Portland General Electric Company
121 SW Salmon Street • 1WTC0306 • Portland, OR 97204
portlandgeneral.com

July 23, 2021

Public Utility Commission of Oregon
Attention: Filing Center
P.O. Box 1088
Salem, OR 97308-1088

RE: UM 2099 In the Matter of PGE's Request for Approval of Agreement for Net Metering and Interconnection Services

Dear Filing Center,

In accordance with UM 2099 Order No. 20-402 enclosed for filing is Portland General Electric Company's (PGE) report reviewing the two-meter solution to date. The report contains the following details as requested in Order No. 20-402:

- 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;
- 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.

Additionally, enclosed for filing are the slides PGE presented in a workshop held on July 20, 2021 that was attended by OPUC Staff, Energy Trust of Oregon and Oregon Solar + Storage Industries Association where PGE presented and discussed the two-meter solution to date with stakeholders.

Thank you for your assistance in this matter. If you have any questions or require further information, please call Chris Pleasant at (503) 464-2555.

Please direct all formal correspondence, questions, or requests to the following e-mail address: pge.opuc.filings@pgn.com.

Sincerely,

\s\ Robert Macfarlane

Robert Macfarlane
Manager, Pricing & Tariffs

Enclosures

UM 2099

July 2021 Report

In accordance with UM 2099 Order No. 20-402 PGE submits this report that reviews the Two-Meter Solution to date.

Response 1. Location and size of net metering applicants required to utilize the two-meter solution.

As of July 2021, PGE has identified ten Generation-Limited Feeders (GLF). There are 34 net metering customers that are required to utilize the two-meter solution on eight of the Generation Limited Feeders. The table below provides a list of the current Generation Limited Feeders the kW DC System Size and the number of Customers utilizing the two-meter solution (TMS).

Generation Limited Feeders	kW DC System Size	# of Customers
1 BETHEL-GEER	33.44	3
2 CANBY-ZIMMERMAN	88.49	4
3 CANYON NETWORK	0	0
4 E-11064	0	0
5 MARQUAM NETWORK	0	0
6 REDLAND-REDLAND 13	164.46	5
7 SCOGGINS-LAURELWOOD	45.52	5
8 SCOTTS MILLS-SCOTTS MILLS 13	0	0
9 WACONDA-RIVER	0	0
10 WACONDA-WACONDA 13	26.38	4
11 WALLACE-WALLACE 13	30.06	3
12 WALLACE-WILLOW LAKE	0	0
13 YAMHILL-YAMHILL 13	134.96	10
Grand Total	**523.31**	**34**

Response 2. Date, time duration, location, number of systems affected for each event called.

PGE had two curtailment events in the Spring of 2021.

- The first event took place on Tuesday, March 9 from 3:00-3:30 PM for 30 minutes on the Estacada-North Fork feeder. Only one net metering customer's system was affected. PGE determined that the curtailment did not mitigate the backfeed and

ended the curtailment early. PGE was not expecting the need to curtail customers on the Estacada-North Fork feeder because there is not enough generation on that feeder to cause backfeed. PGE conducted an after-action review and found that the alarm was set at the transformer level which picked up backfeed from a Qualified Facility (QF) on the Estacada-13 feeder. The Estacada-13 and Estacada-North Fork are connected to the same transformer. The Estacada-13 feeder is not generation limited because when the QF was installed on that feeder, the necessary upgrades required to allow for backfeed were installed as part of the QF's interconnection. PGE has moved the alarm to the Estacada-North Fork feeder breaker to ensure the correct data point is being monitored in the future. After the first curtailment event PGE met with Staff and Stakeholders on March 19, 2021 to review the event and discuss the applied learnings from it.

- The second event took place on Wednesday, March 31, which began at 1:17 PM on the Scoggins-Laurelwood Feeder and lasted approximately 15 to 18 hours depending on the curtailed net metering customer (actual curtailed generation was much less given that the disconnection spanned nighttime hours when the net metering facilities would not be generating). Three net metering customer's systems were affected. As in the first event, PGE found that the curtailment did not mitigate the backfeed and attempted to end the curtailment early. This area of PGE's territory is very hilly and that affected PGE's AMI communication with its meters. Reconnection to two meters was delayed due to this situation. One customer's meter was reconnected at 7:36pm, the second at 6:53am on 4/1 and the third at 9:59am on 4/1. PGE is investigating the cause of the backfeed on this feeder.

Response 3. Any modifications to the implementation of the two-meter solution, including generation limited feeder criteria and event dispatch criteria.

The standards PGE uses to determine if a feeder is generation-limited have not changed since PGE began implementing the two-meter solution. However, PGE does conduct a systemwide review of all distribution feeders and transformers twice per year to determine if they have the potential to be listed or delisted as a generation-limited feeder. This analysis includes reviewing the feeder and transformer load and protection. PGE considers a feeder to be generation-limited if the following criteria are met.

- Feeder is a network feeder
- Feeder does not have Hot Line Blocking and Transfer trip and:
    - Existing Generation to Minimum Consumption Ratio is 90% or Greater, or
    - Future Generation to Minimum Consumption Ratio is 90% or Greater with no Planned Upgrades

PGE considers a Transformer to be generation-limited if the following criteria is met

- Transform is Generation limited if:
    - Substation Configuration does not allow backfeed and Transformer does not have 3V0 Protection, and

- Sum of Feeder Generation to Sum of Feeder Minimum Consumption Ratio is 100% or Greater, or
- Future Generation to Minimum Consumption Ratio is 100% or Greater with no Planned Upgrades, or
- Transformer Serves just one Feeder, and Generation to Minimum Consumption Ratio on that feeder is 90% or Greater, or
- Transformer Serves just one Feeder, and Future Generation to Minimum Consumption Ratio of that feeder is 90% or Greater with no Planned Upgrades

Based on the criteria outlined above, PGE was able to remove the Estacada-North Fork feeder from the list of generation-limited feeders due to planned upgrades. PGE added the following feeders to the generation-limited list:

- E-11064 because the existing generation to daytime minimum load ratio is greater than 90%, and
- Scotts Mills-Scotts Mills 13 because a planned Qualifying Facility (QF) implementation increases the generation:load ratio >90% but the QF implementation does not require upgrades that would protect against backfeed.
- Wallace-Willow Lake because there is a planned QF project on the feeder, but the project has not yet been approved.
- Canyon and Marquam because they are Network Feeders.

A modification PGE is considering making to the two-meter solution is establishing a threshold for initiating curtailment. PGE's substation-level monitoring equipment has a resolution of 100kW, meaning it cannot detect voltage fluctuations less than 100kW. PGE is investigating the possibility of not calling curtailment events on a given feeder until there is at least 100kW of TMS generation available to curtail.

Response 4. Any other relevant insights, including whether the imbalance generation and load actually occurred, and any customer feedback received.

PGE has learned many lessons in the last year of operating the two-meter solution. Some of the insights PGE would like to highlight are:

- The TMS provides PGE with a tool to maintain safe, reliable operation without imposing additional costs on net metering customers. However, PGE has found it to be labor intensive to operate with the current tools in place. Additionally, the TMS generation is often not sufficient to resolve the current backfeed on the identified generation-limited feeders. Finally, in many cases future net metering adoption is unlikely to cause backfeed. Based on these findings PGE is evaluating whether or not to request an extension with the Commission to continue deployment of the TMS in 2022.
- PGE is contemplating a smart inverter demonstration project within the Smart Grid Test Bed. The project proposal is being submitted internally for review in August 2021. Smart inverters can facilitate curtailments but will not entirely mitigate the need for possible curtailments. Ideally, customers would have behind the meter storage coupled with generation in order to mitigate curtailment.

Two-Meter Solution (TMS) Review

Shaun Foster, Manager – Interconnection Services

July 20, 2021

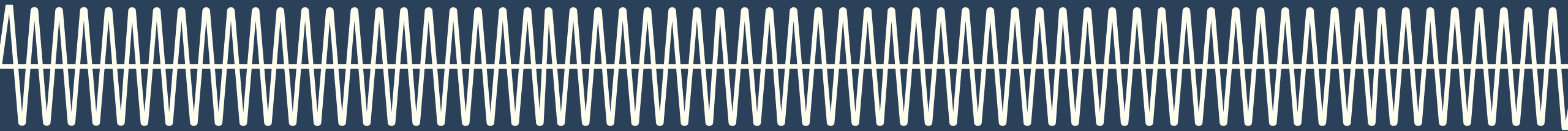
Two-Meter Solution Filing

The following language is from the Commission's UM 2099 Order:

- *PGE should file a report and host a workshop by July 31, 2021, to review the implementation of the two-meter solution to date, including:*
  - *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.*

This presentation provides a summary of the information that will be included in PGE's filing.

Two-Meter Solution Customer Summary



Two-Meter Solution Customers

Who is a TMS Customer?

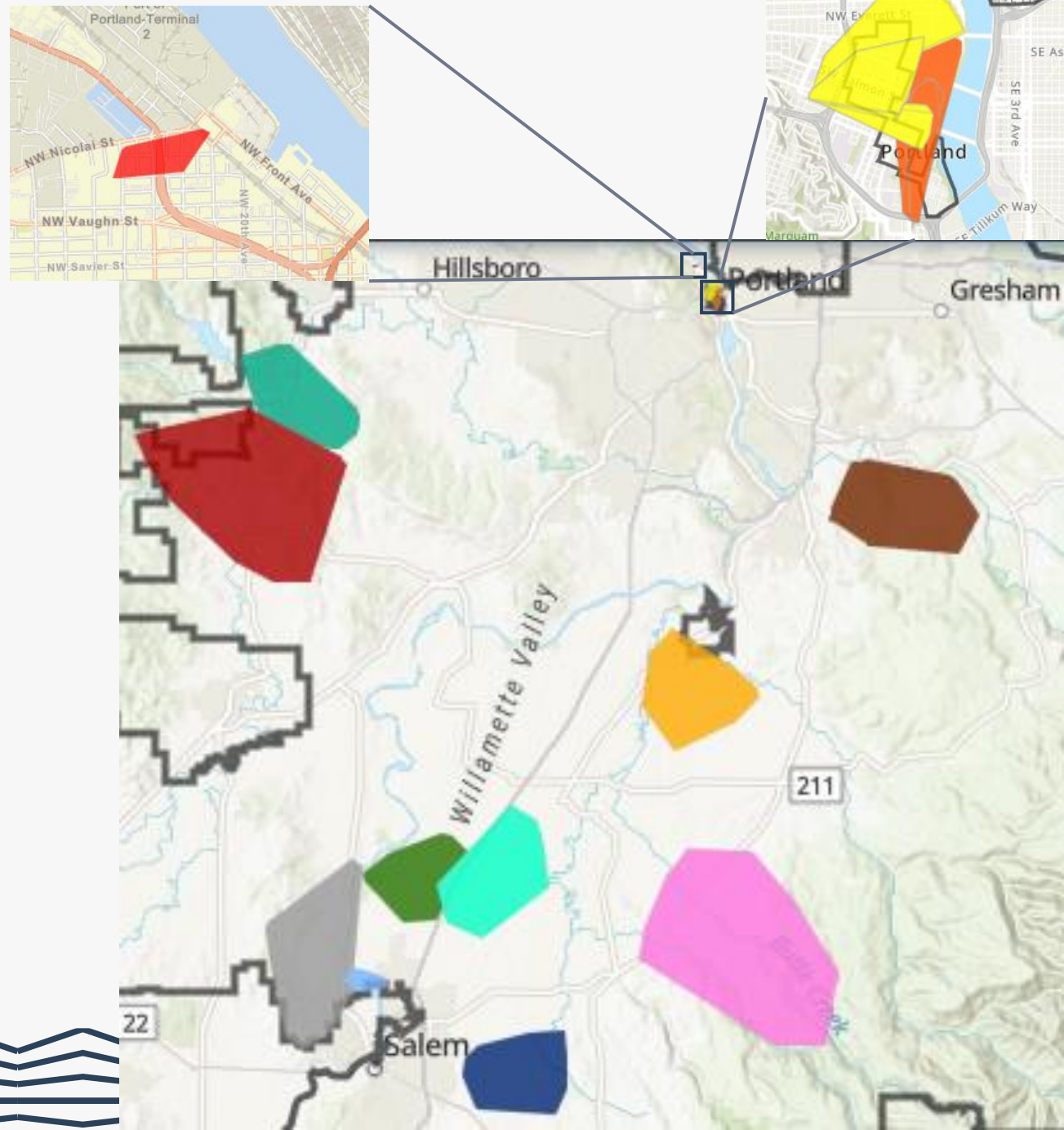
A customer with an installed second meter who is on a feeder that is currently identified as generation-limited.

When a feeder's constraints are removed and that feeder is no longer considered generation-limited, the affected TMS customers will be dropped from the TMS program.

Generation Limited Feeders	kW DC System Size	# of Customers
1 BETHEL-GEER	33.44	3
2 CANBY-ZIMMERMAN	88.49	4
4 REDLAND-REDLAND 13	164.46	5
5 SCOGGINS-LAURELWOOD	45.52	5
8 WACONDA-WACONDA 13	26.38	4
9 WALLACE-WALLACE 13	30.06	3
10 YAMHILL-YAMHILL 13	134.96	10
Grand Total	**523.31**	**34**

Generation-Limited Feeder Locations

Generation Limited Feeders	kW DC System Size	# of Customers
BETHEL-GEER	33.44	3
CANBY-ZIMMERMAN	88.49	4
CANYON NETWORK (8 feeders)	0	0
E-11064	0	0
MARQUAM NETWORK (12 feeders)	0	0
REDLAND-REDLAND 13	164.46	5
SCOGGINS-LAUREL WOOD	45.52	5
SCOTTS MILLS-SCOTTS MILLS 13	0	0
WACONDA-RIVER	0	0
WACONDA-WACONDA 13	26.38	4
WALLACE-WALLACE 13	30.06	3
WALLACE-WILLOW LAKE	0	0
YAMHILL-YAMHILL 13	134.96	10
Grand Total	523.31	34



Curtailment Summary

Curtailment Event Description

Event Characteristics	Event 1	Event 2
Date	Tuesday, March 9th	Wednesday, March 31st
Time	3 – 3:30pm	1:17 – 7:36pm 1:17 – 6:53am (4/1)* 1:17 – 9:59am (4/1)*
Duration	30 mins	6hrs 19mins 17hrs 36mins* 18hrs 42mins*
Location (Feeder)	Estacada-North Fork	Scoggins-Laurelwood
Systems (Customers) Affected	One (20.92kW)	Three (10.24kW, 11.05kW, 13.23kW)

*Note: Sunset on 3/31 was 7:38pm, which would mark the end of solar generation curtailment.

Event 1 Details

Curtailment Event: One TMS customer on the Estacada – North Fork feeder had their solar generation curtailed for ~30 mins (3:00-3:30) on Tuesday, March 9th.

What Went Well?	What Did We Learn?	Applied Learnings

• The curtailment process worked as designed
  • Alarm set as requested
  • Alarm triggered as expected
  • Grid Ops contacted AMI Ops
  • AMI Ops Disconnected the TMS customer
• Grid Ops determined that TMS curtailment didn't mitigate backfeed and ended the curtailment early
• We notified the PUC and Customer within 48hrs – customer was excited to be involved
	• Because the alarm was set at the Xfmr level (as requested), it picked up backfeed from a QF on a feeder that is not gen-limited, i.e., protection is in place
	• Notification to Interconnection Services needs to be more timely in order to support 48hr communication to customer
		• Complete: Reassess alarms and ensure they are at the correct resolution – feeder or transformer
		• Complete: Automated notification to Interconnection Services has been established
		• Explore how to collect feedback from customers after events

Event 2 Details

Curtailment Event: Three TMS customers on the Scoggins-Laurelwood feeder had their solar generation curtailed for approximately 6 hours on March 31st.

What Went Well?

- The curtailment process worked as designed
  - Alarm set as requested
  - Alarm triggered as expected
  - Grid Ops contacted AMI Ops
  - AMI Ops Disconnected the TMS customer
- Grid Ops determined that TMS curtailment didn't mitigate backfeed and issued the request to end the curtailment early

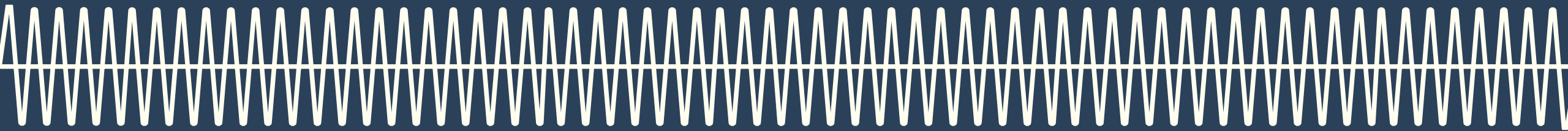
What Did We Learn?

- The TMS event was not enough to resolve the backfeed.
- This area of PGE's territory is very hilly and that affected PGE's AMI communication with its meters.
- The meters received and executed the curtailment command as expected
- The meters did not respond with a "curtailment complete" confirmation message, which caused confusion regarding the status of curtailment

Applied Learnings

- Going forward, a minor update to process, i.e. adding a "status confirmation" ping after the curtailment command to confirm successful communication
- Considering not initiating curtailments until there is sufficient TMS generation to resolve backfeed
- Investigating the source of over-generation on feeder
- Explore how to collect feedback from customers after events

Generation-Limited Feeder Update



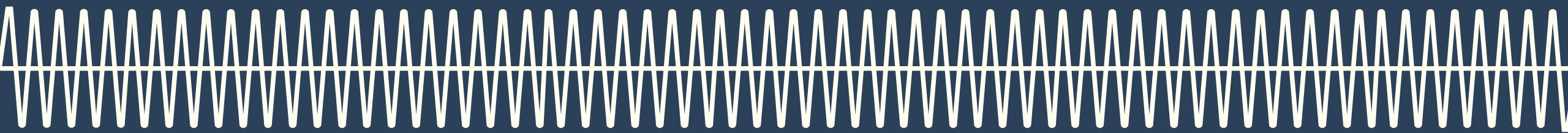
Generation Limited Feeder (GLF) Analysis

- Recap of GLF analysis process
  - Systemwide review of all distribution feeders and transformers twice per year
  - Feeder breaker and transformer protection reviewed and compared with results
  - Feeder is Generation Limited if:
    - Feeder is a network feeder
    - Feeder does not have Hot Line Blocking and Transfer trip, and
      - Existing Generation to Minimum Consumption Ratio is 90% or Greater, or
      - Future Generation to Minimum Consumption Ratio is 90% or Greater with no Planned Upgrades
  - Transformer is Generation Limited if:
    - Substation Configuration does not allow backfeed and Transformer does not have 3V0 Protection, and
      - Sum of Feeder Generation to Sum of Feeder Minimum Consumption Ratio is 100% or Greater, or
      - Future Generation to Minimum Consumption Ratio is 100% or Greater with no Planned Upgrades, or
      - Transformer Serves just one Feeder, and Generation to Minimum Consumption Ratio on that feeder is 90% or Greater, or
      - Transformer Serves just one Feeder, and Future Generation to Minimum Consumption Ratio of that feeder is 90% or Greater with no Planned Upgrades
- Results of most recent GLF Analysis
  - Removed Feeder: Estacada-North Fork – planned Interconnection project includes upgrades to feeder breaker
  - Added Feeders:
    - E-11064 – existing generation to Minimum Consumption Ratio is greater than 90%
    - Scotts Mills-Scotts Mills 13 – planned Interconnection project does not include upgrades
    - Wallace-Willow Lake – planned Interconnection project on substation transformer not yet approved
    - Canyon and Marquam – Network feeders

List of Generation Limited Feeders

#	Feeder Name	DER Capacity Connected (MW) [includes nm & small gen]	DER Capacity In Queue (MW) [includes small gen only]	Gen Nameplate: Min Consumption Ratio GEN/(GEN + Net DML)	Future DML (MW) (Net DML - DER Capacity in Queue)	Future Gen Nameplate: Min Consumption Ratio	Feeder Equipped for DER Readiness	Transformer Equipped "DER Ready" with Configuration or 3V0 Protection	Additional Notes
1	BETHEL-GEER	0.40	1.75	17%	0.17	93%	N	N	Generation Limited (Feeder)
2	CANBY-ZIMMERMAN	1.55	1.98	41%	0.27	93%	N	N	Generation Limited (Feeder + Xfmr)
3	E-11064	0.01	0.00	97%	0.00	97%	N	Y	Generation Limited (Feeder)
4	REDLAND-REDLAND 13	3.21	1.98	79%	-1.12	127%	N	N	Generation Limited (Feeder)
5	SCOGGINS-LAURELWOOD	2.35	0.00	113%	-0.27	113%	Y	N	Generation Limited (Transformer)
6	SCOTTS MILLS-SCOTTS MILLS 13	0.28	3.53	11%	-1.18	145%	N	N	Generation Limited (Feeder + Xfmr)
7	WACONDA-RIVER	0.31	0.00	27%	0.84	27%	Y	N	Generation Limited (Transformer)
8	WACONDA-WACONDA 13	5.28	4.75	142%	-6.31	270%	Y	N	Generation Limited (Transformer)
9	WALLACE-WALLACE 13	2.57	5.47	114%	-5.79	358%	Y	N	Generation Limited (Transformer)
10	WALLACE-WILLOW LAKE	0.05	0.00	4%	1.16	4%	Y	N	Generation Limited (Transformer)
11	YAMHILL-YAMHILL 13	0.84	2.50	24%	0.23	94%	N	N	Generation Limited (Feeder + Xfmr)

Insights and Modifications to the Two-Meter Solution



TMS Modifications and Insights

- Enhancing ability to communicate with some difficult-to-communicate-with meters
- Simplify the identification of generation-limited feeders by aligning DML definition between feeders and transformers
- Establish threshold for initiating curtailment
  - The monitoring equipment has a resolution of 100kW, meaning it cannot detect voltage fluctuations less than 100kW
  - Investigating the possibility of applying two conditions to the curtailment process
    - Installed TMS >100kW on a feeder
    - TMS generation available to curtail > backfeed
- Initiating discussion with Western Oregon Electric to investigate the source of over-generation on Scoggins-Laurelwood feeder
- Smart Grid Test Bed smart inverter demonstration project
  - Submitting proposal in August
  - Smart inverter can facilitate curtailments – doesn't mitigate curtailment. Need BTM storage solution coupled with generation to mitigate curtailment.

Discussion/Next Steps

- The TMS provides PGE with a tool to maintain safe, reliable operation without imposing additional costs on net metering customers
- Experience with the TMS to date
  - Labor intensive to operate with current tools
  - TMS generation is not in many cases sufficient to resolve current backfeed issues
  - Net metering adoption is often unlikely to cause backfeed
- Pursuit of alternatives
  - Several alternatives in development – will not help in '21/'22
  - Investigating possibility of redefining threshold for requiring 2nd meter
- PGE is evaluating whether or not to request an extension with the Commission to implement and deploy the TMS in 2022.