Oregon
Kate Brown, Governor

Public Utility Commission
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December 1, 2020

BY EMAIL
Portland General Electric Company
Pge.opuc.filings@pgn.com

RE: Advice No. 20-32

At the public meeting on December 1, 2020, the Commission adopted Staff's recommendation in this matter docketed as ADV 1081. The Staff Report and a receipted copy of the sheets in your advice filing are attached.

Nolan Moser
Chief Administrative Law Judge
Public Utility Commission of Oregon
(503) 378-3098

ITEM NO. CA5

PUBLIC UTILITY COMMISSION OF OREGON
STAFF REPORT
PUBLIC MEETING DATE: December 1, 2020

REGULAR ____ **CONSENT** __X__ **EFFECTIVE DATE** **December 16, 2020**

DATE: November 23, 2020

TO: Public Utility Commission

FROM: Eric Shierman

THROUGH: Bryan Conway, JP Batmale, and Sarah Hall **SIGNED**

SUBJECT: PORTLAND GENERAL ELECTRIC:
(Docket No. ADV 1081/Advice No. 20-32)
Request to Extend Schedule 16.

STAFF RECOMMENDATION:

The Public Utility Commission of Oregon (OPUC or Commission) should approve Portland General Electric Company's (PGE or Company) Advice No. 20-32.

DISCUSSION:

Issue

Whether the Commission should approve Advice No. 20-32, PGE's proposal to extend for three months the current terms of Schedule 16, a tariff for the pole charging demonstration project.

Applicable Rule

Under ORS 757.205(1):

> Every public utility shall file with the Public Utility Commission, within a time to be fixed by the commission, schedules which shall be open to public inspection, showing all rates, tolls and charges which it has established and which are in force at the time for any service performed by it within the state, or for any service in connection therewith or performed by any public utility controlled or operated by it.

The Commission may approve tariff changes if they are deemed to be fair, just, and reasonable. ORS 757.210. OAR 860-022-0025(2) specifically requires that each energy utility changing existing tariffs or schedules must include in its filing a statement plainly indicating the increase, decrease, or other change made with the filing, the number of customers affected by the proposed change and the resulting change in annual revenue; and the reasons or grounds relied upon in support of the proposed change.

Filings that propose any change in rates, tolls, charges, rules, or regulations must be filed with the Commission at least 30 days before the effective date of the change. ORS 757.220; OAR 860-022-0015. Tariff filings to be effective on less than 30 days following notice of the change may be authorized with a waiver of less than statutory notice pursuant to ORS 757.220 and OAR 860-022-0020.

OAR 860-022-0030(1) further requires that for tariff or schedule filings proposing increased rates, the utility must for each separate schedule, identify the total number of customers affected, the total annual revenue derived under the existing schedule, and the amount of estimated revenue which will be derived from applying the proposed schedule, the average monthly use and resulting bills under both the existing rates and the proposed rates that will fairly represent the application of the proposed tariff or schedules, and the reasons or grounds relied upon in support of the proposed increase.

Analysis

Background
On January 14, 2020, PGE first filed an advice letter proposing a special tariff for the Company's pole charging demonstration project, which sites electric vehicle service equipment (EVSE) on distribution poles. At the February 25, 2020 Public Meeting, Staff recommended the Commission approve this proposal, provided that the terms of offering the service for free expire on December 15, 2020. The Commission adopted Staff's recommendation.

In accordance with Staff's recommendation, PGE has been working on changing the terms of Schedule 16. On October 27, 2020, the Company notified Staff that by previously providing energy at no cost to the electric vehicle (EV) operator, the City of Portland (City) did not require a franchise fee. Now that PGE seeks to require payment from EV operators, the Company must negotiate a franchise agreement with the City municipal government. PGE is having delays reaching an agreement with the City. The three-month extension is to grant more time for PGE and the City to come to agreement.

Lessons Learned
Staff finds that the Company has demonstrated value in its initial findings from this R&D project. As a result, Staff recommends the Commission approve this three-month extension to avoid a disruption of service during negotiations with the City of Portland.

PGE's advice letter includes an attached white paper summarizing the lesson learned from this R&D project. The Company believes the results signal success. Those results, in the table below, were taken from 233 active days of operation.[1]

Key Performance Indicator	SE 29th Ave.	SE 35th Pl.
kWh used	3,874.634	7,524.346
Number of Unique Users	95	105
Number of Sessions	259	406
Number of Sessions per day	1.12	1.74
Average Duration of Stay	4 hours, 05 minutes and 50 seconds	4 hours, 16 minutes and 32 seconds
Average Charging time	2 hours, 47 minutes and 10 seconds	2 hours, 59 minutes and 20 seconds

PGE notes two problems that mitigated utilization of these two pole chargers during this experiment. The first is COVID-19. The second is that PGE sought EV-only parking from the City and was granted this exclusive use of the public parking space, but the City didn't mark these spaces with notification of this exclusion until after the project's implementation.

The SE 35th Place location was marked as "EV-only" in May. The SE 29th Ave location didn't receive City markings until the end of August (see Figure 1 below). Though the two sites are in the same neighborhood, the one with earlier City signage delivered 94 percent more energy outlays. This may have served as a natural experiment for the importance of this EV-only status.

[1] *See* ADV 1081, Portland General Electric Company, PGE Electric Vehicle Pole Charging Demonstration Project, Attachment A, Table 3, November 3, 2019, page 13.

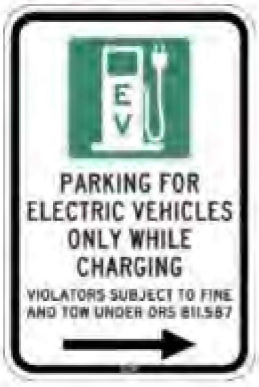


Figure 1: City Sign

Another important lesson this demonstration project produced is the potential for cost saving in comparison to parking lot stalls. Because the EVSE is sited closer to a distribution pole, the cost of the line extension and the site's electrical work (make ready), are lower on a per port basis.[2]

Cost Category	Description	Parking Stall ($/port)	Utility Pole ($/port)
Utility Labor and Materials	Cost of primary conductor, secondary conductor, transformer (if applicable), meter equipment, and associated labor.	$500 - $1,000	$500 - $1,000
Make-ready Labor, Materials and EVSE Installation	Includes primary pathway (if applicable), secondary pathway, meter base, distribution panel, and branch circuit pathway and conductor, and associated labor. Mounting of EVSE to utility pole and/or connection to make-ready infrastructure.	$4,100 - $10,500	$500 - $1,000
Engineering, Design, Permits, and Fees	Civil / electrical engineering and design costs (if applicable), permits, and right-of-way / franchise fees (if applicable)	$150 - $300	$1,210 - $2,000
	TOTAL	**$4,750 - $11,800**	**$2,210 - $4,000**

Staff finds enough value in these findings to recommend the Commission approve this three-month extension so the two existing sites' service will not be interrupted on account of stalled negotiations with the City.

[2] *See* ADV 1081, Portland General Electric Company, PGE Electric Vehicle Pole Charging Demonstration Project, Attachment A, Table 2, November 3, 2019, page 11.

Next Steps

If a franchise agreement with the City can be achieved during this three-month extension, in addition to adding a fee for the EV operator, PGE plans to add up to three other sites outside the City of Portland. These other sites would be connected to a street light.

On October 14, 2020, PGE and Staff discussed the terms of a revised tariff. Rather than use the terms of the Company's tariff for its public charging stations (Schedule 50), PGE said the Company would like to offer terms more like its residential service block rate at 12 cents per kWh. Staff recommended using a time of use (TOU) rate such as Schedule 7's TOU option. This would be consistent with other public charging rates. The Company's Schedule 50 and other companies' use of Schedule 38 both incentivize off-peak charging. Since Schedule 7's TOU off-peak rate is just over 4 cents per kWh, this will also give EV operators an opportunity to charge at a significantly lower cost than 13 cents per kWh. Staff will be engaging with PGE over the next three months to resolve the charging rate situation prior to PGE's refiling in early 2021.

Conclusion

PGE deserves recognition for being the first electric company in Oregon to research the deployment of EVSE on distribution poles. Staff recommends the Commission approve this three-month extension to avoid a disruption of service during negotiations with the City of Portland.

PROPOSED COMMISSION MOTION:

Approve PGE's Advice No. 20-32.

SCHEDULE 16 (Concluded)

SPECIAL CONDITIONS

1. PGE will monetize and provide a credit to customers the value of the Clean Fuels Credits generated by the EV Chargers.

2. PGE may restrict charging to a limited duration to ensure customers are not overusing the EV Charger.

3. PGE may reduce charging speeds during Peak Time Rebate Events called under Schedule 7.

4. EV User-owned EV chargers are not eligible for service under this schedule.

TERM

This demonstration project is active until March 15, 2021. (C)

PGE Advice No. 20-32
Schedule 16 Electric Vehicle Pole Charging Demonstration Project Update
Attachment A

Received
Filing Center
NOV 03 2020

POLE-MOUNTED EV CHARGER WHITE PAPER

Portland General Electric's learnings from deploying two utility pole chargers

Portland General Electric

Author: Anik Shrestha
November 2020

Pole Mounted Charger Demonstration

Table of contents

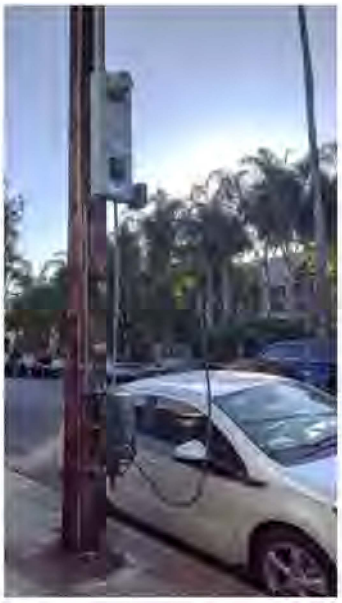
Acronyms & Definitions

EV	Electric Vehicles
EVSE	Electric Vehicle Supply Equipment
ROW	Right of Way
NEC	National Electrical Code
NESC	National Electrical Safety Code
L2	Level 2 (208/240VAC / 20 – 80A charging infrastructure)
kW	Kilowatt
kWh	Kilowatt hour
ICE	Internal Combustion Engine
App	Application
RFID	Radio Frequency Identification
NFC	Near-field communication
OPUC	Oregon Public Utility Commission
PBOT	Portland Bureau of Transportation
Plugshare	Free EV driver's application for iOS, Android, and web, allowing users to find charging stations, leave reviews, and connect with other plug-in vehicle owners
ChargePoint	Electric vehicle infrastructure manufacturer

Pole-Mounted Charger Demonstration Project Whitepaper

Overview

The State of Oregon has a goal of growing electric vehicle (EV) adoption to 250,000 vehicles by 2025. To reach this goal, approximately 100,000 of those vehicles would be registered in Portland General Electric Company's (PGE) service territory (up from 20,000 in 2019)[1]. Many of these new EV drivers will simply put chargers in their home garages and do the majority of their refueling in the evening. However, many people lack dedicated off-street parking at their current residence and cite this as a main concern in getting an EV, as they lack a location to install a charger.[2] Given the dearth of public charging throughout Portland neighborhoods and/or in the right-of-way, these customers currently have no way to charge an electric vehicle in close proximity to their home and therefore are unlikely to consider acquiring one.



To ensure that all residents may enjoy the myriad benefits associated with EV ownership, customers must have reliable access to public charging infrastructure close to their residence, in locations where their vehicles are likely to dwell for long periods of time. One solution is placing chargers in the right-of-way near multi-family housing and in residential neighborhoods where homes lack driveways/garages. This strategy aligns with the City of Portland's EV Strategy and Climate Action Plan, which highlight the need for increased access to right-of-way charging in neighborhoods with limited off-street parking.[3][4]

To address the scarcity of public charging in many Portland neighborhoods, PGE collaborated with the City of Portland on a limited pilot to install Level 2 (L2) charging stations directly on existing utility or light poles. PGE consulted with a few of the jurisdictions with similar programs, including Los Angeles and New York utilities and municipalities, and researched programs in New York, Maryland, Montreal, and parts of Europe.

PGE hypothesized this application would significantly reduce installation costs by eliminating all civil work and limiting permitting requirements, as well as address a major barrier for many prospective EV drivers. We found this be largely true. However, technical and safety requirements were unclear, and use of the right-of-way, EV-only parking, and equity issues proved to be challenging questions as well. Despite these obstacles, the value demonstrated by these charging stations leads PGE to believe that they are a simple and cost-effective way to increase access to charging, especially for those who don't have access to off-street parking.

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[1] https://apps.puc.state.or.us/orders/2020ords/20-047.pdf
[2] In PGE's 2019 Evaluation of Transportation Electrification Pilot programs, 22% of participants surveyed in PGE's territory had mentioned that they have no access to dedicated off-street parking. Further, 51% of participants listed that their current parking situation at home was a reason for concern in their decision to purchase an EV
[3] https://www.portland.gov/sites/default/files/2019-07/final_electric-vehicle_report2016_web.pdf
[4] Market Strategies International. (2018) 'Portland General Electric 2018 Electric Vehicle Survey Among Residential Customers' [PowerPoint presentation] located here

Pole-Mounted Charger Demonstration Project Whitepaper

Background

On January 14, 2020, PGE filed Schedule 16, Electric Vehicle Pole Demonstration Project, with an effective date of March 1, 2020. The Public Utility Commission of Oregon (OPUC) approved PGE's tariff on March 1, 2020.[5] To satisfy the requirements of OAR 860-022-0025(2), PGE ensured that Schedule 16 would not increase, decrease or otherwise change existing retail rates or have anything other than a de minimis impact on revenues by offering the use of charger at no cost.

Demonstration Scope, Geography, and Timeframe

PGE limited the scope, geography, and timeframe of this demonstration to the installation of two L2 charging stations on PGE-owned distribution poles to determine operational viability, identify and answer safety questions, and highlight compliance challenges.

Scope	Two L2 chargers on two poles Charging stations offered free of charge for the duration of the demonstration
Geography	Southeast Portland (SE Clinton St.)
Timeframe	Launched Q1 2020 Evaluation complete December 15, 2020

Demonstration Project Goals:

The primary goals of the pole-charging demonstration were to:

1. Identify operational considerations for deploying charging infrastructure on poles:
   - Design standards, safety considerations, installation costs, pole policies, installation practices, processes diagramed, etc.
2. Identify City operational considerations:
   - Permitting requirements, right-of-way constraints, parking designations, etc.
3. Evaluate customer awareness:
   - Survey customers in the area on their awareness of the stations and the chargers' impact on their willingness to consider an EV
4. Evaluate the economics of pole charging and potential businesses models:
   - Value and feasibility of keeping chargers in service and the structure of future pole-charging business models.

[5] PGE Schedule 16. Electric Vehicle Charging Pilot. https://www.portlandgeneral.com/-/media/public/documents/rate-schedules/sched_016.pdf

Metrics for Success

The demonstration would be deemed a success if PGE achieved and documented all the project goals above. Additionally, PGE would also monitor utilization, satisfaction, and costs to gauge customer value and to help inform future opportunities.

Technical Approach

Pole Selection Process

The City of Portland and PGE selected the two pole-charging sites based on a variety of criteria, including the following:

1. City heatmap prioritizing neighborhoods/streets for public EV charging
2. Local housing stock
    a. concentration of multi-family homes
    b. limited access to off-street parking
3. Local propensity for near-term EV adoption
4. Alignment of demonstration with current and future zone parking guidelines areas, with consideration for equity and affordability
5. Proximity of the pole in the right-of-way (ROW) to the parking spot
6. Proximity to an ADA ramp (corner or a driveway)
7. Proximity to the curb (far enough for doors not to hit)
8. Age of the pole (utility preference for poles installed after 1980)
9. Size and height of the utility pole
10. Transformer location on the pole;
11. Climbing space and presence of other devices on the pole to ensure crews can safely work on the pole
12. Parking availability near the utility pole;
13. Presence of risers[6] on the pole
14. Proximity of other objects to the pole (e.g., trees, mailboxes, etc.)

The City of Portland provided the guidance on which neighborhoods to focus and PGE's Utility Asset Management team provided direction on which poles fit the criteria. PGE evaluated 60 poles before selecting two locations. Table 1 shows how each selected pole fit the above-listed criteria.

[6] A riser is an electrical connection attached to the side of a pole.

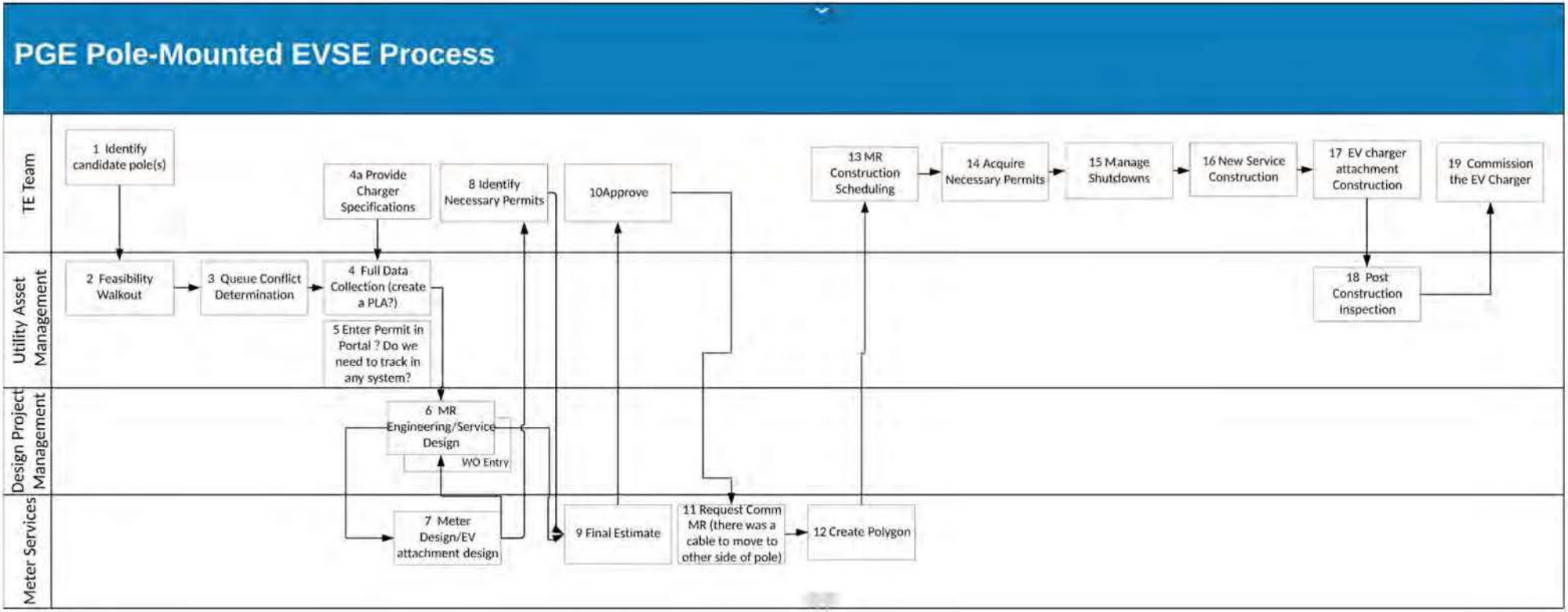
Table 1. Summary of selected poles' compliance with pole selection criteria.

Criteria	SE 29th Ave.	SE 35th Pl.
City area identified as priority for EV charging	The city identified the SE Clinton neighborhood as a priority for EV Charging	The city identified the SE Clinton neighborhood as a priority for EV Charging
Local housing stock (concentration of multi-family homes)	The SE Clinton neighborhood has a large cluster of multi-family homes	The SE Clinton neighborhood has a large cluster of multi-family homes
Local housing stock (limited access to off-street parking)	Most of the housing units near this pole have no access to off-street parking	Most of the housing units near this pole have no access to off-street parking
Local propensity for near-term EV adoption	The SE Clinton neighborhood and surrounding neighborhoods were identified as areas where near-term EV adoption would be likely	The SE Clinton neighborhood and surrounding neighborhoods were identified as areas where near-term EV adoption would be likely
Current and future parking guidelines (how can you do it in an equitable way users can afford)	The city of Portland identified the area located near this pole as a place where parking guidelines would be under consideration for change	The city of Portland identified the area located near this pole as a place where parking guidelines would be under consideration for change
Proximity of the pole in the right of way to the road	The pole was in a location close enough to the road where a charger's chord would reach	The pole was in a location close enough to the road where a charger's chord would reach
Proximity to an ADA ramp, corner and/or driveway	The pole and charger were within 40 feet of a driveway or an ADA ramp. The charger did not block access to any driveways	The pole and charger were within 20 feet of a driveway or an ADA ramp. The charger did not block access to any driveways
Proximity to the curb	The pole was within a few feet of the curb and far enough so that a car door would not hit the pole if swung open	The pole was within a few feet of the curb and far enough so that a car door would not hit the pole if swung open
Age of pole	This pole was installed after 1980	This pole was installed after 1980
Size and height of the pole	The pole met the criteria looked at for size and height of pole	The pole met the criteria looked at for size and height of pole
Transformer location on the pole	The transformer was on the side facing the street, an ideal location as the charger would be on the same side of the pole	The transformer was on the side facing the street, an ideal location as the charger would be on the same side of the pole
Climbing space on the pole (other devices on the pole)	There would be sufficient climbing space on this pole, should the meter not be needed	There would be sufficient climbing space on this pole, should the meter not be needed
Parking Availability near the pole	There was significant unreserved parking near the pole	There was significant unreserved parking near the pole
Did the pole have risers; and how close was it to other devices off the pole (mailbox, trees, etc.)	The pole was at least 10 feet away from any other device in the ROW	The pole was at least 10 feet away from any other device in the ROW

Pole-Mounted Charger Demonstration Project Whitepaper

Figure 1 shows the selection to activation process of each pole.

Figure 1.Pole-Mounted EV Charger Process



Implementation

PGE offered free charging for 2 hours of charging and parking during the day (7AM to 7PM). To use the charger, customers needed to download the EVSE manufacturer's mobile application (app) on their mobile device and/or use the EVSE's manufacturer's Radio Frequency Identification (RFID) card. Using near-field communication (NFC) technology from their phone or RFID card, customers would be able to initiate a charging session.

A message was put onto the charger itself, the EVSE manufacturer's app, and the Plugshare app that the two chargers were free to use until the end of the demonstration period of December 15th, 2020. PGE also created door hangers with a notification that these devices were installed in the neighborhoods and that community members should not purchase an EV purely on the basis that these chargers were accessible, as they would be removed should the demonstration not be extended.

PGE relied on its partners at the City of Portland to install parking signs that delineated the marked parking for 2-Hour EV only parking. The first signs at the charger located on SE 35th Place, took nearly two months to be installed and for the curb to be marked. The City of Portland designated EV parking only at the charger located on 29th Ave closer to the end of the pilot on August 28, 2020. The City of Portland had agreed that their parking enforcement would monitor these two chargers and ticket anyone blocking the chargers just as it does at PGE's Electric Avenue. PGE has received no indication if any driver has been ticketed.

Figure 2. charger on SE 29th Ave.

Learnings & Best Practices

Flexible Agreement

To scale this demonstration to other parts of PGE's territory, a flexible franchise agreement with a municipality is necessary. Many franchise agreements do not imagine new technologies and applications or changing energy goals, but instead speak to existing applications. The franchise agreement should be flexible and allow for new kinds of revenue for the municipality and the utility, a diversity of outcomes, and an expansion of the municipal-utility relationship, now and in the future.

Parking

It is crucial to have dedicated EV parking for pole chargers to maximize charger utilization and promote positive user experience, as they prevent internal combustion engine vehicles from monopolizing the space. Designated EV-only Parking (potentially in partnership with charging deployments like this) is one mechanism that cities can deploy that helps create demand for EVs. However, this could be also a friction point with residents if the spots are in areas of high on-street parking demand. In this case, residents who require on-street parking might be frustrated if spaces are reserved for EVs.

Installation

Due to pole-mounted chargers being a relatively new concept, installation for the chargers required creativity and collaboration. The City of Los Angeles served as an inspiration to PGE, but we learned they custom

fabricated all their attachments to their light poles. Relying on their experiences installing transformers and meters onto other utility poles, PGE's Meter Services and Utility Asset Management teams developed a process for installing chargers onto the selected poles.

In compliance with current labor requirements and work practices, PGE deployed the following teams for charger installations:

- 2-man Meterman crew – installed the CT metering for the chargers
- 4-man Line crew – installed the conduit and wiring for the meter and breaker. The line crew also attached the charger to the pole
- 1 Electrician – PGE engaged an electrician that is certified to install ChargePoint chargers. The electrician installed the wire from the breaker to the charger and commissioned and tested the charger.

Labor requirements for future installations would be accounted for in the accompanying standards and work practices documentation.

Both chargers were installed on the same day. The first charger took the crew three hours to install, while the second charger was finished in just 90 minutes—demonstrating the crews increased proficiency. Installation times would likely vary (or improve) if PGE utilizes different equipment and/or scales the project more broadly.

Chargers

PGE staff selected and leased two L2 charging wall mounted unit due to ease of use for PGE and customers, as well as safety for the surrounding community. The chargers featured retractable cords, so the cords would not hang in the walkway when not in use, and the charger itself featured rounded edges so anyone who accidentally tripped and hit the charger was less likely to be injured. The unit also offered near field communications (NFC), which allows customers to activate the charger by tapping their mobile phone, using a charger OEM registered card, or a credit card. However, customers were not charged for using the pole chargers because PGE offered the chargers free-of-cost.

Safety

The charger installations were completed with National Electric Safety Code (NESC) and National Electric Code (NEC) compliance as a primary objective. Further, ChargePoint, the hardware provider, also has several safety features attached in Appendix 1. PGE closely monitored activity involving the chargers and actively responded to any feedback.

On February 24, 2020, PGE staff met with the City of Portland and Oregon Public Utility Commission (OPUC) safety staff to conduct site visits of the poles. OPUC safety staff questioned whether the chargers would need to follow NEC or NESC code. Upon further review, safety staff determined that chargers on utility poles would be covered by both the NEC and NESC.

OPUC safety staff and PGE staff both expressed concerns regarding the charging cords and whether they would prove to be a tripping hazard to citizens walking in the neighborhood. To date, PGE has received zero charging cord tripping complaints.

Design standards

Due to the unforeseen circumstances of the COVID-19 pandemic, PGE was unable to spend as much time focusing on design standards as previously anticipated. Should the project continue through 2021, PGE will focus on design standards that satisfy NEC and NESC codes.

Cost effectiveness

Public L2 charging has traditionally been provided by installing charging stations in existing parking lots adjacent to commercial and multi-family developments, as illustrated below in Figure 3. If existing parking lots are far from an existing electrical service or the electrical distribution network, civil (excavation, boring, trenching, and concrete work, etc.) and electrical (conductors, pathway, transformer, panelboards, etc.) construction costs can range from $4,750 - $11,800 per port (or more) based on PGE internal estimates.

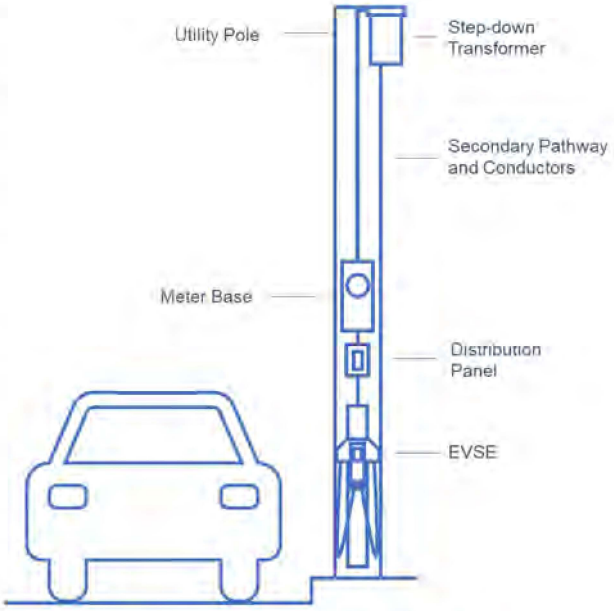


Figure 3 Utility pole-mounted Level 2 EVSE.

Installing L2 charging stations directly on utility or light poles could significantly reduce costs by eliminating all civil work and requiring only the basic electrical work as shown in Figure 4. PGE estimates that utility pole-mounted chargers could be installed for $2,210 to $4,000 per port, with opportunity to reduce costs at scale. (Table 2 provides further details on pole-charging installation costs.)

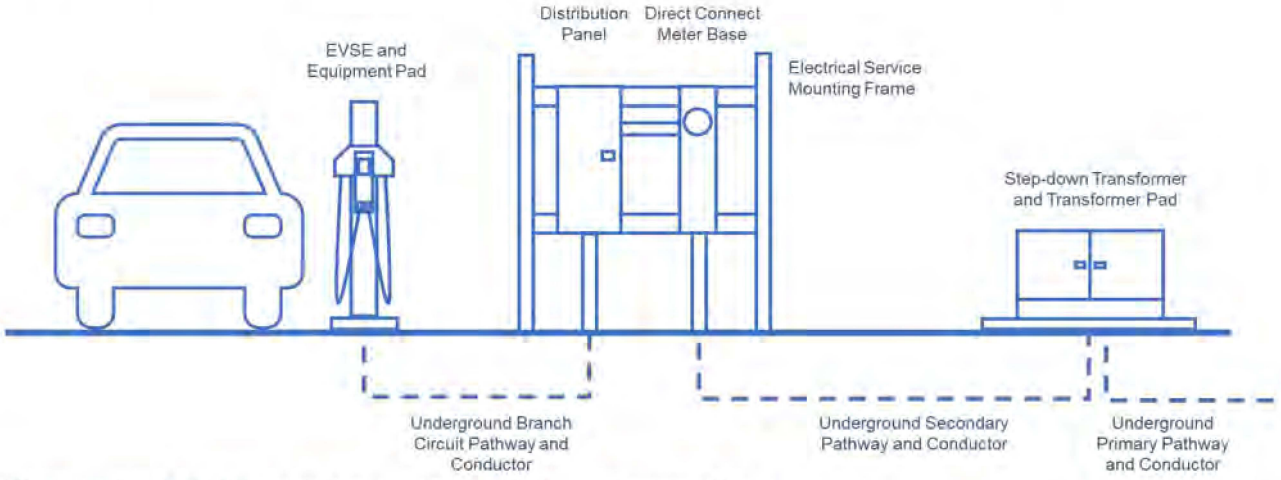


Figure 4 Typical Level 2 EVSE installation in an existing off-street parking facility

Utility and light poles can also serve customers who live in neighborhoods where a lack of off-street or electrical service capacity limits the ability to install residential L2 charging. Further, L2 pole charging would lessen municipal ROW expenses (i.e. restoration costs, decreased lifetime of asphalt), while adding value for residents.

Right of Way Approach

There are myriad technologies and applications seeking coveted space in the Right-of-Way (ROW). Understandably, municipalities carefully manage the ROW, as it is one of their greatest assets. They spend millions of dollars annually paving and repaving streets and are hesitant to allow new infrastructure that requires cutting the pavement, takes up space, or that might eventually be abandoned. To mitigate ROW interference, PGE leveraged existing utility pole, which:1) eased constraints for limited space in the ROW; 2) reduced administrative burden for the City and utility by using previously permitted poles; and 3) reduced the need to trench/patch asphalt and sidewalks, which helps the street last longer and saves the City money.

Parking

The City of Portland placed parking signage on the utility poles containing the chargers, similar to the one shown in Figure 5 to the right. The City also striped two white lines called a '*white space box*' on the street indicating the parking spot in question.

Figure 5. EV Parking only sign

Table 2. Cost comparison of parking stall and utility pole mounted Level 2 EVSE.

Cost Category	Description	Parking Stall ($/port)	Utility Pole ($/port)
Utility Labor and Materials	Cost of primary conductor, secondary conductor, transformer (if applicable), meter equipment, and associated labor.	$500 - $1,000	$500 - $1,000
Make-ready Labor, Materials and EVSE Installation	Includes primary pathway (if applicable), secondary pathway, meter base, distribution panel, and branch circuit pathway and conductor, and associated labor. Mounting of EVSE to utility pole and/or connection to make-ready infrastructure.	$4,100 - $10,500	$500 - $1,000
Engineering, Design, Permits, and Fees	Civil / electrical engineering and design costs (if applicable), permits, and right-of-way / franchise fees (if applicable)	$150 - $300	$1,210 - $2,000
	TOTAL	**$4,750 - $11,800**	**$2,210 - $4,000**

City of Portland Learnings

Due to the new technology and application of these chargers, the City of Portland's Bureau of Transportation (PBOT) does not have a standard process to permit these chargers. Because the chargers were free-of-cost, the City used an encroachment permit with the plan of learning from this demonstration. PBOT mentioned that if this were to move forward and on a larger scale, they would create a new permitting process that would include all aspects of the project, including parking designation, signage and striping. The new proposed permit would create an easy way for both the City and PGE to efficiently permit these types of chargers.

The parking signage and striping requirements for this project were delayed the impacts of COVID, which impacted user experience. In discussions between PGE and PBOT, PBOT mentioned that they could make parking striping and signage available for PGE to install in the future. PBOT would then inspect the stencils and signage to ensure compliance with City standards. This could be easier for both parties as signage could be installed at the same time as the chargers.

In terms of parking enforcement, PBOT suggested idle fee software as a way to encourage drivers to leave the space after their charge time is complete. This would have the dual benefit of decreasing parking enforcement costs for the city.

PBOT recommended that going forward they would advocate to work closely with PGE to help identify individual neighborhoods and streets where these chargers should be considered. Overall, they were satisfied with the devices and saw them as a good solution to increase access to charging, especially in residential neighborhoods. PBOT also mentioned that they were eager to start working on policy around implementing these chargers.

Customer experience and utilization

User experience was generally positive. Many people were happy to see PGE and the City moving in this direction, including the Executive Director of the Citizen's Utility Board, Bob Jenks. On April 28, 2020 he wrote on CUB's blog:

> *By placing the chargers on utility poles and having the City designate them as EV-only parking spaces, there are now dedicated areas to charge within blocks of new apartments and restaurants....CUB applauds PGE for testing this idea. Owners of EVs require utility service and we must find ways to meet the needs of EV owners, including people who live in multi-family buildings....Allowing PGE to invest some of this money back into helping customers manage their EV charging makes sense. We can serve EV load and still ensure that EVs are contributing revenue to the system and helping lower everyone's rates.*[7]

PGE received a 10 out of 10 on the Plugshare charging locator app for the charger located at 2608 SE 35th Place, while only receiving an 9.3 out of 10 at the charger located at 2746 SE 29th Avenue. A majority of the complaints PGE received on the Plugshare app and the EVSE's app, were in regard to the charger on 29th constantly being blocked by internal combustion engine (ICE) cars.

Almost immediately after the City put up the EV only parking sign on 29th Avenue, PGE noticed an increase in utilization. The charger's average of 0.82 sessions a day increased to 1.03 sessions a day, and the charger's score on Plugshare went up from 7.2 on August 28th to 8.1 on September 14th and 9.3 at the time of writing. As mentioned above, there was a delay in parking signage and striping, resulting in complaints by EV drivers of the chargers being "ICED", or blocked by Internal Combustion Engine Vehicles. As such, we note the importance of parking signage and striping occurring concurrently with charger installation. Appendix 2 includes comments from the PlugShare App.

[7] Curbside EV Charging Comes to SE Portland: https://oregoncub.org/news/blog/curbside-ev-charging-comes-to-southeast-portland/2182/

Utilization

PGE did very little marketing of these Pole Chargers. We made the chargers free to use and created door tag flyers to ensure residents of the Clinton neighborhood were aware of the chargers, their purpose, and the duration of the project. Despite the limited marketing effort, the limited duration of the demonstration, and the delayed signage for the SE 29th Avenue charger, customer utilization of the chargers was on par with, and at times, better than Electric Avenue charging stations. Table 3 provides shows the utilization data as of October 22, 2020.

Table 3, Utilization data at the time of writing (233 days active)

Key Performance Indicator	SE 29th Ave.	SE 35th Pl.
kWh used	3,874.634	7,524.346
Number of Unique Users	95	105
Number of Sessions	259	406
Number of Sessions per day	1.12	1.74
Average Duration of Stay	4 hours, 05 minutes and 50 seconds	4 hours, 16 minutes and 32 seconds
Average Charging time	2 hours, 47 minutes and 10 seconds	2 hours, 59 minutes and 20 seconds

Clean Fuels Credits

Under the Oregon Clean Fuels Program, Clean Fuel Credits are generated through EV charging and can be sold to regulated parties. PGE generates credits based off the number of EV's registered in its territory as well as by the electric fuel it provides to EV's at its public facing EVSE. The two pole-mounted chargers are both public facing electric fuel stations and therefore can generate clean fuel credits for PGE.

To date, the chargers have dispatched 11,399 kWh of electricity, which is approximate equivalent to 9 clean fuels credits. Based on current market values, the credits have generated $1,054.53 in revenue. The cost of capacity and to supply the energy used by these chargers was calculated to be $784, meaning PGE was able to net $270.53 based off the value of these credits.

Initially, PGE expected these chargers would have higher utilization, which in turn would create more clean fuel credits to sell and offset costs accumulated by the demonstration. However, due to a variety of reasons, including, but not limited to, the pandemic and the lack of parking signage around the charger for the 29th Avenue charger, utilization for both devices were lower than anticipated. Despite these challenges, the charger on SE 35th Place, with its single port, became PGE's most used public L2 charger during the coronavirus pandemic.

Conclusion & Next Steps

Pole-mounted EV chargers are a relatively new concept and have only been explored in limited deployments. Though deployed on a small scale during a global pandemic, the demonstration produced high customer satisfaction and charger utilization. This demonstration has shown that utility pole mounted chargers are significantly less expensive to install than L2 EVSE traditionally installed in the right-of-way, making a larger pilot appropriate to test whether PGE can cost-effectively scale pole-mounted chargers in its territory. While the pandemic limited PGE's learnings, success to date supports moving forward with the next phase of this work.

Next Steps & Remaining Questions

PGE proposes extending the duration of the current pilot to explore additional questions we were unable to answer during this 12 month period. With the additional time, PGE would keep the current EVSE on the utility poles and add up to three (3) additional EVSE onto light poles in locations outside of the City of Portland. Additional questions PGE would like to explore are listed below.

Category	Questions
Pricing	For a variety of reasons, PGE offered use of these chargers free-of-charge. Would utilization change if there was a fee for use? How does this impact equity and access to EV charging for underserved communities?
Parking & enforcement	What kind of time limit is ideal for both the municipality and customers? Does a 2 or 4-hour parking limit make the most sense? Who would enforce parking periods? What can or would an enforcement program look like? How could an idle program help?
Different technology	What other infrastructure might provide a better customer experience? Would using a light pole work better than using a utility pole? Would it impact NEC/NESC code?
Design standards	What is the optimal installation/configuration to satisfy NEC and NESC code?
ADA considerations	Should chargers only be put on poles close to curb cuts to allow for wheelchair access? Are there low-cost, high-impact improvements that can be made to make these chargers more ADA-friendly?
Utility-pole make-ready	When poles are being replaced, can the conduit required be pre-installed on the pole? Could the charger be put on the pole as soon as a new pole is replaced? Would this decrease costs to put EVSE on in the future?

Appendix 1 EVSE's Safety Features

EVSE's Safety Features

ChargePoint CT4000 Family

Safety and Connectivity Features

Ground Fault Detection	20 mA CCID with auto retry
Open Safety Ground Detection	Continuously monitors presence of safety (green wire) ground connection
Plug-Out Detection	Power terminated per SAE J1772™ specifications
Power Measurement Accuracy	+/- 2% from 2% to full scale (30A)
Power Report/Store Interval	15 minute, aligned to hour
Local Area Network	2.4 GHz WiFi (802.11 b/g/n)
Wide Area Network	LTE Category 4

Safety and Operational Ratings

Enclosure Rating	Type 3R per UL 50E
Safety Compliance	UL listed and cUL certified; complies with UL 2594, UL 2231-1, UL 2231-2, and NEC Article 625
Surge Protection	6 kV @ 3,000A. In geographic areas subject to frequent thunder storms, supplemental surge protection at the service panel is recommended.
EMC Compliance	FCC Part 15 Class A
Operating Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	-40°C to 60°C (-40°F to 140°F)
Non-Operating Temperature	-40°C to 60°C (-40°F to 140°F)
Operating Humidity	Up to 85% @ 50°C (122°F) non-condensing
Non-Operating Humidity	Up to 95% @ 50°C (122°F) non-condensing
Terminal Block Temperature Rating	105°C (221°F)
Network	All stations include integral LTE modem and will be automatically configured to operate as gateway or non-gateway as needed

Appendix 2: PlugShare Reviews

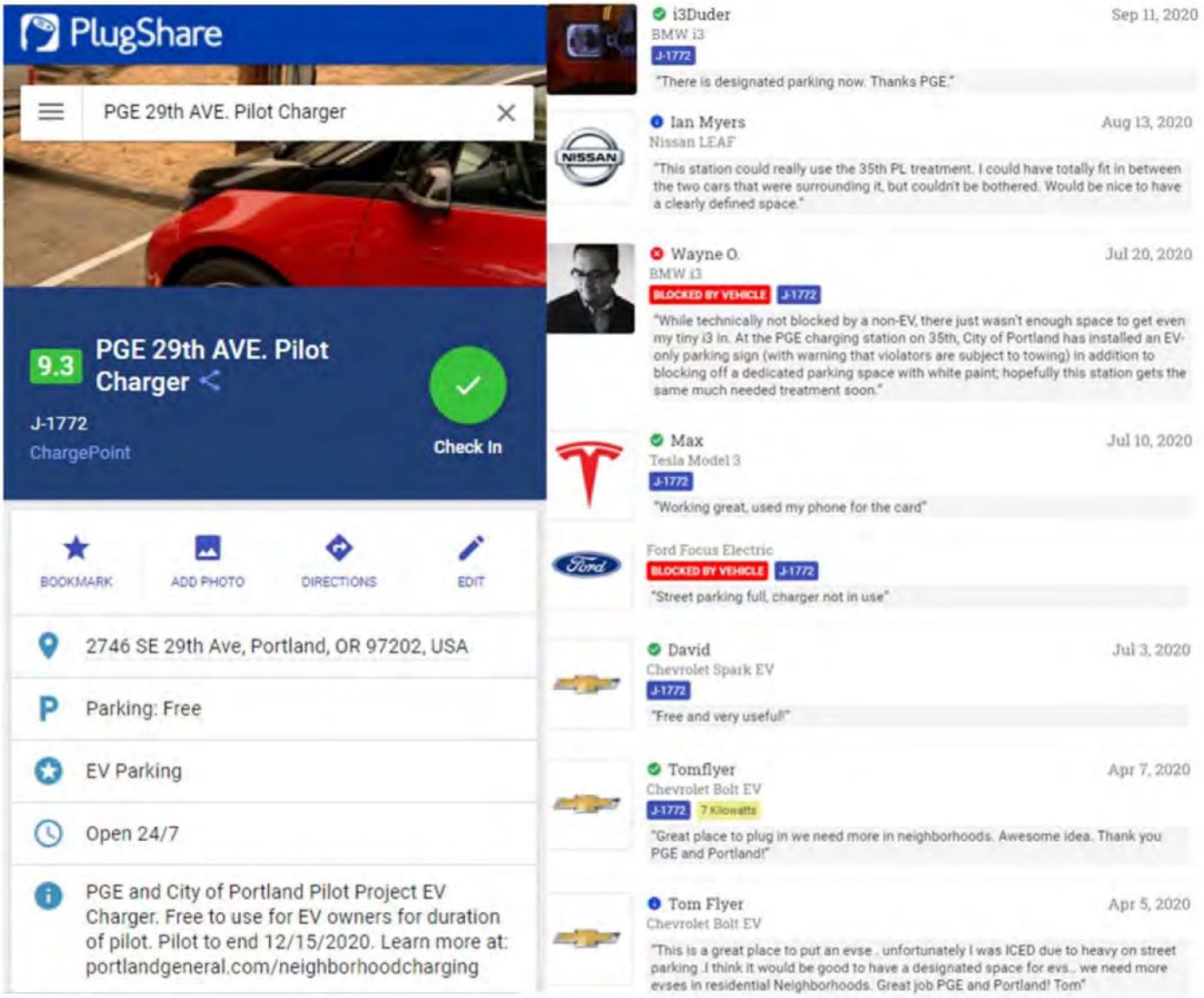


Figure 6. Plugshare 29th Ave. Reviews

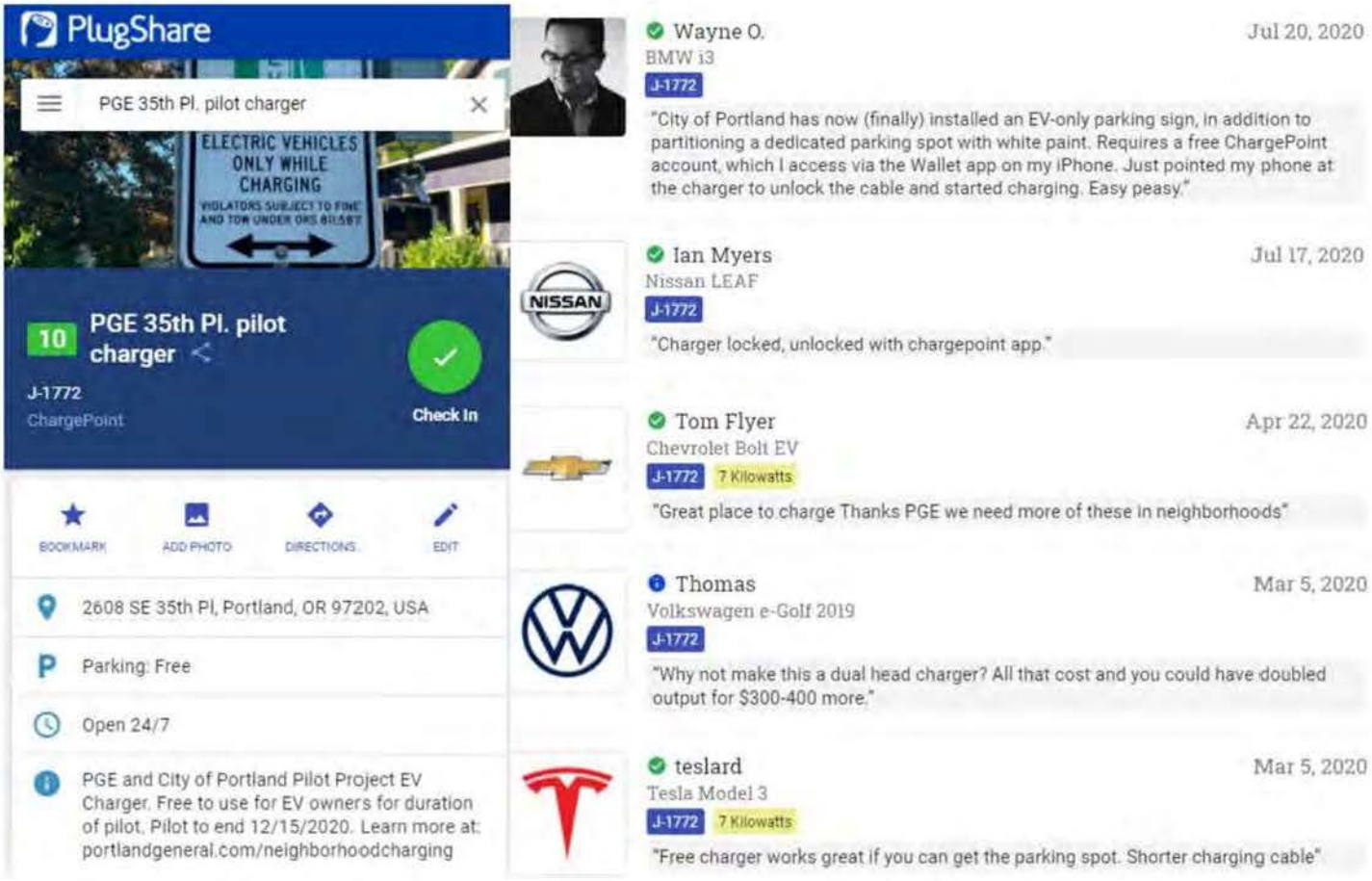


Figure 7. Plugshare SE 35th Pl. Reviews