



Portland General Electric
121 SW Salmon Street · Portland, Ore. 97204

September 22, 2020

Public Utility Commission of Oregon
Attn: Filing Center
201 High Street S.E., Suite 100
P.O. Box 1088
Salem, OR 97308-1088

RE: UM 2099 PGE Reply Comments in Request for Approval of Agreement for Net Metering and Interconnection Services

Introduction

Portland General Electric Company (PGE or the Company) appreciates the opportunity to submit response comments to the Public Utility Commission of Oregon (Commission or PUC) in response to Staff and Stakeholders comments submitted on August 21, 2020 in PUC Docket No. 2099, which seeks Commission approval of updates to PGE's Net Metering Interconnection Agreement. The proposed updates allow the Company to clearly communicate with net metering customers on a limited number of constrained feeders that PGE may remotely disconnect net metering systems for reliability and safety reasons when local generation is predicted to exceed local load. Other provisions of the standard net metering agreement already allow PGE to remotely disconnect the customer's facility due to reliability and safety concerns. This new language provides customers with more information regarding the possibility of such disconnects for customers that are connected to constrained feeders.

PGE is committed to serving its customers. The proposed two-meter solution is intended to reflect that commitment. The two-meter solution is a temporary measure to enable net metering interconnections on feeders that otherwise cannot support these interconnections. The two-meter solution is the least risk, least cost, and most timely solution that PGE has available at this time. This solution is comprised of proven, reliable technology currently deployed on PGE's system.

In the responses below, PGE explains the knowns and unknowns associated with this solution. For example, PGE understands approximately when and how often remote disconnects will occur; however, further refinement and development of precise, quantitative criteria will only be understood after the solution is implemented for a period of time. As PGE prepares for deployment of more distributed energy resources (DERs), PGE will investigate the potential and viability of alternative solutions in the future, such as smart inverters and energy storage. PGE is dedicated to continuously building and refining the processes, tools, and capabilities to support this future state.

PGE is actively investing in this work through PGE's grid modernization and Distributed Resource Planning (DRP) efforts. The dialogue initiated by the two-meter solution is representative of the stakeholder engagement and exchange of ideas PGE welcomes as customer solutions continue to change the energy landscape.

PGE appreciates Staff and Stakeholder engagement in workshops hosted by PUC Staff on July 13, 2020 and August 4, 2020. These workshops covered many topics including why the temporary use of the two-meter solution for net metering applicants on generation limited feeders is a low cost and easily implemented solution. Without this interim solution, net metering would not be an option for these customers because of the cost-prohibitive interconnection upgrades that would be required in these constrained areas. PGE continues to pursue other longer-term technical solutions and will implement alternatives to the two-meter solution if and when those alternatives become available.

In summary, PGE's two-meter solution introduces the possibility of infrequent curtailment of a net metering system as a temporary solution when generation exceeds consumption on a constrained feeder in order for customers to participate in net metering. As Oregon net metering rules allow electric utilities to adopt control requirements for customer generators to protect public safety or system reliability, this approach is consistent with current policy. It is also consistent with the form net metering agreement approved by the Commission which permitted disconnecting the net metering facility for safety and reliability reasons.

Staff organized their comments to the two-meter solution around three key components:

- *Utilization* – requests PGE to provide details for when the interim two-meter solution should be used.
- *Generation Limited Feeder Criteria* – requests the detailed criteria PGE uses to identify a Generation Limited Feeder and the schedule PGE will commit to notify the solar installation community to the Generation Limited Feeder list.
- *Event Dispatch Criteria* – requests PGE to provide detailed criteria PGE will use to remotely disconnect the customer's net metering system.

Each component has a list of recommendations with a request for PGE to respond, where further explanation is required for Staff to determine whether the benefits of PGE's proposal outweigh the risks. Below are PGE's responses.

Utilization

PGE is committed to working with Staff and Stakeholders on how and when PGE utilizes its two-meter solution. PGE is also dedicated to continually vetting and refining solutions that allow customers to interconnect on constrained feeders. PGE's proposed two-meter solution is intended to be a temporary solution that enables customers to connect to constrained feeders in the least-risk and lowest-cost way possible. This near-term approach does not preclude future alternative solutions and is not intended to eliminate or circumvent a transparent process for implementing longer term solutions.

Recommendation #1: PGE should file a quarterly report in this docket that contains the following data and host a workshop to review the findings with Staff and stakeholders

- *Location and size of net metering applicants required to utilize the two-meter solution;*
- *Date, time, duration, location, number of systems affected for each event called;*
- *Any modifications to the implementation of the two-meter solution, including generation limited feeder criteria and event dispatch criteria; and*
- *Any other relevant insights, including whether the imbalance generation and load actually occurred and any customer feedback received.*

PGE will commit to file a periodic report that contains the location and size of net metering projects required to utilize the two-meter solution, details of any curtailment events on generation limited feeders including the date, time, duration, location, and number of systems affected for each event called. Analysis indicates they are likely to occur during Spring and Fall when loads are low, and generation is high. PGE recommends the frequency of reports and workshops align more closely with events. Semi-annual reports and workshops delivered in the Spring and Fall are likely to be timely and relevant. Additionally, though PGE cannot predict with complete certainty, PGE does not expect curtailment events in Fall 2020; the earliest an event is expected to be called would be Spring 2021.

Recommendation #2: In its reply comments, PGE should explain why the two-meter solution is preferable at this time, compared to other alternative solutions, such as smart inverter capabilities and customer sited storage.

PGE is invested in enabling customers to adopt and interconnect Distributed Energy Resources (DERs), such as the solar installations covered in UM 2099. Given the current state of PGE's generation limited feeders, the temporary two-meter solution presents the most timely, least risk, and lowest cost solution available at this time that effectively addresses the reliability issues present on generation limited feeders while allowing interconnection of net metering projects to continue on these feeders. The alternative available in the near-term is to require the net metering applicants to pay for substation upgrades, which effectively precludes net metering as an option for these customers given the high cost of such upgrades.

PGE continues to invest in improving its distribution system. However, these improvements are costly and not available in the timeframe needed to address the current generation limited feeder issues. This temporary two-meter solution allows net metering customers to continue to interconnect to PGE's distribution system and allows PGE to continue to move forward working with staff and stakeholders in a planful way on Distribution System Planning which will allow DER investment that benefits net metering customers and all customers in the long term. While there are other solutions being considered, they are not ready to be deployed to help these affected customers.

PGE looks forward to participating with staff and stakeholders in vetting alternative solutions that achieve a long-term solution that has minimal upfront costs to net metering interconnection customers and does not put undue burden on all customers for expensive distribution upgrades.

PGE considered utilizing customer-owned smart inverters as a tool for mitigating the impact of net metering projects on generation limited feeders. However, Oregon has not yet formally adopted IEEE 1547-2018 and there are numerous customer-owned systems that do not meet the current IEEE 1547 standard. Systems that are not compliant with the current IEEE 1547 standard do not have the smart inverter features that could be leveraged as an alternative to the two-meter solution. Older systems are also not compliant with current UL safety standards that would be required to allow these systems to be used as a disconnecting device. Issues related to accessing the customer-owned smart inverters, including a consistent connection via customer-owned WiFi and data security, would also need to be addressed before considering this option as an alternative to the two-meter solution.

PGE is considering customer sited storage as a possible longer-term solution. PGE is standing up a residential storage pilot project now, but more experience with that pilot and understanding of the storage control systems is needed before determining how to leverage customer storage to address feeder generation limitations. Exploring customer-sited storage as a possible future solution should be explored in ongoing related dockets such as UM 2005 Distribution System Planning.

Recommendation #3: *In its reply comments, PGE should explain, in as much detail as possible, the timeline in which the current generation limited feeders are scheduled to receive the upgrades required to mitigate the need for the two-meter solution. PGE should also indicate how the utilization of the two-meter solution will be considered in its distribution system planning efforts, DRP efforts, and interconnection studies for Oregon small generators and community solar generators.*

When determining whether to invest in a feeder upgrade, PGE has a responsibility to all customers to ensure the upgrades are cost prudent and benefit all customers. For example, PGE must weigh a costly system upgrade that benefits one customer against other system upgrades that benefit multiple customers. To that end, PGE utilizes a portfolio prioritization process when determining system upgrades. With the exception of the Redland substation reconstruction (currently slated for 2025 completion), upgrades to the other generation limited feeders currently do not deliver sufficient benefits to be included on PGE's upgrade list. However, in response to the UM 2005 docket PGE will consider how utilities integrate DER enablement among other distribution investment priorities. PGE foresees some of the current generation limited feeders being prioritized for system upgrades based on decisions within the UM 2005 proceeding.

Recommendation #4: *In its reply comments, PGE should indicate whether it will continue to curtail generators after the required system upgrades and other DER management technologies are deployed.*

PGE does not intend to curtail generation via the two-meter solution after system upgrades are made or other, yet-to-be-identified DER management technologies are deployed. While PGE continues to develop alternative, longer-term technical solutions, curtailment may continue to be an effective tool in managing the reliability of the distribution system with greater penetration of DER on the system. As mentioned in PGE's most recent IRP, high renewable penetration may necessitate some level of curtailment.¹ Customers with the two-meter solution would be treated like all other customers and could be subject to disconnection for other reliability and safety reasons.

Recommendation #5: *In its reply comments, PGE should explain in detail if there is a point of penetration at which the two-meter solution will no longer allow additional net metering generators to interconnection safely and reliably without additional upgrades. PGE should address how reaching that point would affect customers with the two-meter solution in place.*

As net metering installations increase on a generation limited feeder, the second meter will continue to be offered to customers. PGE will not limit the number of customers that will be offered the two-meter option. Hours of curtailment will not increase, however the number of customers curtailed will increase with the addition of new net metering customers on the generation limited feeder. All net metering customers on the generation limited feeder will be subject to the same curtailment events on the shared feeder. There should not be a point of DER penetration in which the two-meter solution will no longer be viable. The two-meter recommendation will continue to be in place for feeders/substations that meet the generation limited criteria. A feeder may be lifted from being generation limited in the event that system improvements are made, or there are significant changes to the feeder load profile (external load additions) which renders the feeder to remain below the thresholds as defined as a generation limited feeder or substation transformer.

Generation Limited Feeder Criteria

PGE will work with Staff and Stakeholders to develop an on-going transparent process that provides Staff and Stakeholders visibility into PGE's generation limited feeder criteria

¹ In addition to calculating integration costs, the [integration costs analysis] yields curtailment statistics for candidate renewable resources. High production from renewable resources can result in periods of time where the system has an oversupply of renewable energy, which may be curtailed. Curtailment may occur for economic or operational reasons, and the cost and amount of curtailment depends on a variety of factors including market prices, system conditions, and resource constraints.

(e.g., posting to PGE's net metering website and workshops). Below, PGE provides more detailed information about 1) its specific criteria for identifying generation limited feeders; and 2) its specific criteria for determining which generators are on a generation limited feeder.

Recommendation #6: *In its reply comments, PGE should provide a detailed explanation of the criteria that it uses to identify generation limited feeders, including customer type, its methodology for calculating minimum daytime load and estimating solar PV generation, as well as, whether protective/sensing equipment is included in this criteria.*

A generation limited feeder has a higher risk of feedback, which would both damage equipment and impact reliability to all existing customers served on the feeder. PGE has identified the following current criteria to classify a feeder as generation limited, Limited Generation Feeder Identification, Net Minimum Load Output, Net Daytime Minimum Load Output and Gross Daytime Minimum Load Calculation. Detailed explanations of each identified criterion and the methodology is provided below.

Limited Generation Feeder Identification

If sufficient levels of protection are not present at the associated substation level, a limited feeder is defined as having aggregate daytime inverter-based generation (kW) greater than 90% of its minimum daytime consumption load (kW). This is in accordance with PGE's current Protection Design Practices. When determining whether a feeder is limited, PGE includes previously queued net metering projects and qualified facility projects in this calculation.

In addition, if sufficient levels of protection are not present at the attached substation transformer level, a limited feeder is also defined as a feeder attached to a substation transformer in which aggregate daytime generation (kW) is greater than or equal to 100% of its minimum daytime consumption load (kW). Feeders that meet either of these two tests are considered limited generation feeders.

Net Minimum Load Output

PGE uses software (PI Datalink) to generate the previous year's loading data (real power measured in megawatts) for each distribution feeder and distribution power transformer. Loading data is determined on an average hourly basis, therefore, 8760 points of loading data are available. From this dataset, any system condition considered to be "abnormal" will not be used. Abnormal conditions include any known load shifts from preferred to alternate feeder or the utilization of intermittent distributed generation such as DSG or non-solar inverter-based resources. After abnormal conditions are removed, the lowest hourly loading value is used. A timestamp for this loading value will be depicted at the "start" hour of this occurrence. If a minimum load must be determined during an abnormal condition; distribution system simulation via modeling tools, can be performed to determine an estimated minimum load value.

For networked distribution systems, coincidental minimal load values shall be collected for each network system or grouping of feeders to determine a “net” minimum loading value. Associated coincidental loading values of those feeders shall be recorded as their minimum load. A similar method is utilized for distribution power transformers that normally operate in parallel. A timestamp for these loading values will be depicted at the “start” hour of this occurrence. If a minimum load is determined during an abnormal condition; modeling tools, like PSS/E, can be utilized to determine an estimated minimum load value.

Recorded reactive demand shall be within the coincidental timeframe of the recorded minimum load output for their corresponding feeders or transformers.

Net Daytime Minimum Load Output

The methodology to obtain net daytime minimum load is similar to obtaining the net minimum load output with exception to available annual dataset. Specified daily “start” hours range from 9:00 to 16:00, rendering 2920 points of available loading data. Associated reactive demand and “start” hour timestamp is captured and recorded accordingly.

Gross Daytime Minimum Load Calculation

To calculate gross or pure demand, flowing into the distribution system, the following assumptions are made:

- Large Solar PV (~500kW or greater) is operating and calculated at a percentage of nameplate output depending on the month which daytime minimum load is determined.
- Small Solar PV (~< 500kW) is operating at and calculated at a percentage of nameplate output depending on the month which daytime minimum load is determined.
- Large Solar PV and Small Solar PV reduced outputs are added to net power output to determine gross load (kW).
- Only PV-related output is factored into this calculation. Other common DGs (storage, DSG, wind, etc.) are not included in this calculation.

Protective/sensing equipment is not included in the minimum or daytime minimum load calculation criteria.

Recommendation #7: *In its reply comments, PGE should provide a detailed explanation of the criteria it will use to determine whether an individual net metering applicant on a generation limited feeder is required to utilize the two-meter Solution.*

The criteria used to determine if an individual net metering applicant is required to utilize the two-meter solution is that if the applicant is currently served by a feeder that has been deemed as generation limited, the customer will be required to utilize the two-meter

solution in order to interconnect their system to PGE's distribution system. The customer will be required to add a second meter base to accommodate the remote-disconnect meter. The meter is provided and installed by PGE.

Recommendation #8: *In its reply comments, PGE should commit to a schedule on which it will update its generation limited feeders and notify the solar installation community. PGE should also refine its generation limited feeder list and methodologies with actual data following dispatch events.*

PGE will perform a general review of its generation limited feeders with publication of the daytime minimum load report. This will occur semi-annually. Additional updates may occur on a per-application basis during the net metering or QF review process. Scheduled updates shall occur during early autumn (September/October) and early spring (March/April) timeframes. PGE will notify the solar installation community by updating the publicly accessible map on PGE's website that displays the service areas of the generation limited feeders via polygons. Generation limited feeder lists/methodologies will likely not be updated based on dispatch events, but after a dispatch event occurs PGE will review and make and make updates if necessary.

Event Dispatch (Disconnect) Criteria

Though, PGE is still refining its event disconnect criteria, PGE is committed to sharing detailed information with Staff and Stakeholders as it further refines its event disconnect criteria. Below, PGE has provided responses and additional information regarding its event disconnect criteria.

Recommendation #9: *In its reply comments, PGE should provide a detailed explanation of its event dispatch criteria, including all assumptions and formulas, and an explanation of how and why it determined these criteria are the most appropriate for use in this solution.*

The remote disconnect criteria as currently envisioned includes sending a remote disconnect message via PGE's Automated Metering Infrastructure (AMI) network to disconnect the customer's second meter served by the feeder that is at risk of experiencing backfeed. This may be predetermined via data analysis, or data captured in real-time via SCADA-related information. Remote disconnection will occur only on a per feeder basis. The assumptions PGE will use to initiate a remote disconnect include the following:

- Time of day – peak solar times occur during daylight hours. Hours between 9:00 AM to 5:00 PM were selected as these are hours that solar irradiance is at the highest.
- Time of year (month) – Solar irradiance also changes on a month-to-month basis, with greater prominence during late spring/summer months than the remainder of the year.

- Ambient temperature - Ambient temperature is considered as an indicator of customer behavior. Daytime minimum load events occur when heating/HVAC usage is low.
- Sun/cloud cover – (Near) full solar PV output occurs only when there is minimal cloud cover.

Recommendation #10: *In its reply comments, PGE should explain why it is necessary and appropriate to disconnect net metering generators every time generation exceeds load, and whether other factors can be included in the predictive analysis that limit the need for curtailment. PGE should also indicate if all generators will be curtailed when an event is called, or if there is an order in which it will send disconnect signals on a given feeder.*

It is necessary and appropriate to disconnect net metering generators when generation exceeds load on a generation limited feeder to prevent catastrophic damage to transformers at the substation. If catastrophic damage were to occur it would not just affect the electric reliability for the net metering customer, but every customer served by the generation limited feeder. Additionally, catastrophic damage exposes all customers to increasing costs when repairs are necessary. Below is a technical explanation of what can occur to the distribution system if overvoltage were to occur.

As generation approaches load the anti-islanding capability of the DER may be comprised. PGE requires hot line reclosing blocking when generation reaches 90% of load in order to allow the DER anti-islanding to operate.

When there is ground fault on the high side of the substation transformer, the line relays will trip the line breakers leaving the substation primary without a ground reference for tapped (including line control) substations. The DER back-feeding to the primary will create an overvoltage condition on the unfaulted phases of up to 173% of normal phase-ground voltage. Until the fault is cleared and the back-feed condition is interrupted, the arresters on the un-faulted phases will be exposed to this overvoltage and will continuously conduct, leading to thermal runaway and arrester failure. The overvoltage condition can also damage the substation transformer and the line insulators. At low DER penetration the relatively large stranded load facilitates rapid cessation of the DER; at higher penetration levels the DER removes itself increasingly slowly. The DER protection does not see these type of faults.

1. To mitigate this PGE uses a scheme that rapidly detects the overvoltage condition and remove the transformer as a source; this is referred to as 3V0 sensing or as 59N protection.
2. PGE also sends transfer trip to the DER(s) causing the back-feed condition.

Any DER that causes back feed to transmission is required to have transfer trip.

Recommendation #11: *In its reply comments, PGE should clarify whether the ability to automate the event dispatch and the criteria for a generation limited feeder are mutually exclusive.*

The ability to automate event disconnect and the criteria for generation limited feeders are not mutually exclusive. For SCADA-enabled feeders, an automated event disconnect process is feasible. The criteria would be reduced to feeder loading meeting a certain threshold in real time, triggering a curtailment event.

Recommendation #12: *In its reply comments, PGE should propose a communication strategy to inform affected net metering customers within 48 hours of a temporary disconnection event under the two-meter solution. This communication should, at minimum, include the following details about the event:*

- *Date*
- *Start time*
- *End time*
- *Predicted feeder generation*
- *Predicted disaggregated load*
- *Predicted net load*
- *Actual net load*

PGE will inform affected net metering customers within 48 hours of a temporary disconnection event under the two-meter solution. We will provide the following details to the affected customer: Date, Start Time, End Time and Actual Net Load. PGE does not believe the predicted feeder generation or predicted disaggregated load values will be useful to customers and would not intend to include that data in the customer communication. PGE does commit to providing these values in a semi-annual or quarterly report to the OPUC.

PGE's reply comments to OSEIA

PGE appreciates that OSEIA largely agrees with staff's proposed recommendations filed in Staff comments. OSEIA's comments did not contain any specific recommendations or alternative proposed solutions to PGE's temporary proposal for net metering customers who are on generation limited feeders for PGE to respond to in reply comments. OSEIA brought up several issues that require a long-term solutions that PGE agrees should be addressed in more appropriate policy dockets such as UM 2111 Investigation into Interconnection Process and Policies, UM 2005 Distribution System Planning or UM 2011 General Capacity Investigation.

To reiterate PGE is committed to serving its customers. The proposed two-meter solution reflects that commitment. The two-meter solution is an interim measure to enable net metering interconnections on feeders that otherwise cannot support these interconnections. The two-meter solution is the least risk, least cost, most timely solution PGE has available at this time.

This solution is comprised of proven, reliable technology currently deployed on PGE's system. PGE appreciates Staff and Stakeholders questions and engagement on this very important issue. PGE is committed to working with parties on a balanced and equitable solution that does not impede interconnections on feeders that otherwise cannot support these interconnections.

This concludes PGE's comments.

Please direct questions or comments regarding this filing to Chris Pleasant at (503) 464-2555. Please direct all formal correspondence and requests to the following email address pge.opuc.filings@pgn.com

Sincerely,

\s\ Robert Macfarlane

Robert Macfarlane
Manager, Pricing & Tariffs

cc: UM 2099 Service list