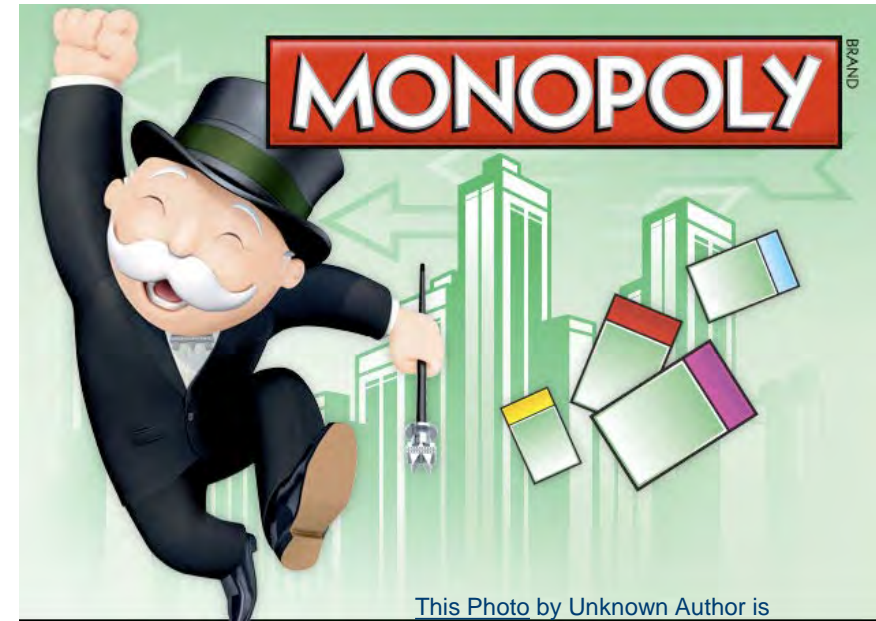
# OCPP

- Commonality in almost all these installations is OCPP
- Open Charge Point Protocol
- Standard communication protocol for command and control of EV chargers



# OCP

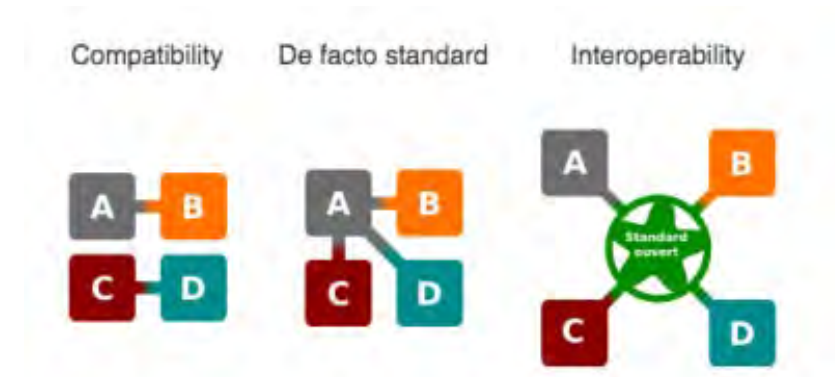
- Some charging vendors use proprietary communications for their charging networks
- Can cause compatibility issues
- What if you have chargers from different vendors?
- What if the vendor goes out of business?



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# OCPP

- By using OCPP, theoretically different vendors chargers can work with different vendors' network management systems
- Best example of OCPP interoperability is Siena of Portico installation – 4 different vendors' chargers controlled by ChargeLab's OCPP NMS



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# OCPP

- OCPP isn't just applicable to Level 2 chargers
- BCIT's NMS software also communicates via OCPP to its two DCFC units at OASIS
- Plan is to test OCPP comms to the two FLO | AddÉnergie DCFC units we installed in Queens Park in the City of New Westminster





# PCI-Compliant Payment

- PCI acronym for Payment Card Industry
- Security standard for organizations that handle payment from major credit cards
- Created to increase controls around cardholder data to reduce credit card fraud
- Payment in many jurisdictions in Canada must be PCI-compliant, but not as many in US



# PCI-Compliant Payment

- With many EV Network Management Systems being US-based, PCI compliance is often overlooked
- BCIT has built a PCI-compliant component into its EV NMS
- Future work may include building a PCI-compliant extension to the OCPP standard so payment is also included in the standard



# Conclusions

- These installations can be considered the blueprints for other MURBs to follow
- EVEMS approach greatly increases the electrical efficiency of EV charging in MURBs
- Use of open protocols gives MURBs best chance of protecting their EV charging investment, and preventing being locked to a particular vendor



# Q&A on MURB installations





# Break

- Workshop resumes at 10:55 am PST

