ITEM NO. RA3

PUBLIC UTILITY COMMISSION OF OREGON
STAFF REPORT
PUBLIC MEETING DATE: June 15, 2021

REGULAR X CONSENT ____ EFFECTIVE DATE June 15, 2021

DATE: June 7, 2021

TO: Public Utility Commission

FROM: Eric Shierman

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

SUBJECT: PORTLAND GENERAL ELECTRIC:
(Docket No. UE 389)
New Schedule 53 Heavy-Duty Electric Vehicle Charging Program.

STAFF RECOMMENDATION:

Staff recommends the Public Utility Commission of Oregon (Commission) approve Portland General Electric's (PGE or Company) filing, Advice No. 21-03, which creates a Schedule 53 for the Company's proposed Heavy-Duty Electric Vehicle Charging Program.

DISCUSSION:

Issue

Whether the Commission should approve PGE's Advice No. 21-03, which creates a Schedule 53 for the Company's proposed Heavy-Duty Electric Vehicle (EV) Charging Program.

Applicable Rule

Under ORS 757.357(3), the Commission shall direct each electric company to file applications for programs that would accelerate transportation electrification (TE). Under ORS 757.357(4), the Commission shall consider whether the program's investments and other expenditures:

1. Are within the service territory of the electric company;
2. Are prudent as determined by the commission;

3. Are reasonably expected to be used and useful as determined by the commission;
4. Are reasonably expected to enable the electric company to support the electric company's electrical system;
5. Are reasonably expected to improve the electric company's electrical system efficiency and operational flexibility, including the ability of the electric company to integrate variable generating resources; and
6. Are reasonably expected to stimulate innovation, competition and customer choice in electric vehicle charging and related infrastructure and services.

Under OAR 860-087-0030, a Company must file an application with the Commission for each program that seeks to accelerate TE. OAR 860-087-0030(1) details what the Company must include in its Program application. Broadly, these requirements include:

(a) A description of the program;
(b) Data used to support the description;
(c) A description of program coordination;
(d) A description of the electric company's long-term strategy to accelerate transportation electrification in its service territory in an effective and efficient manner and how the proposed program fits within the long-term strategy;
(e) A description of program costs;
(f) A description of the expected program benefits;
(g) A description of how the electric company will evaluate the program; and
(h) A description of how the program addresses the considerations of Oregon Laws 2016, 028, section 20(4)(a)-(f).

Executive Order 20-04 establishes Governor Brown's new greenhouse gas emissions goals for the State of Oregon and directs state agencies to identify and prioritize actions to meet those goals. Section 5.4(B) of the Executive Order directs the Public Utility Commission to "[e]ncourage electric companies to support transportation electrification infrastructure that: supports GHG reductions, helps achieve the transportation electrification goals set forth in Senate Bill 1044 (2019), and is reasonably expected to result in long-term benefit to customers."

Analysis

Background
In April 2019, PGE entered into negotiations to help a commercial customer build a heavy-duty charging site on Swan Island, called Electric Island. PGE executed a contract with this customer on September 15, 2020. On February 2, 2021, PGE filed Advice No. 21-03 to seek Commission approval of a new Schedule 53. Staff

recommended that the Commission suspend this filing in order to work with the Company to obtain necessary information to evaluate the program under Division 87 of the Administrative Rules, as well as hold workshops for adequate stakeholder involvement. The Commission suspended this proposal at the March 9, 2021, Public Meeting.[1] Staff has used this time to gather facts pertaining to the merits of this program.

In the time between March 9, 2021 and this recommendation, Staff sent information requests and attended two public workshops where representatives of the Company made themselves available to answer questions. The first workshop was held on March 22, 2021, and was widely attended by stakeholders. The second workshop was held on May 28, 2021. The only party to join Staff and the Company was the Citizens' Utility Board.

In this memo, Staff will highlight the program details, discuss the role of make-ready investments, and apply the six statutory considerations. Finally, Staff will conclude with a summary of the reasons for our recommendation that the Commission approve this program.

Program Details
PGE's proposed Nonresidential Heavy-Duty Charging Program is offered to manufacturers of heavy-duty electric vehicles and operators that deploy electric vehicle service equipment (EVSE) that can recharge an electric vehicle at a rate in excess of 1 MW.

Schedule 53 will pay a portion of a qualifying customer's project development costs. These expenditures are capped at $5 million per customer. The tariff sheet does not specify what that portion is, but PGE describes the customer being responsible for half the costs on page 8 of the program application and the Company's response to IR 21.

PGE states that the objectives of this program are to:

1. Provide unique opportunities to better understand grid impacts from heavy duty Electric Vehicle charging rates and how complementary grid edge technology (storage, solar, demand response) can help ensure infrastructure can be deployed in ways that benefit the grid.
2. Offer opportunities to actively engage and provide helpful guidance to customers in the design, deployment, commissioning, and operation of heavy-duty vehicle charging infrastructure.

[1] Any investments in heavy duty charging made prior to this tariff approval will be addressed in PGE's General Rate Case in accordance with Order No. 21-083.

3. Obtain heavy-duty Electric Vehicle usage data and gain insights to charging load profiles.

Staff's recommendation is based on new heavy-duty EVSE sites that this program may fund. In its financial modeling, PGE forecasts that two sites will participate in this program.[2,3] Given this program's eligibility requirements, the sites can be either manufacturer of heavy-duty EV with product development in PGE's service territory or the sites can be a fleet operator of heavy-duty trucks that install EVSE with an excess of 1 MW demand capacity per port. At the May 28, 2021, workshop, PGE described the fleet customer as being the more likely market segment to participate.

Purpose of the Make-Ready Investment
In this section, Staff will discuss the condition in which ratepayers can benefit from an investment in a heavy-duty site's make-ready infrastructure. Staff sees ratepayer benefits in assisting a program participant to overcome a financial barrier to move forward with the project, so that early learnings can be achieved to avoid future costs in construction and the distribution system, before heavy-duty EVs become widely adopted by the trucking industry. We then apply this condition to meeting the three stated program objectives. Staff ultimately concludes that a make-ready investment in the new sites is expected to meet this condition.

The bulk of the program cost is expected to come from funding the site's electrical work connecting the meter to the EVSE (make-ready). At the March 9, 2021, meeting, Commissioner Tawney asked PGE if building the make-ready itself offers significant learnings.[4] PGE replied that there are unique aspects of how the make-ready infrastructure is built for higher power levels. Staff noticed that, though PGE quantified the monetary value of program learnings in the Company's financial analysis, the avoided cost of future make-ready expenditures was not included. Staff sought clarification on these make-ready learnings in IR 38. The unique aspects are:

- Site layout and charging dispenser location to ensure that heavy-duty electric vehicles can safely enter, exit, and navigate inside the site in long-chassis or tractor-trailer configurations.
- The need to serve loads beyond 2.5 MW with primary service or multiple secondary services.

[2] *See* Docket No. UE 389, PGE, Response to OPUC Standard Data Request No. 026, May 11, 2021, p1.
[3] The Commission adopted Staff's recommendation in Order No. 21-083 that any investment made prior to this tariff will be addressed in PGE's next General Rate Case.
[4] OPUC Public Meeting, March 9, 2021 (timestamp 48:27), available at https://oregonpuc.granicus.com/MediaPlayer.php?view_id=2&clip_id=714 (comments of Commissioner Letha Tawney).

- The need to support multiple charging technology configurations, including:
  i. Charging systems that house the charging dispenser and power conversion electronics in a single unit.
  ii. Charging systems that house the dispenser and power conversion electronics in separate units.
  iii. Charging systems that accept medium-voltage.
  iv. Charge systems with integrated energy storage systems.
- The need to support the integration of multiple grid edge technologies, including on-site energy storage, on-site generation, and advanced load controls.[5]

Staff will now discuss the need of an incentive to address a financial barrier. If a project were expected to go forward without ratepayer funding, these learnings on how to better build out make-ready infrastructure could still be achieved. At the May 28, 2021, workshop, PGE explained that PGE is not expected to build the make-ready at these projects. Engineering companies like Black and Veatch will be hired to do this work.[6] PGE plans to provide engineering support and the learning will come from the contractor's implementation. If the cost of the make-ready infrastructure were not a barrier to the project going forward, PGE could still gain learnings from the make-ready construction by providing this engineering support and engagement without funding the construction of the make-ready.

The make-ready investment is typically the most expensive part of an EV infrastructure project. If ratepayers subsidize this portion of the project, a project that might have been too uneconomic to exist could move forward but for the existence of the subsidy. So the role of make-ready investments in a portfolio of utility transportation electrification programs is to remove a financial barrier.

Staff is unclear whether there will be fuel cost savings at higher charging levels, based on data provided by the Company. This points to the need for a make-ready incentive to provide learnings related to fuel cost uncertainty. PGE's original assumption about fleet charging behavior points to some fuel cost savings, while charging at 1 MW presents fleets with higher fuel costs than diesel. To overcome negative fuel savings, the very existence of a new 1 MW site will likely be in need of a large subsidy since all aspects of electrification – the price of the truck, the cost of the fuel, and the added infrastructure requirement will together make this charging strategy significantly more expensive than operating combustion engines.

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[5] *See* Docket No. UE 389, PGE, Response to OPUC Standard Data Request No. 038, May 11, 2021, p1.
[6] Business Wire. *Black & Veatch Leads Design, Construction of `Electric Island,' a First-of-its-Kind, High-Capacity Public Charging Station Designed for Medium- and Heavy-Duty Electric Vehicles* March 22, 2021, p1.

The program's objectives to test grid edge technology, engage with this customer, and collect data would not require a make-ready investment if the program participant were expected to pay for the needed make-ready in the absence of a subsidy, but the financial barrier to the emergence of a new site suggests a subsidy of this magnitude may be necessary. The incentive allows for new sites less certain to be built to move forward, providing opportunities to meet program objectives.

The case for make-ready investment in new sites appears strong, given the uncertainty that any new sites will be built in the next two years. The proposal offers sufficient grounds for Staff to recommend the Commission approve this program. Commission approval of this program can be forward looking, an opportunity to gather learnings on new heavy-duty sites.

The Six Statutory Factors for the Commission
ORS 757.357(4) identifies six factors that the Commission shall consider when approving a transportation electrification program and determining cost recovery. Staff evaluates them with the new heavy-duty sites.

The first consideration is whether or not the investments or other expenditures are within the service territory of the electric company. PGE's Sheet 53-1 limits the availability of this pilot to its service territory.

The second consideration is whether or not the investments or other expenditures are prudent as determined by the Commission. PGE's financial analysis shows this program is expected to almost break even. The largest component of the monetary benefit is around $4 million of avoided costs from expected learnings. PGE's analysis performed this analysis in a very thoughtful way by incorporating the value of learnings into the cost benefit analysis. The basis for PGE's estimates of avoided costs were presented in the Company's response to IR 33. That response documents the potential value of learning how to optimize distributed energy resources in response to this new load. Staff has attached PGE's response to IR 33 as an appendix to this Public Meeting Memo.

Staff notes that the design of this program, and the terms of the tariff are broad. Expenditures on this program will require scrutiny in a future rate case to ensure that no more than the prudent level of spending was made to meet the program objectives.

The third consideration is whether or not the investments or other expenditures are reasonably expected to be used and useful as determined by the Commission. At the March 9, 2021, Public Meeting, Commissioner Tawney sought more clarity on what

technology risk is being taken on by this program.[7] Staff followed up with information requests that further pursued this question to better understand how used and useful pre-commercial knowledge is expected to be. Staff asked PGE to describe the risk that heavy-duty EV commercial adoption differs from pre-commercial assumptions. PGE described four specific engineering and design techniques that may help mitigate this risk:

- Additional switch vaults and primary circuit pathway to accommodate future primary service installations should higher powered charging infrastructure connect to the distribution grid at primary voltage levels;
- Equipment pads with suspended metal floors, enabling conductors and communications cables to be routed and re-routed to and from any location on the equipment pad;
- Pre-cast concrete trenches connecting equipment pad areas and charging islands to enable conductors and communications cables to be routed and re-routed from any location on the equipment pad to any charging island; and
- Specially constructed charging islands with cast-in-place vaults and metal lids installed underneath each charging dispenser location, enabling the conduit window to be modified for any charging dispenser by installing a new metal lid.[8]

PGE expects these techniques will ensure the make-ready investments will accommodate any future charging technology change without added underground civil and electrical infrastructure improvements.

Staff asked PGE to describe the probability the pre-commercial EVSE specs PGE will acquire knowledge of will not become adopted by the market. The Company responded that the probability of this technology risk is low:

> The probability of pre-commercial heavy-duty electric vehicle charging equipment being unused by the market is likely low due to global standards development work currently underway. PGE staff are leading the global development of the CharIN Megawatt Charging System (MSC)1 PGE has observed the participation of major vehicle manufacturers, charging station manufacturers, and supporting suppliers and anticipates that a heavy-duty electric vehicles will use a single standard charging protocol and connector.[9]

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[7] OPUC Public Meeting, March 9, 2021 (timestamp 50:11), available at https://oregonpuc.granicus.com/MediaPlayer.php?view_id=2&clip_id=714 (comments of Commissioner Letha Tawney).
[8] *See* Docket No. UE 389, PGE, Response to OPUC Standard Data Request No. 021, May 11, 2021, p1, p2.
[9] *See* Docket No. UE 389, PGE, Response to OPUC Standard Data Request No. 022, May 11, 2021, p1.

If PGE's assumptions are realized, this would be a more widely compatible standard than the light duty market has developed.

The fourth consideration is whether or not the investments or other expenditures are reasonably expected to enable the electric company to support the electric company's electrical system. PGE's modeling indicates that, if the cost of these investments are excluded, customers that qualify for this program are expected to bring in more revenue than the marginal cost to serve the load.

The fifth consideration is whether or not the investments or other expenditures are reasonably expected to improve the electric company's electrical system efficiency and operational flexibility, including the ability of the electric company to integrate variable generating resources. Learning how to integrate the expected capacity demand of heavy-duty EVs on the grid is central to this program's purpose.

The sixth consideration is whether or not the investments or other expenditures are reasonably expected to stimulate innovation, competition and customer choice in electric vehicle charging and related infrastructure and services. If PGE is able to develop effective management of heavy-duty charging load before widespread commercial adoption of electric Class 8 trucks, that will be a valuable innovation. In PGE's response to IR 33, the Company made a strong case that it can.

PGE allows program participants to purchase the EVSE the customer chooses. This ensures a competitive market among EVSE manufacturers to foster technological innovation.

Conclusion

Commission approval of this program is expected to result in new heavy-duty charging sites. Staff recommends the Commission approve Advice No. 21-03 because PGE's proposed investment in a new heavy-duty site satisfies the requirements of OAR Division 87, Section 30, and with regards to Commission approval, the proposal demonstrates specifically that:

- These services are limited to PGE's service territory;
- Though not described as a pilot in the tariff sheet or program application, this two year program is limited in cost and duration like a pilot;
- A make-ready investment may be necessary to see a new fleet site in the next two years;
- PGE has thought through the technology risk of investing in pre-commercial technology and the likelihood these investments will be used and useful as the heavy-duty EV market develops;
- Participating customers are expected to offer more revenue than the marginal cost to serve the load;
- The program may lead to later deployment of grid edge technologies that help integrate heavy-duty load into PGE's system;
- This program offers opportunities to help innovate the development of new technology.

PROPOSED COMMISSION MOTION:

Approve PGE's filing, Advice No. 21-03, which creates a Schedule 53 for the Company's proposed Heavy-Duty Electric Vehicle Charging Program.

May 11, 2021

TO: Eric Shierman
Public Utility Commission of Oregon

FROM: Robert Macfarlane
Manager, Pricing and Tariffs

PORTLAND GENERAL ELECTRIC
UE 389
PGE Response to OPUC Data Request No. 033
Dated April 13, 2021

Request:

Please identify the expected net present value of the following list of benefits PGE identified on page 9 of the program application:

a. Early learnings about the grid impacts of heavy-duty charging infrastructure
b. Potential opportunity to test the use of complementary grid edge technologies to mitigate the impact of heavy-duty charging infrastructure
c. Potential opportunity to receive grid services from vehicles or other grid edge technologies such as energy storage system, on-site generation, or grid edge controls
d. Opportunity to enhance planning estimates for heavy-duty fleet vehicle loads
e. Potential opportunity to better understand the value and use cases associated with vehicle-to-grid technologies
f. Development of standards and safety protocols for electrical system workforce training and deployment

Response:

a. Early learnings about the grid impacts of heavy-duty charging infrastructure

PGE recognizes the high level of uncertainty associated with projecting the net present value of the early learnings captured from the projects that may be built under Schedule 53. PGE proposes to use the following scenario analysis to create a range of estimated values by using early learnings to decrease future investments in distribution system infrastructure and energy costs. PGE has also attempted to make conservative assumptions throughout this analysis to acknowledge the uncertain nature of future benefits,

In Table 21 of Section 1.4 of PGE's 2019 Transportation Electrification Plan, PGE projects that there will be 1,500 heavy-duty electric vehicles in PGE's service area by 2030. If only 10% of these vehicles were provided 1 MW chargers, PGE may need to support up to 150 MW of new

heavy-duty vehicle charging load. If ten 1 MW chargers were grouped together at each charging location, PGE would need to upgrade their distribution network to support 15, 10 MW new load additions throughout their service area.

While the number of charging ports located at a single site and charging port power output may vary, early conversations with customers have informed PGE's assumption that multiple new load additions of this size are likely by 2030. PGE has chosen to focus on a smaller number of large new load additions for this scenario analysis as these have the largest impact on the distribution system.

PGE's Distribution Planning team estimates that current methods of serving new load additions of 10 MW fall under one of six planning scenarios, summarized in the table below. These estimates are made assuming that the maximum nameplate load can be served with the loss of one major system element (N-1 planning).

Scenario	Work required	Likelihood	Cost
1	Line extension only	Low	$0.5M
2	Feeder reconductor only	Low	$1.0M
3	New feeder and new breaker at existing substation	High	$3.0M
4	New feeder and transformer replacement at existing substation	High	$4.0M
5	New feeder and new transformer with substation expansion	Moderate-High	$5.0M
6	New substation and feeder	Moderate	$10.0M

Typical PGE feeders are not loaded beyond 12 MW to ensure N-1 capacity is maintained, meaning that the 15 hypothetical load additions of 10 MW would require more than a utility line extension if an existing feeder was loaded beyond 2 MW, rendering Scenarios 1 and 2 unlikely. PGE proposes to focus on Scenarios 3-5 based on potential likelihood.

To serve these new locations using current methods, PGE could potentially spend $45 to $75M to install new feeders, breakers, transformers and/or upgrade existing substations (Scenarios 3, 4, or 5 only). Alternatively, early learnings could enable PGE to gain insight into the load profiles and diversity factors of heavy-duty vehicle charging loads, providing reasonable assurances that a site with 10 MW of nameplate capacity could be served with less capacity.

PGE is currently conducting internal analyses of light duty vehicle fast charging infrastructure to better quantify demand and energy use. These analyses rely on load profiles and diversity factors derived from PGE and customer owned charging infrastructure and may help PGE update new service design practices. However, these learnings were only available after new loads were connected to PGE's distribution network. PGE believes that Schedule 53 will enable similar learnings to occur before heavy-duty vehicle charging infrastructure is widely deployed. Learnings from Schedule 53 are also expected to impact more than just line extension designs due to the potential size of new load additions.

Lower capacity requirements make it more likely that an existing 12 MW feeder could serve a new charging site. Each instance that the installation of a new feeder is avoided could save up to $2.5M to $4.5M (Scenarios 3 – 5 only).

PGE proposes that early learnings about load profile and diversity factor could enable at least one future 10 MW charging deployment to avoid the installation of a new feeder from an existing substation transformer.

PGE also expects to capture early learnings on power quality and voltage management impacts from heavy-duty vehicle charging locations. Large, highly-variable loads (e.g. an electric arc furnace) have the potential to affect power quality and service reliability to other customers served by a common feeder. One solution that PGE has found to be effective is to require a dedicated feeder and substation transformer for the large customer load, thus mitigating any power quality impacts to nearby customers. Early learnings from heavy-duty vehicle charging may enable PGE to establish new standards for charging profiles, including the ramp rate (rate at which the charging power output increases), power factor, or other attributes. These standards could enable these large new loads to be served by a common feeder and/or common substation transformer with other customers.

PGE proposes that additional learnings about power quality and voltage management issues could avoid the installation of at least one additional new feeder and substation transformer.

To recognize PGE's ability to optimize distribution system designs based on customer-provided information at the time of the new service request and the uncertainty associated with making projections about future new load additions, PGE proposes that only 25% of these potential savings be attributed to this pilot. To provide a range of potential values, PGE has provided attribution rates as low as 15% and as high as 35%. The following tables show the net present value of the early learnings captured in IR33a-f of this information request.

Table 1. Net present value of early learnings - base scenario (25% of CAPEX savings attributed to pilot)

Early Learnings Benefits			
Program	Benefit		NPV $000s
IR 33a	Distribution CAPEX	Avoided new feeder projects (heavy duty charging infrastructure)	1,813
IR 33b	Distribution CAPEX	Avoided feeder reconductoring (complementary grid edge technologies)	878
IR 33d	Distribution CAPEX	Avoided feeder reconductoring	936
IR 33e	Vehicle to Grid	Improved Availability Increases Avoided Cost of Capacity in Future Programs	219
	Demand Response	Improved Availability Increases Avoided Cost of Capacity in Future Programs	116
IR 33f	Distribution CAPEX	Savings from Development of Safety Training Protocals	50
	Benefits		**4,012**

Table 2. Net present value of early learnings - low scenario (15% of CAPEX savings attributed to pilot)

Early Learnings Benefits			
Program	Benefit		NPV $000s
IR 33a	Distribution CAPEX	Avoided new feeder projects (heavy duty charging infrastructure)	1,088
IR 33b	Distribution CAPEX	Avoided feeder reconductoring (complementary grid edge technologies)	527
IR 33d	Distribution CAPEX	Avoided feeder reconductoring	562
IR 33e	Vehicle to Grid	Improved Availability Increases Avoided Cost of Capacity in Future Programs	219
	Demand Response	Improved Availability Increases Avoided Cost of Capacity in Future Programs	116
IR 33f	Distribution CAPEX	Savings from Development of Safety Training Protocals	50
	Benefits		**2,561**

Table 3. Net present value of early learnings - high scenario (35% of CAPEX savings attributed to pilot)

Early Learnings Benefits			
Program	Benefit		NPV $000s
IR 33a	Distribution CAPEX	Avoided new feeder projects (heavy duty charging infrastructure)	2,538
IR 33b	Distribution CAPEX	Avoided feeder reconductoring (complementary grid edge technologies)	1,229
IR 33d	Distribution CAPEX	Avoided feeder reconductoring	1,310
IR 33e	Vehicle to Grid	Improved Availability Increases Avoided Cost of Capacity in Future Programs	219
	Demand Response	Improved Availability Increases Avoided Cost of Capacity in Future Programs	116
IR 33f	Distribution CAPEX	Savings from Development of Safety Training Protocals	50
	Benefits		**5,463**

b. Potential opportunity to test the use of complementary grid edge technologies to mitigate the impact of heavy-duty charging infrastructure

PGE proposes the same scenario analysis described in IR 33.a be used to create a rough estimate of the benefits of complementary grid edge technologies to mitigate the impacts of heavy-duty charging infrastructure.

As discussed above, PGE may need to meet the load of 15 new 10 MW heavy-duty vehicle charging sites complementary grid edge technologies, including energy storage, on-site generation, and advanced controls make it more likely that an existing 12 MW feeder can serve these new loads by buffering peak site demands (energy storage and generation) or providing direct load control to ensure charging sessions stay below a pre-determined peak (advanced controls).

PGE proposes that early learnings about the application of complementary grid edge technologies to mitigate the impact of heavy-duty electric vehicle charging infrastructure could enable up to one future 10 MW charging deployments to avoid the installation of a new feeder using an existing transformer and substation. Low, medium, and high estimations of net present values are shown in IR33.a.

c. Potential opportunity to receive grid services from vehicles or other grid edge technologies such as energy storage system, on-site generation, or grid edge controls

Please reference IR12 for the benefits of grid services from the sites deployed under Schedule 53.

d. Opportunity to enhance planning estimates for heavy-duty fleet vehicle loads

PGE anticipates that the customer interactions and projects that result from Schedule 53 may provide enhanced insight into planned heavy-duty fleet charging infrastructure deployments. The learnings achieved through this pilot, including load profiles, diversity factors, and integrations with complementary grid edge technologies will enable PGE to determine the best locations in its service area to deploy this type of infrastructure. The combined insights and learnings could help PGE provide advice to customers about where to locate infrastructure and include the latest projections in charging infrastructure demand in distribution system upgrade plans.

PGE proposes that enhanced planning estimates would enable PGE to avoid installing a new feeder and breaker using an existing transformer and substation. Low, medium, and high estimations of net present values are shown in IR33.a.

e. Potential opportunity to better understand the value and use cases associated with vehicle-to-grid technologies

PGE propose the following scenario analysis to evaluate the potential benefits of enhanced understanding of vehicles-to-grid and demand response technologies. PGE will again provide a range of estimates and has also attempted to choose conservative assumptions.

PGE proposes that the enhanced understanding of vehicle-to-grid technologies and use cases could result in a 10% improvement in resource availability from vehicle-to-grid programs from 2030 to 2039. To estimate the impact of improved resource availability during this time period, PGE estimates that the vehicle-to-grid battery capacity will be ten times greater than the capacity available in 2022, totaling 1,781 kW (0.4% of PGE total estimated maximum 443 MW of vehicle charging from 1,500 heavy-duty electric vehicles). A 10% improvement in vehicle availability could than result in an incremental 178 kW of capacity. The net present value of the enhanced resource availability is showing the tables presented in IR33a.

PGE also proposes that the enhanced understanding of vehicle-to-grid technologies and use cases could result in a 10% improvement in resource availability from demand response programs from 2030 to 2039. PGE proposes that the demand response capacity could be five times larger than the 2022 level, resulting in a total available the demand reduction capacity of 740 kW. A 10% improvement in the availability of vehicles could result in an incremental increase in 74 kW of demand reduction. The net present value of the enhanced resource availability is shown in the tables presented in IR33a.

f. Development of standards and safety protocols for electrical system workforce training and deployment

Heavy-duty electric vehicle charging infrastructure designs are novel and may benefit from the standards development and workforce training opportunities presented by the projects that could

be deployed under Schedule 53. PGE's early participation in site design, ownership, and operation of make-ready infrastructure present unique opportunities to learn civil and electrical infrastructure design best practices and implement them for future programs. Schedule 53 may also present the local workforce with opportunities to design, engineer, construction, permit, and operate heavy-duty electric vehicle charging infrastructure, resulting in further savings and efficiencies.

If one 10 MW deployment of make-ready charging capacity costs $4M to design, engineer, permit, and construct and PGE standards and a highly trained workforce were to achieve just a 1% cost savings, a $40,000 savings would be achieved by 2030. PGE assumes the 1% of savings is attributable to this pilot. The net present value of this benefit is presented in the tables shown in IR33a.