Chapter 6. Foundations

This chapter addresses cross-cutting portfolio work such as evaluations, line-extensions, and make-ready. The Chapter is meant to explain these activities so the reader has context before moving into the portfolio's program activities.

6.1 Role of Demonstrations

PGE is conducting a managed charging demonstration to actively control the time, rate, and/or duration of electric vehicle charging. PGE will test this using on-board telematics to optimize charging around grid considerations such as wholesale prices, bulk capacity needs, distribution congestion, and equipment health. PGE will control the timing of EV charging, whilst ensuring that vehicles meet the operational needs of participants such as that state of charge remains at or above minimum requirements at planned departure time. The objective of this demonstration is to better understand how managed charging can reduce the negative impacts of high EV adoption and turn them into an operational asset.

PGE is evaluating options for a Vehicle-to -Grid, -Building, or -Home (V2X) demonstration to assess the use of vehicle-based energy storage as a source of grid services. This research will focus on improving our understanding of the technical paths for bi-directional management of EV charging, as well as the associated costs, performance, and limitations. This work may span multiple customer segments including single family, multi-family, commercial and/or fleet and may overlap with other Smart Grid Testbed research areas. Research in this area will be used in close coordination with the broader TE team to ensure that project learnings support broader programmatic efforts to scale these offerings across a broader customer base.

6.2 Evaluation

After completing a competitive RFP process, PGE contracted with Opinion Dynamics in March 2023 to conduct process and impact evaluations of four TE pilots and programs. Following are key learning objectives associated with the four ongoing evaluations:

6.2.1 Evaluation Activities

6.2.1.1 Residential Smart EV Charging

Process Evaluation:

- Is Residential Smart EV Charging meeting enrollment targets? How effective has education and outreach been?
- What are the characteristics of enrollees (e.g., low income, in underserved communities)?
- What percent of enrollees purchase new EVSE versus bring their own EVSE?
- Does the panel upgrade rebate increase customers' willingness to enroll?
- What is customer satisfaction with the participation experience, including communications, charging app usage, and incentive payments?
- What challenges have customers had purchasing or installing their EVSE?
- What challenges have customers had participating in Smart Charging/DR events?
- How has internet connectivity affected DR event participation?
- Have customers changed their charging or plug in patterns over time?

- When and why do customers opt out of DR events?
- Why do customers un-enroll?

Impacts Evaluation:

- What are the daily and seasonal MW impacts from DR events?
- How do evaluated DR savings compare to planning assumptions?
- What are the typical weekday load shapes for EVSE and evPulse enrollees, and how do they compare to PGE's system peaks?
- When is non-coincident peak load for enrollees?
- How often do enrollees opt out of DR events? What are the impacts on DR savings?
- Are there any key charging pattern differences between any enrollee segments?

6.2.1.2 Business EV Charging Rebates

Process Evaluation:

- How is PGE progressing towards its participation and expenditure goals?
- How are customers learning about Business EV Charging Rebates? How effective has PGE's education and outreach been?
- What types of customers are participating?
- What percentage of ports are located in underserved communities?
- How influential are the rebates in customers' decisions to install EV charging, and as appropriate, operate EV fleets?
- How effective has assistance from PGE and/or EVSE vendors been? Could this be improved in any way?
- Are customers satisfied with their EVSE choices?
- How many customers have un-enrolled and for what reasons?
- Have enrollees had any challenges procuring, installing, and maintaining their chargers?
- Who is able to access charging at participant sites?

Impacts Evaluation:

- What are the typical weekday load shapes for participants' chargers; how do they compare to PGE's system peaks?
  - How do the load shapes vary by type of business or user mix?
  - How does charging vary for L2 versus DC fast chargers?
- What is the total monthly energy consumption from all participants?
- What is the non-coincident peak load for participants' charging in aggregate, and by business/user type?
- What is the average load factor (utilization) across all participants, and range of load factors?

6.2.1.3 Fleet Partner

Process Evaluation:

- How effective has PGE's education and outreach been in generating awareness and interest for Fleet Partner?
- Are any participation steps and requirements unclear to customers?
- How is PGE progressing towards its participation goals?
  - What percentage of ports are located in underserved communities, which may have adverse air quality?
  - How many customers are electrifying transit, shuttle, and school bus vehicles?
- Why do customers that are aware Fleet Partner decide not to participate?
- How many customers have withdrawn and for what reasons?
- Is the custom incentive for make-ready infrastructure set appropriately?
- How effective are PGE's internal customer tracking processes?
- How accurate are cost estimates in the preliminary designs? What are the main causes of deviations?
- How accurate are estimated construction schedules? What are the main causes of deviations?
- How effective has technical assistance from PGE and/or charging vendors been?
- What challenges have customers had regarding siting, permitting, designing, and building charging infrastructure?
- How satisfied are customers with the different participation phases?
- Are participants achieving their business goals?

Impacts Evaluation:

- What are the average daily and total monthly energy consumption by customer and in aggregate? How does this vary for L2 versus DC fast chargers?
- What are the typical weekday load shapes for participants' chargers; how do they compare to PGE's system peaks?
  - How do load shapes vary by business/organization type?
  - How does charging vary for L2 v. DC fast chargers?
- What is the average number of charging sessions per day for each customer?
- What are customers' non-coincident peak loads individually and in aggregate?
- What is the average load factor across all customers, and for each charging site?
- What is the charging demand coincident with PGE's summer and winter system peaks, for each site and all charging stations combined?

6.2.1.4 Drive Change Fund

Process Evaluation:

- How effective has PGE's education and outreach been in generating awareness of the Drive Change Fund?
- What types of organizations and customers are the Drive Change Fund serving? Are there any notable gaps in customer types or geographies?
- Are residential customers benefiting?
- How easy/difficult is the application process? Could it be improved? Do any project requirements need adjusting?
- How useful is PGE's project scoping and application assistance?
- Could the application review and selection process be improved in any way?
- What challenges do grantees have completing their projects, and how can PGE provide further assistance? Does this vary by project type?
- What successes have grantees achieved for their organizations and constituents? Would they recommend the Drive Change Fund to peer organizations?
- What lessons has PGE learned through multiple rounds of applications and grant awards? Have any best practices been developed?

Impacts Evaluation:[179]

- What is the average load factor (utilization) for grantees' installed chargers, and range of load factors?
- What are the typical weekday load shapes for grantees' installed chargers, and how do they compare to PGE's system peaks?
- How do the load shapes vary by type of organization or vehicle mix?
- What is the total monthly energy consumption for each grantee, and from all grantees?
- What is the non-coincident peak load for grantees' charging in aggregate, and by individual grantee?

6.2.2 Evaluation Reporting and Budget

PGE expects to submit comprehensive evaluation reports to the OPUC in early 2024 and 2025. For Residential Smart EV Charging and Fleet Partner, PGE will receive interim memos in summer 2023 to inform the planning assumptions and incentive levels for those efforts.

The following table shows how the contracted evaluation costs are allocated by pilot/program and year.

[179] Pending charging sessions data availability. DCF customers do not have to provide these data as a condition of participation.

Table 21. Contracted Evaluation Costs by Pilot/Program and Year

Pilot/Program	2023	2024	2025	Total
Business & Multi-Family Make-Ready Solutions	[redacted]	[redacted]	[redacted]	[redacted]
Business EV Charging	[redacted]	[redacted]	[redacted]	[redacted]
Fleet Partner	[redacted]	[redacted]	[redacted]	[redacted]
Public Charging - Municipal Charging Collaboration and Electric Ave	[redacted]	[redacted]	[redacted]	[redacted]
Residential Smart EV Charging	[redacted]	[redacted]	[redacted]	[redacted]
Drive Change Fund	[redacted]	[redacted]	[redacted]	[redacted]

6.3 Line Extension/Make-Ready

The Line Extension process is PGE's mechanism for providing additional utility infrastructure to meet a customer's request for new electric service. The Line Extension Allowance (LEA) is the part of this process which provides a discount to the customer on the upfront cost of the utility infrastructure, based on the forecasted energy consumption from the new electric service. It is PGE's responsibility to provide electric service to the service point at the location requested by the customer, which is where PGE places the meter. The customer is responsible for designing, constructing, and maintaining infrastructure "behind-the-meter". The following figure illustrates the delineations between these components when connecting an EV charger to PGE's distribution system:

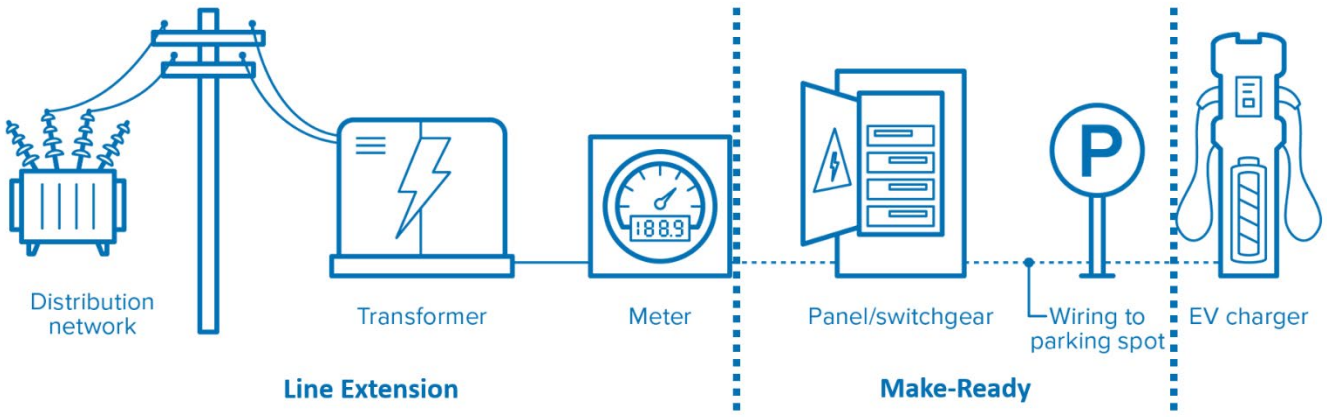

Figure 16. Delineations between Line Extension, Make-Ready, and EV Charger

Unfortunately, it is common for commercial customers to add new electrical load to their existing service without notifying PGE if the building capacity can support the additional charging load. In these cases, PGE has no visibility into what the new load is, when it was added, its power capacity, its typical operating hours, or the energy consumption of that individual load. This is how many EV

chargers have been installed at commercial properties to date, which makes it challenging for PGE to understand and influence how EV chargers are impacting the grid.

ORS 757.357 (HB 2165, 2021) allows PGE to extend utility ownership to behind-the-meter assets, like make-ready, for Transportation Electrification projects. By making PGE responsible for additional infrastructure, it allows the customer to focus on the parts of the project that most impact their business—the chargers and vehicles—while also allowing PGE to gather additional information and set additional requirements.

The utility fulfills the following roles for make-ready infrastructure:

- Ensures sites are properly metered and ready for an EV rate:
  - At present we believe a separate meter is needed to have clear data from which to learn and develop new approaches to TE Loads. However we are not sure that a separate meter is necessary for all types of TE load now or in the future. The activities funded through this Plan require a separate meter for sites where make-ready is necessary. For smaller EV loads, such as where an electrical contractor builds the circuit interconnecting the TE load to the system behind-the-meter, PGE is pursuing a load disaggregation approach or other usage data.
- Site Development:
  - Can help identify whether distribution system upgrades can be avoided by incorporating solutions into make-ready design (e.g., right-sizing charging, battery storage, load management).
  - Where PGE dollars have been used to install make-ready, the utility can also impose terms and conditions. In the case of Business Make-Ready PGE can require public access to some portion of the chargers on site. This is how utility dollars can be leveraged to assure equitable access to charging.
- Standards, which ensure that chargers meet PGE's technical requirements and industry standards for safety, interoperability, and demand-response capability:
  - In the future, these same technical requirements may also include more sophisticated forms of managed charging and V2G.
- Data, which provides PGE with data for each individual charging port, including energy use, peak power, session duration, unique users, session cost:
  - This continually informs PGE of how its rate structures are affecting how EV owners fuel their vehicles and whether a unique use case is emerging.
- Education and Partnership, as having a role in make-ready means early engagement with our customers:
  - This gives PGE more advance notice of future TE load and a load ramp over 5-10 years
  - This allows PGE to help customers right-size their charger(s) and educate them on grid-friendly charging behavior.
- Facilitate TE, as make-ready enables electrification:

  - Early partnership with customers may create opportunity for more efficient/effective EV expansion at the site if it was made ready for additional chargers.
  - If the benefits of TE load are valued and recognized within the structure of a TE line extensions, the system can provide make-ready cost-share so more businesses can make the financial case for EV charging

- Seamless Customer Experience, making it easy for customers to choose electric "fuel":
  - Reduces customer friction and provides peace of mind for customers that they don't have to manage design, construction, maintenance
  - May improve project timelines because PGE is an expert in the plan/build process

As PGE contemplates the evolution of PGE-owned make-ready infrastructure and how it may be incorporated into the Line Extension process, a key component will be the process to estimate expected energy consumption associated with the new electric service.

For typical Line Extensions today, PGE receives an electrical load sheet in the customer's new service request. This identifies the connected load (kW) of all electrical devices on the new service. PGE uses this information to estimate demand load (kW) and to size transformers appropriately. PGE has also identified standard utilization factors (also called Combined Factors) based on the type of facility (e.g., 0.17x for hotels, 0.29x for hospitals). These Combined Factors were developed based on years of historical usage data and are used to estimate annual energy consumption based on the total demand load and the annual operating hours.

When PGE began to receive requests for new services with only EV charging (no building), PGE found it challenging to estimate annual energy consumption absent a clear Combined Factor. In 2021, PGE analyzed available historical data for existing EV charging stations and determined a standard Combined Factor to use for EV-only services. However, there was limited data available. The 2023 TE Plan requirements for meter data should provide learnings to assist this issue.

When PGE launched Fleet Partner in 2021, the program estimated energy consumption differently. Since the chargers were to be primarily used by fleet vehicles owned by the customer, PGE could estimate energy consumption based on the vehicle miles traveled, fuel efficiency (kWh/mi), and an estimated 10 percent in losses between the meter and the vehicle. PGE plans to validate this estimation method using actual data from Fleet Partner chargers but believes this method to be more accurate than the Combined Factor method. It should be noted that the accuracy is also improved because the customer legally agrees to using the estimated energy consumption in the Fleet Partner Participation Agreement.

Unfortunately, the vehicle miles traveled method for estimating energy consumption only works when there is a predictable schedule of vehicles using the chargers. For public charging, this method is less applicable, so PGE plans to use the Combined Factor method while gathering data through its various EV programs to improve the accuracy of the Combined Factor method (or create a different method for estimating energy consumption).

To aid in the development of future EV rates, PGE plans to use insights collected through make-ready programs. Every EV charging use case (fleet, multi-family, public L2, public DCFC, public heavy-duty) has its unique characteristics. These characteristics will be critical to identify during the rate design process. Each use case may vary by:

- Daily load profile hourly average and peak kW

- Charger-to-vehicle ratio
- Nameplate kW per charger by vehicle type
- Annual energy consumption per charger or vehicle
- Utilization factor/combined factor (energy usage based on demand load)
- Demand factor by charger quantity (demand load based on connected load)
- Off-peak versus on-peak usage
- Site load ramp (year-by-year)

Many of the products proposed in this Plan are built on the foundation that more data, insights, and customer engagement is needed for each of the EV charging use cases to effectively build full-scale programs and rates that address barriers and cost-effectively incorporate TE load onto the system.