



**Portland General Electric**  
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PortlandGeneral.com

May 1, 2018

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 1728 Application to Update Schedule 201 Qualifying Facility Information

Pursuant to Oregon Revised Statutes 758.525 and Order No. 14-058, Portland General Electric Company (PGE) submits updated pricing pages for its Schedule 201, Qualifying Facility Power Purchase Information for Qualifying Facilities (QF) sized at 10 MW or less (3 MW or less for Solar QFs). Also attached for filing is a Declaration of Ryn Khandoker.

***1. The Revised Avoided Cost Prices are Consistent with Commission Orders and the Assumptions and Inputs Acknowledged by the Commission in PGE's 2016 IRP Update***

In Order No. 14-058, the Commission directed electric utilities to update their avoided cost prices on May 1 every year based on the following four factors:

1. Updated natural gas prices;
2. On- and off-peak forward-looking electricity market prices;
3. Changes to the status of the Production Tax Credit (PTC); and
4. Any other action or change in an acknowledged Integrated Resource Plan (IRP) update relevant to the calculation of avoided costs.

This filing incorporates updates to three of the four factors. It does not include updates to the third factor, as there were no applicable changes to the status of the PTC. The updates to the remaining three factors are discussed in Attachments A and B to this filing and were determined as follows:

1. *Updated natural gas prices*: these prices apply only to the Standard Fixed Price Option (i.e., non-renewable projects) and are updated every May 1. For this filing they were calculated, in part, based on the study described in Section 8 of PGE's acknowledged 2016 IRP Update and other approved methods for incorporating updated gas prices.
2. *On-and off-peak forward-looking electricity market prices*: these prices are updated every May 1. For this filing they were calculated, in part, based on the forward electricity curves presented in Section 9 of PGE's acknowledged 2016 IRP Update and other approved methods for incorporating updated electricity market prices.
3. *Any other action or change in an acknowledged IRP update*: PGE has revised the standard prices to reflect updated resource costs and operating parameters, carbon offset costs, financial parameters, and capacity contributions of incremental wind and solar resources as provided in the acknowledged 2016 IRP Update and described in Attachments A and B of this filing.<sup>1</sup>

PGE has provided detailed summaries of the Avoided Cost price calculations in Attachments A and B. Attachment C provides a summary of the inputs and assumptions. PGE is also providing work papers with this filing.

## **2. Prompt Commission Action is Necessary to Protect PGE's Customers**

PGE requests the Commission review the filing at the May 8, 2018 public meeting and order the prices effective upon approval. Order No. 14-058 allows the prices to be effective *within* 60 days of the May 1 filing.<sup>2</sup> The Commission has previously exercised its discretion to approve avoided cost filings earlier than the end of the sixty day period.<sup>3</sup> At the public meeting at which PGE's May 1, 2017 filing was considered, the Commission was clear that there should be no expectation that the Commission will take a full sixty days to rule on a May 1 update and that the Commission was not telegraphing any specific period for review. Commissioner Hardie unequivocally indicated that the only expectation that parties should have is that there will be a May 1 filing and a quick review of the filing.<sup>4</sup>

This filing is straightforward and lends itself to a quick review with nearly all updates having already been presented in PGE's acknowledged 2016 IRP Update. It is important that the Commission act promptly to ensure that avoided costs are updated as soon as possible to avoid the potential of significant harm to customers. An expeditious review of PGE's filing will not disrupt the "settled and uniform institutional climate" for QF developers as QF developers have had ample notice that avoided costs would decrease upon approval of PGE's May 1 filing and therefore have had plenty of

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<sup>1</sup> Acknowledged PGE's 2016 IRP Update (LC 66) at the OPUC April 24, 2018 Public Meeting.

<sup>2</sup> Order No. 14-058 at 26 (emphasis added).

<sup>3</sup> Order No. 7-177 (Commission approving PGE's May 1, 2017 avoided cost update effective June 1, 2017).

<sup>4</sup> May 18, 2017 Special Public Meeting at, 1:14:30.

time to submit QF applications and obtain executable contracts in advance of the May 1 filing.<sup>5</sup> For these reasons, which are discussed in more detail below, the Commission should approve the updated rates effective May 8, 2018.

**a. Any Delay in Reviewing PGE’s May 1 Filing May Result in Additional Expense to PGE’s Customers**

The Commission has a statutory duty to use the jurisdiction and powers of its office to protect customers from unjust and unreasonable extractions.<sup>6</sup> In this case, prompt Commission action is necessary to protect customers from bearing the costs of QF contracts at prices much higher than market costs. PGE is currently processing approximately 125 QF applications and the pace of new applications continues to be robust.<sup>7</sup> For example, PGE has received 99 applications since its last May 1 avoided cost filing and 51 applications since the September 18, 2017 effective date of PGE’s post-IRP acknowledgment avoided cost filing.<sup>8</sup> Almost all of the applications are from sophisticated out-of-state developers for solar facilities ranging in size from 1 to 3 MW, the size eligible for standard prices.<sup>9</sup> Each 3 MW solar project that PGE executes between now and the time new avoided cost prices are approved results in customers paying approximately \$770,000 more to QF developers than they would otherwise pay if the contracts were based on updated and more accurate avoided costs.<sup>10</sup> This additional expense and the corresponding potential harm to customers increases each day that the Commission delays ruling on PGE’s filing and allows inaccurate avoided costs to remain in effect.<sup>11</sup> The table below reflects the estimated customer price impacts if the Commission were to allow inaccurate prices to remain in effect until either the regularly scheduled May 22, 2018 or June 19, 2018 public meetings.<sup>12</sup>

Public Meeting	Avoided Cost Effective Date	Contracts Executed Since May 8th	Customer Impact <sup>13</sup> (Millions)
May 22nd	May 23rd	11	\$8.5
June 19th	June 20th	14	\$10.8

PGE notes that, even with this update, its prices are higher than what it expects from bids into its 2018 RFP and are significantly higher than those proposed by its neighboring utilities.<sup>14</sup> PGE supports PacifiCorp’s request to open a generic docket to

<sup>5</sup> ORS 758.515(3).

<sup>6</sup> ORS 756.040.

<sup>7</sup> Declaration of Ryin Khandoker at 1.

<sup>8</sup> *Id.* at 1.

<sup>9</sup> Declaration of Ryin Khandoker at 1, Order No. 17-310.

<sup>10</sup> *Id.* at 1.

<sup>11</sup> *Id.* at 1. While it is difficult to speculate as to how many contracts might be executed in any given time period, we note that during the month of April alone, PGE executed 17 Solar QF PPA for projects with nameplate at or under 3 MW.

<sup>12</sup> *Id.* at 2.

<sup>13</sup> Over 15 years

<sup>14</sup> See Docket No. UM 1729, PacifiCorp’s Motion for Emergency Interim Relief at 9 (Apr. 26, 2018).

re-examine avoided cost calculation methodologies.<sup>15</sup> The docket should aim to ensure that pricing methodologies do not provide incentives for QF developers to engage in geographic arbitrage.<sup>16</sup>

**b. An expeditious review of PGE's filing will not disrupt the "settled and uniform institutional climate" for QF developers**

PGE's filing lends itself to an expeditious review and the change in prices presents no surprises that would be disruptive to the QF developer community. The basis for calculating the avoided cost prices are routine and known. PGE uses the method that has been reflected in the Commission's rules for nearly forty years.<sup>17</sup> Additionally, PGE provided stakeholders with the assumptions and inputs to the methodology far in advance of the filing and PGE shared the updated supply-side resource assumptions and inputs with all stakeholders (including industry groups and attorneys representing QF developers) and Commission Staff on January 25, 2018 in preparation for the 2016 IRP Update. PGE provided updated capacity contribution values on February 28, 2018. PGE discussed these and other details regarding the IRP Update at its February 15, 2018 Roundtable meeting and filed the Update on March 8, 2018. Throughout the IRP Update process, PGE clearly informed its stakeholders that the assumptions and inputs would be the basis for the May 1 avoided cost update.<sup>18</sup> Stakeholders had months to review the assumptions and inputs and no party objected to them. Staff declared the data to be "accurate and relatively well-sourced" and "well-documented and credible."<sup>19</sup>

It should also be no surprise to the QF development community that PGE is seeking an expeditious review and approval of this filing. PGE has made numerous filings alerting the Commission and customer groups of the harm to customers resulting from the payment of outdated and artificially high avoided costs to QF developers and has repeatedly attempted to obtain relief from this Commission for the resulting harm to customers.<sup>20</sup> QF developers know that utilities file updated avoided cost prices on May 1; they know the Commission has stated that it will act quickly in reviewing the May 1 filings; and they know that PGE has aggressively tried to protect customers from the expense of outdated and inaccurate avoided cost prices. An expeditious approval of PGE's filing will not be unexpected or disruptive to the QF development community.

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<sup>15</sup> *Id.*

<sup>16</sup> See Order No. 16-130 at 4.

<sup>17</sup> OAR 860-029-0040, originally adopted in 1981.

<sup>18</sup> Docket No. LC 66, PGE's Motion for Commission Acknowledgment of PGE's 2016 Integrated Resource Plan Update at 2 (Mar. 8, 2018).

<sup>19</sup> Docket No. LC 66, Staff Report at 5 (April 17, 2018); April 24, 2018 Public Meeting at 50:00 (JP Batmale: "The aspects of the IRP Update that change the key parameters in the Company's avoided cost data appear to be well documented and credible.")

<sup>20</sup> See Docket No. UM 1728, PGE's Application to Update Schedule 201 (May 1, 2017) (requesting May 17, 2017 effective date for May 1, 2017 rate update, noting volume of pending applications for QF contracts, and addressing economic harm to customers that could result from delayed approval of updated rates); Docket No. UM 1854, PGE's Application to Lower the Standard Price and Standard Contract Eligibility Cap for Solar Qualifying Facilities at 9-13, (Jun. 30, 2017) (discussing the harm to customers resulting from inaccurate standard avoided costs); Docket No. UM 1728, PGE's Motion for Temporary Relief from Schedule 201 Prices at 1-3 and 6-10 (Aug. 18, 2017) (describing harm to customers associated with outdated and artificially high standard avoided costs rates).

Developers have had ample opportunity to submit applications in time to ensure that they obtain executable contracts prior to the May 1 filing.

Indeed, this filing presents an opportunity for the Commission to address a situation where QF developers have the ability to act to protect their interests but customers do not. Developers can time their applications for standard QF contracts to ensure they obtain a given set of avoided cost prices. Customers, on the other hand, must rely on the Commission to ensure that the costs paid to QF developers are accurate and up to date. PGE has made every effort to get the assumptions and inputs contained in this filing to Commission Staff, stakeholders and the QF development community as far in advance of the filing as possible. PGE has done so because it recognizes that the consequences here are significant – each week of delay in approving the filing results in additional expense to our customers. PGE therefore urges the Commission to act quickly and approve the filing at its May 8, 2018 public meeting.

Should you have any questions or comments regarding this filing, please contact Rob Macfarlane at (503) 464-8954. Please direct all formal correspondence and requests to the following email address [pge.opuc.filings@pgn.com](mailto:pge.opuc.filings@pgn.com)

Sincerely,



Robert Macfarlane  
Interim Manager, Pricing and Tariffs

Enclosures

cc: Service List – UM 1610

**SCHEDULE 201  
QUALIFYING FACILITY 10 MW or LESS  
AVOIDED COST POWER PURCHASE INFORMATION**

**PURPOSE**

To provide information about Standard Avoided Costs and Renewable Avoided Costs, Standard Power Purchase Agreements (PPA) and Negotiated PPAs, power purchase prices and price options for power delivered by a Qualifying Facility (QF) to the Company with nameplate capacity of 10,000 kW (10MW) or less.

**AVAILABLE**

To owners of QFs making sales of electricity to the Company in the State of Oregon (Seller).

**APPLICABLE**

For power purchased from small power production or cogeneration facilities that are QFs as defined in 18 Code of Federal Regulations (CFR) Section 292, that meet the eligibility requirements described herein and where the energy is delivered to the Company's system and made available for Company purchase pursuant to a Standard PPA.

**ESTABLISHING CREDITWORTHINESS**

The Seller must establish creditworthiness prior to service under this schedule. For a Standard PPA, a Seller may establish creditworthiness with a written acknowledgment that it is current on all existing debt obligations and that it was not a debtor in a bankruptcy proceeding within the preceding 24 months. If the Seller is not able to establish creditworthiness, the Seller must provide security deemed sufficient by the Company as set forth in the Standard PPA.

**POWER PURCHASE INFORMATION**

A Seller may call the Power Production Coordinator at (503) 464-8000 to obtain more information about being a Seller or how to apply for service under this schedule.

**PPA**

In accordance with terms set forth in this schedule and the Commission's Rules as applicable, the Company will purchase any Energy in excess of station service (power necessary to produce generation) and amounts attributable to conversion losses, which are made available from the Seller.

A Seller must execute a PPA with the Company prior to delivery of power to the Company. The agreement will have a term of up to 20 years as selected by the QF.

A QF with a nameplate capacity rating of 10 MW or less as defined herein may elect the option of a Standard PPA.

**SCHEDULE 201 (Continued)**

## PPA (Continued)

Any Seller may elect to negotiate a PPA with the Company. Such negotiation will comply with the requirements of the Federal Energy Regulatory Commission (FERC), and the Commission including the guidelines in Order No. 07-360, and Schedule 202. Negotiations for power purchase pricing will be based on either the filed Standard Avoided Costs or Renewable Avoided Costs in effect at that time.

**STANDARD PPA (Nameplate capacity of 10 MW or less)**

A Seller choosing a Standard PPA will complete all informational and price option selection requirements in the applicable Standard PPA and submit the executed Agreement to the Company prior to service under this schedule. The Standard PPA is available at [www.portlandgeneral.com](http://www.portlandgeneral.com). The available Standard PPAs are:

- Standard In-System Non-Variable Power Purchase Agreement
- Standard Off-System Non-Variable Power Purchase Agreement
- Standard In-System Variable Power Purchase Agreement
- Standard Off-System Variable Power Purchase Agreement
- Standard Renewable In-System Non-Variable Power Purchase Agreement
- Standard Renewable Off-System Non-Variable Power Purchase Agreement
- Standard Renewable In-System Variable Power Purchase Agreement
- Standard Renewable Off-System Variable Power Purchase Agreement

The Standard PPAs applicable to variable resources are available only to QFs utilizing wind, solar or run of river hydro as the primary motive force.

**GUIDELINES FOR 10 MW OR LESS FACILITIES ELECTING STANDARD PPA**

To execute the Standard PPA the Seller must complete all of the general project information requested in the applicable Standard PPA.

When all information required in the Standard PPA has been received in writing from the Seller, the Company will respond within 15 business days with a draft Standard PPA.

The Seller may request in writing that the Company prepare a final draft Standard PPA. The Company will respond to this request within 15 business days. In connection with such request, the QF must provide the Company with any additional or clarified project information that the Company reasonably determines to be necessary for the preparation of a final draft Standard PPA.

When both parties are in full agreement as to all terms and conditions of the draft Standard PPA, the Company will prepare and forward to the Seller a final executable version of the agreement within 15 business days. Following the Company's execution, an executed copy will be returned to the Seller. Prices and other terms and conditions in the PPA will not be final and binding until the Standard PPA has been executed by both parties.

**SCHEDULE 201 (Continued)****OFF-SYSTEM PPA**

A Seller with a facility that interconnects with an electric system other than the Company's electric system may enter into a PPA with the Company after following the applicable Standard or Negotiated PPA guidelines and making the arrangements necessary for transmission of power to the Company's system.

**BASIS FOR POWER PURCHASE PRICE****AVOIDED COST SUMMARY**

The power purchase prices are based on either the Company's Standard Avoided Costs or Renewable Avoided Costs in effect at the time the agreement is executed. Avoided Costs are defined in 18 CFR 292.101(6) as "the incremental costs to an electric utility of electric energy or capacity or both which, but for the purchase from the qualifying facility or qualifying facilities, such utility would generate itself or purchase from another source."

Monthly On-Peak prices are included in both the Standard Avoided Costs as listed in Tables 1a, 2a, and 3a and Renewable Avoided Costs as listed in Tables 4a, 5a, and 6a. Monthly Off-Peak prices are included in both the Standard Avoided Costs as listed in Tables 1b, 2b, and 3b and Renewable Avoided Costs as listed in Tables 4b, 5b, and 6b.

**ON-PEAK PERIOD**

The On-Peak period is 6:00 a.m. until 10:00 p.m., Monday through Saturday.

**OFF-PEAK PERIOD**

The Off-Peak period is 10:00 p.m. until 6:00 a.m., Monday through Saturday, and all day on Sunday.

Standard Avoided Costs are based on forward market price estimates through the Resource Sufficiency Period, the period of time during which the Company's Standard Avoided Costs are associated with incremental purchases of Energy and capacity from the market. For the Resource Deficiency Period, the Standard Avoided Costs reflect the fully allocated costs of a natural gas fueled combined cycle combustion turbine (CCCT) including fuel and capital costs. The CCCT Avoided Costs are based on the variable cost of Energy plus capitalized Energy costs at a 93% capacity factor based on a natural gas price forecast, with prices modified for shrinkage and transportation costs.

Renewable Avoided Costs are based on forward market price estimates through the Renewable Resource Sufficiency Period, the period of time during which the Company's Renewable Avoided Costs are associated with incremental purchases of energy and capacity from the market. For the Renewable Resource Deficiency Period, the Renewable Avoided Costs reflect the fully allocated costs of a wind plant including capital costs.



**SCHEDULE 201 (Continued)****PRICING FOR STANDARD PPA**

Pricing represents the purchase price per MWh the Company will pay for electricity delivered to a Point of Delivery (POD) within the Company's service territory pursuant to a Standard PPA up to the nameplate rating of the QF in any hour. Any Energy delivered in excess of the nameplate rating will be purchased at the applicable Off-Peak Prices for the selected pricing option.

The Standard PPA pricing will be based on either the Standard or Renewable Avoided Costs in effect at the time the agreement is executed.

The Company will pay the Seller either the Off-Peak Standard Avoided Cost pursuant to Tables 1b, 2b, or 3b or the Off-Peak Renewable Avoided Costs pursuant to Tables 4b, 5b, or 6b for: (a) all Net Output delivered prior to the Commercial Operation Date; (b) all Net Output deliveries greater than Maximum Net Output in any PPA year; (c) any generation subject to and as adjusted by the provisions of Section 4.3 of the Standard PPA; (d) Net Output delivered in the Off-Peak Period; and (e) deliveries above the nameplate capacity in any hour. The Company will pay the Seller either the On-Peak Standard Avoided Cost pursuant to Tables 1a, 2a, or 3a or the On-Peak Renewable Avoided Costs pursuant to Tables 4a, 5a, or 6a for all other Net Output. (See the PPA for defined terms.)

**1) Standard Fixed Price Option**

The Standard Fixed Price Option is based on Standard Avoided Costs including forecasted natural gas prices. It is available to all QFs.

This option is available for a maximum term of 15 years. Prices will be as established at the time the Standard PPA is executed and will be equal to the Standard Avoided Costs in Tables 1a and 1b, 2a and 2b, or 3a and 3c, depending on the type of QF, effective at execution. QFs using any resource type other than wind and solar are assumed to be Base Load QFs.

Prices paid to the Seller under the Standard Fixed Price Option include adjustments for the capacity contribution of the QF resource type relative to that of the avoided proxy resource. Both the Base Load QF resources (Tables 1a and 1b) and the avoided proxy resource, the basis used to determine Standard Avoided Costs for the Standard Fixed Price Option, are assumed to have a capacity contribution to peak of 100%. The capacity contribution for Wind QF resources (Tables 2a and 2b) is assumed to be 5%. The capacity contribution for Solar QF resources (Tables 3a and 3b) is assumed to be 5%.

Prices paid to the Seller under the Standard Fixed Price Option for Wind QFs (Tables 2a and 2b) include a reduction for the wind integration costs in Table 7. However, if the Wind QF is outside of PGE's Balancing Authority Area as contemplated in the Commission's Order No. 14-058, the Seller is paid the wind integration charges in Table 7, in addition to the prices listed in Tables 2a and 2b, for a net-zero effect.

**SCHEDULE 201 (Continued)**

PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

Sellers with PPAs exceeding 15 years will receive pricing equal to the Mid-C Index Price for all years up to five in excess of the initial 15.

## SCHEDULE 201 (Continued)

PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

TABLE 1a												
Avoided Costs												
Fixed Price Option for Base Load QF												
On-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92
2021	53.16	53.01	52.61	50.38	50.26	50.41	50.57	50.64	50.61	50.78	51.95	52.88
2022	54.48	54.34	53.95	51.85	51.74	51.90	52.08	52.20	52.21	52.38	53.73	54.66
2023	56.37	56.22	55.84	53.95	53.82	53.99	54.16	54.32	54.33	54.50	55.07	56.02
2024	57.14	57.22	57.27	56.39	56.47	56.55	56.63	56.70	56.79	56.86	57.95	58.04
2025	59.42	59.50	59.22	58.30	58.35	58.38	58.47	58.55	58.64	58.76	59.85	59.94
2026	61.26	61.34	60.96	59.99	60.00	60.09	60.18	60.28	60.36	60.45	61.62	61.71
2027	63.05	63.15	63.21	62.23	62.32	62.42	62.51	62.61	62.71	62.81	64.05	64.15
2028	65.50	65.60	65.71	64.78	64.88	64.99	65.09	65.20	65.31	65.57	66.73	66.84
2029	68.38	68.50	68.61	67.74	67.99	68.31	68.43	68.55	68.68	68.83	70.20	70.32
2030	72.05	73.56	73.70	72.63	72.78	72.93	73.06	73.21	73.35	73.60	75.04	75.19
2031	76.89	77.04	77.19	75.90	76.04	76.20	76.35	76.51	76.67	76.89	78.46	78.63
2032	80.15	80.31	80.32	78.82	78.98	79.15	79.31	79.49	79.65	79.83	81.57	81.74
2033	83.87	84.06	83.65	82.24	82.40	82.36	82.54	82.72	82.89	83.08	84.89	85.08
2034	87.14	87.33	85.15	83.71	83.90	83.97	84.15	84.33	84.53	84.70	86.54	86.74
2035	88.57	88.77	86.55	84.34	84.53	83.66	83.83	84.01	84.17	84.53	86.09	86.28
2036	90.60	90.80	88.52	86.23	86.42	85.54	85.71	85.89	86.07	86.41	88.05	88.24
2037	92.98	93.19	90.82	88.49	88.67	87.76	87.94	88.13	88.31	88.67	90.35	90.55
2038	95.27	95.48	93.05	90.63	90.82	89.89	90.08	90.27	90.45	90.83	92.55	92.76
2039	97.63	97.85	95.34	92.86	93.04	92.07	92.26	92.46	92.67	93.04	94.82	95.04
2040	100.01	100.24	97.64	95.08	95.29	94.29	94.50	94.68	94.89	95.29	97.13	97.33
2041	102.51	102.74	100.07	97.43	97.64	96.62	96.81	97.02	97.24	97.64	99.54	99.75
2042	105.06	105.30	102.54	99.81	100.03	98.97	99.17	99.40	99.63	100.03	101.97	102.21
2043	107.67	107.92	105.08	102.27	102.48	101.39	101.60	101.84	102.07	102.48	104.49	104.74

## SCHEDULE 201 (Continued)

PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

TABLE 1b												
Avoided Costs												
Fixed Price Option for Base Load QF												
Off-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65
2021	23.55	23.41	23.01	20.77	20.65	20.80	20.97	21.03	21.00	21.17	22.35	23.27
2022	24.28	24.14	23.76	21.65	21.54	21.70	21.88	22.00	22.01	22.18	23.53	24.47
2023	25.47	25.32	24.94	23.05	22.92	23.09	23.26	23.42	23.43	23.60	24.16	25.12
2024	25.82	25.91	25.95	25.07	25.15	25.23	25.31	25.39	25.47	25.55	26.64	26.72
2025	27.37	27.46	27.18	26.26	26.30	26.33	26.42	26.51	26.59	26.71	27.80	27.89
2026	28.57	28.66	28.27	27.30	27.31	27.40	27.49	27.59	27.68	27.77	28.93	29.02
2027	29.71	29.81	29.87	28.89	28.98	29.08	29.17	29.27	29.37	29.47	30.71	30.81
2028	31.50	31.60	31.70	30.77	30.88	30.98	31.08	31.20	31.30	31.56	32.72	32.84
2029	33.70	33.82	33.92	33.06	33.30	33.63	33.74	33.86	33.99	34.14	35.51	35.64
2030	36.67	38.19	38.32	37.26	37.40	37.55	37.69	37.83	37.97	38.22	39.67	39.81
2031	40.80	40.95	41.11	39.82	39.95	40.11	40.27	40.43	40.59	40.80	42.37	42.54
2032	43.58	43.74	43.75	42.25	42.41	42.57	42.73	42.92	43.08	43.26	44.99	45.17
2033	46.33	46.52	46.11	44.69	44.86	44.82	45.00	45.17	45.35	45.54	47.35	47.54
2034	48.72	48.91	46.73	45.30	45.48	45.56	45.74	45.92	46.11	46.28	48.13	48.32
2035	49.51	49.71	47.50	45.28	45.47	44.60	44.77	44.96	45.11	45.47	47.04	47.22
2036	50.89	51.09	48.81	46.52	46.71	45.83	46.00	46.17	46.36	46.70	48.34	48.53
2037	52.35	52.56	50.19	47.86	48.03	47.13	47.31	47.50	47.68	48.03	49.72	49.91
2038	53.83	54.04	51.61	49.19	49.37	48.45	48.63	48.82	49.01	49.38	51.10	51.31
2039	55.36	55.57	53.06	50.58	50.77	49.80	49.98	50.18	50.40	50.77	52.55	52.76
2040	56.89	57.12	54.52	51.96	52.18	51.17	51.38	51.56	51.77	52.18	54.01	54.21
2041	58.52	58.76	56.09	53.45	53.66	52.64	52.83	53.04	53.26	53.66	55.56	55.77
2042	60.20	60.44	57.68	54.95	55.17	54.11	54.31	54.54	54.76	55.17	57.11	57.35
2043	61.91	62.16	59.32	56.51	56.73	55.63	55.85	56.08	56.31	56.73	58.73	58.98

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

TABLE 2a												
Avoided Costs												
Fixed Price Option for Wind QF												
On-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					14.38	16.41	28.39	34.00	29.92	24.06	24.06	30.18
2019	26.96	25.36	20.60	17.31	16.88	17.31	28.46	31.79	29.49	23.60	25.53	29.90
2020	30.82	29.10	23.42	18.71	18.08	19.01	29.76	34.15	31.06	26.48	28.53	34.02
2021	35.34	35.20	34.80	32.56	32.44	32.60	32.76	32.83	32.79	32.96	34.14	35.06
2022	36.31	36.16	35.78	33.68	33.57	33.73	33.91	34.03	34.03	34.21	35.56	36.49
2023	37.78	37.63	37.25	35.36	35.23	35.40	35.57	35.72	35.74	35.91	36.47	37.43
2024	38.29	38.37	38.42	37.54	37.62	37.70	37.78	37.85	37.94	38.01	39.10	39.19
2025	40.13	40.22	39.94	39.02	39.06	39.09	39.18	39.27	39.35	39.47	40.56	40.65
2026	41.59	41.67	41.29	40.32	40.33	40.42	40.51	40.61	40.69	40.78	41.95	42.04
2027	42.99	43.09	43.14	42.16	42.25	42.36	42.45	42.55	42.65	42.75	43.99	44.09
2028	45.04	45.14	45.24	44.32	44.42	44.52	44.63	44.74	44.84	45.11	46.26	46.38
2029	47.51	47.63	47.73	46.87	47.11	47.44	47.56	47.68	47.80	47.96	49.32	49.45
2030	50.76	52.28	52.41	51.35	51.49	51.65	51.78	51.92	52.06	52.31	53.76	53.90
2031	55.18	55.33	55.48	54.19	54.33	54.49	54.64	54.80	54.96	55.18	56.75	56.92
2032	58.14	58.30	58.32	56.82	56.98	57.14	57.30	57.49	57.65	57.82	59.56	59.73
2033	61.28	61.47	61.06	59.64	59.81	59.77	59.95	60.13	60.30	60.49	62.30	62.49
2034	64.03	64.22	62.04	60.61	60.79	60.86	61.04	61.23	61.42	61.59	63.43	63.63
2035	65.07	65.27	63.06	60.85	61.03	60.16	60.33	60.52	60.68	61.03	62.60	62.78
2036	66.70	66.90	64.62	62.34	62.52	61.64	61.81	61.99	62.17	62.51	64.15	64.34
2037	68.54	68.74	66.37	64.05	64.22	63.32	63.50	63.69	63.87	64.22	65.91	66.10
2038	70.34	70.54	68.11	65.70	65.88	64.95	65.14	65.33	65.51	65.89	67.61	67.82
2039	72.20	72.41	69.91	67.43	67.61	66.64	66.83	67.03	67.24	67.61	69.39	69.61
2040	74.06	74.29	71.69	69.13	69.35	68.35	68.55	68.74	68.94	69.35	71.18	71.39
2041	76.04	76.28	73.61	70.97	71.18	70.15	70.35	70.55	70.78	71.18	73.07	73.28
2042	78.07	78.31	75.56	72.82	73.05	71.99	72.18	72.41	72.64	73.05	74.98	75.23
2043	80.14	80.39	77.55	74.74	74.96	73.86	74.08	74.31	74.54	74.96	76.96	77.21

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

<b>TABLE 2b</b>												
<b>Avoided Costs</b>												
<b>Fixed Price Option for Wind QF</b>												
<b>Off-Peak Forecast (\$/MWH)</b>												
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>2018</b>					5.71	5.71	15.04	23.04	23.55	20.49	20.49	24.82
<b>2019</b>	22.46	21.80	17.19	10.78	8.57	7.69	17.89	22.33	22.76	20.60	21.72	25.24
<b>2020</b>	24.58	24.78	19.24	13.17	10.00	9.63	19.09	25.24	25.73	23.44	25.06	29.75
<b>2021</b>	22.63	22.49	22.09	19.85	19.73	19.88	20.05	20.11	20.08	20.25	21.43	22.35
<b>2022</b>	23.34	23.20	22.82	20.71	20.60	20.76	20.94	21.06	21.07	21.24	22.59	23.53
<b>2023</b>	24.51	24.36	23.98	22.09	21.96	22.13	22.30	22.46	22.47	22.64	23.20	24.16
<b>2024</b>	24.84	24.93	24.97	24.09	24.17	24.25	24.33	24.41	24.49	24.57	25.66	25.74
<b>2025</b>	26.37	26.46	26.18	25.26	25.30	25.33	25.42	25.51	25.59	25.71	26.80	26.89
<b>2026</b>	27.55	27.64	27.25	26.28	26.29	26.38	26.47	26.57	26.66	26.75	27.91	28.00
<b>2027</b>	28.67	28.77	28.83	27.85	27.94	28.04	28.13	28.23	28.33	28.43	29.67	29.77
<b>2028</b>	30.44	30.54	30.64	29.71	29.82	29.92	30.02	30.14	30.24	30.50	31.66	31.78
<b>2029</b>	32.62	32.74	32.84	31.98	32.22	32.55	32.66	32.78	32.91	33.06	34.43	34.56
<b>2030</b>	35.57	37.09	37.22	36.16	36.30	36.45	36.59	36.73	36.87	37.12	38.57	38.71
<b>2031</b>	39.68	39.83	39.99	38.70	38.83	38.99	39.15	39.31	39.47	39.68	41.25	41.42
<b>2032</b>	42.44	42.60	42.61	41.11	41.27	41.43	41.59	41.78	41.94	42.12	43.85	44.03
<b>2033</b>	45.16	45.35	44.94	43.52	43.69	43.65	43.83	44.00	44.18	44.37	46.18	46.37
<b>2034</b>	47.53	47.72	45.54	44.11	44.29	44.37	44.55	44.73	44.92	45.09	46.94	47.13
<b>2035</b>	48.30	48.50	46.29	44.07	44.26	43.39	43.56	43.75	43.90	44.26	45.83	46.01
<b>2036</b>	49.65	49.85	47.57	45.28	45.47	44.59	44.76	44.93	45.12	45.46	47.10	47.29
<b>2037</b>	51.09	51.30	48.93	46.60	46.77	45.87	46.05	46.24	46.42	46.77	48.46	48.65
<b>2038</b>	52.54	52.75	50.32	47.90	48.08	47.16	47.34	47.53	47.72	48.09	49.81	50.02
<b>2039</b>	54.05	54.26	51.75	49.27	49.46	48.49	48.67	48.87	49.09	49.46	51.24	51.45
<b>2040</b>	55.55	55.78	53.18	50.62	50.84	49.83	50.04	50.22	50.43	50.84	52.67	52.87
<b>2041</b>	57.15	57.39	54.72	52.08	52.29	51.27	51.46	51.67	51.89	52.29	54.19	54.40
<b>2042</b>	58.81	59.05	56.29	53.56	53.78	52.72	52.92	53.15	53.37	53.78	55.72	55.96
<b>2043</b>	60.49	60.74	57.90	55.09	55.31	54.21	54.43	54.66	54.89	55.31	57.31	57.56

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

<b>TABLE 3a</b>												
<b>Avoided Costs</b>												
<b>Fixed Price Option for Solar QF</b>												
<b>On-Peak Forecast (\$/MWH)</b>												
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>2018</b>					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05
<b>2019</b>	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78
<b>2020</b>	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92
<b>2021</b>	34.38	34.23	33.83	31.60	31.48	31.63	31.79	31.86	31.83	32.00	33.17	34.09
<b>2022</b>	35.32	35.18	34.80	32.69	32.58	32.75	32.92	33.04	33.05	33.22	34.57	35.51
<b>2023</b>	36.77	36.62	36.24	34.35	34.22	34.39	34.56	34.71	34.73	34.90	35.46	36.42
<b>2024</b>	37.27	37.36	37.40	36.52	36.61	36.68	36.76	36.84	36.92	37.00	38.09	38.17
<b>2025</b>	39.09	39.18	38.89	37.98	38.02	38.05	38.14	38.22	38.31	38.43	39.52	39.61
<b>2026</b>	40.52	40.61	40.22	39.26	39.27	39.35	39.44	39.54	39.63	39.72	40.89	40.97
<b>2027</b>	41.90	42.00	42.06	41.08	41.17	41.27	41.36	41.46	41.56	41.66	42.90	43.00
<b>2028</b>	43.93	44.03	44.14	43.21	43.31	43.41	43.52	43.63	43.74	44.00	45.16	45.27
<b>2029</b>	46.38	46.50	46.60	45.74	45.98	46.31	46.43	46.54	46.67	46.83	48.19	48.32
<b>2030</b>	49.61	51.12	51.25	50.19	50.34	50.49	50.62	50.76	50.91	51.16	52.60	52.74
<b>2031</b>	54.00	54.14	54.30	53.01	53.15	53.31	53.46	53.62	53.78	54.00	55.57	55.74
<b>2032</b>	56.95	57.11	57.13	55.62	55.78	55.95	56.11	56.29	56.46	56.63	58.37	58.54
<b>2033</b>	60.05	60.24	59.84	58.42	58.59	58.55	58.73	58.90	59.08	59.27	61.08	61.27
<b>2034</b>	62.77	62.96	60.78	59.35	59.53	59.60	59.79	59.97	60.16	60.33	62.17	62.37
<b>2035</b>	63.79	63.99	61.78	59.57	59.75	58.88	59.05	59.24	59.40	59.75	61.32	61.50
<b>2036</b>	65.41	65.61	63.33	61.04	61.23	60.35	60.52	60.70	60.88	61.22	62.86	63.05
<b>2037</b>	67.21	67.41	65.04	62.71	62.89	61.99	62.17	62.36	62.54	62.89	64.58	64.77
<b>2038</b>	68.98	69.19	66.76	64.34	64.52	63.60	63.78	63.98	64.16	64.54	66.26	66.47
<b>2039</b>	70.82	71.03	68.52	66.04	66.23	65.26	65.44	65.64	65.85	66.23	68.01	68.22
<b>2040</b>	72.65	72.89	70.28	67.72	67.94	66.94	67.14	67.33	67.54	67.94	69.77	69.98
<b>2041</b>	74.61	74.84	72.17	69.53	69.74	68.72	68.91	69.12	69.34	69.74	71.64	71.85
<b>2042</b>	76.60	76.84	74.09	71.35	71.58	70.52	70.71	70.94	71.17	71.58	73.51	73.76
<b>2043</b>	78.64	78.89	76.05	73.24	73.46	72.36	72.58	72.81	73.04	73.46	75.46	75.71

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Standard Fixed Price Option (Continued)

TABLE 3b												
Avoided Costs												
Fixed Price Option for Solar QF												
Off-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65
2021	23.55	23.41	23.01	20.77	20.65	20.80	20.97	21.03	21.00	21.17	22.35	23.27
2022	24.28	24.14	23.76	21.65	21.54	21.70	21.88	22.00	22.01	22.18	23.53	24.47
2023	25.47	25.32	24.94	23.05	22.92	23.09	23.26	23.42	23.43	23.60	24.16	25.12
2024	25.82	25.91	25.95	25.07	25.15	25.23	25.31	25.39	25.47	25.55	26.64	26.72
2025	27.37	27.46	27.18	26.26	26.30	26.33	26.42	26.51	26.59	26.71	27.80	27.89
2026	28.57	28.66	28.27	27.30	27.31	27.40	27.49	27.59	27.68	27.77	28.93	29.02
2027	29.71	29.81	29.87	28.89	28.98	29.08	29.17	29.27	29.37	29.47	30.71	30.81
2028	31.50	31.60	31.70	30.77	30.88	30.98	31.08	31.20	31.30	31.56	32.72	32.84
2029	33.70	33.82	33.92	33.06	33.30	33.63	33.74	33.86	33.99	34.14	35.51	35.64
2030	36.67	38.19	38.32	37.26	37.40	37.55	37.69	37.83	37.97	38.22	39.67	39.81
2031	40.80	40.95	41.11	39.82	39.95	40.11	40.27	40.43	40.59	40.80	42.37	42.54
2032	43.58	43.74	43.75	42.25	42.41	42.57	42.73	42.92	43.08	43.26	44.99	45.17
2033	46.33	46.52	46.11	44.69	44.86	44.82	45.00	45.17	45.35	45.54	47.35	47.54
2034	48.72	48.91	46.73	45.30	45.48	45.56	45.74	45.92	46.11	46.28	48.13	48.32
2035	49.51	49.71	47.50	45.28	45.47	44.60	44.77	44.96	45.11	45.47	47.04	47.22
2036	50.89	51.09	48.81	46.52	46.71	45.83	46.00	46.17	46.36	46.70	48.34	48.53
2037	52.35	52.56	50.19	47.86	48.03	47.13	47.31	47.50	47.68	48.03	49.72	49.91
2038	53.83	54.04	51.61	49.19	49.37	48.45	48.63	48.82	49.01	49.38	51.10	51.31
2039	55.36	55.57	53.06	50.58	50.77	49.80	49.98	50.18	50.40	50.77	52.55	52.76
2040	56.89	57.12	54.52	51.96	52.18	51.17	51.38	51.56	51.77	52.18	54.01	54.21
2041	58.52	58.76	56.09	53.45	53.66	52.64	52.83	53.04	53.26	53.66	55.56	55.77
2042	60.20	60.44	57.68	54.95	55.17	54.11	54.31	54.54	54.76	55.17	57.11	57.35
2043	61.91	62.16	59.32	56.51	56.73	55.63	55.85	56.08	56.31	56.73	58.73	58.98



**SCHEDULE 201 (Continued)**

## PRICING OPTIONS FOR STANDARD PPA (Continued)

**2) Renewable Fixed Price Option**

The Renewable Fixed Price Option is based on Renewable Avoided Costs. It is available only to Renewable QFs that generate electricity from a renewable energy source that may be used by the Company to comply with the Oregon Renewable Portfolio Standard as set forth in ORS 469A.005 to 469A.210.

This option is available for a maximum term of 15 years. Prices will be as established at the time the Standard PPA is executed and will be equal to the Renewable Avoided Costs in Tables 4a and 4b, 5a and 5b, or 6a and 6b, depending on the type of QF, effective at execution. QFs using any resource type other than wind and solar are assumed to be Base Load QFs.

Sellers will retain all Environmental Attributes generated by the facility during the Renewable Resource Sufficiency Period. A Renewable QF choosing the Renewable Fixed Price Option must cede all RPS Attributes generated by the facility to the Company from the start of the Renewable Resource Deficiency Period through the remainder of the PPA term.

Prices paid to the Seller under the Renewable Fixed Price Option include adjustments for the capacity contribution of the QF resource type relative to that of the avoided proxy resource. Both Wind QF resources (Tables 5a and 5b) and the avoided proxy resource, the basis used to determine Renewable Avoided Costs for the Renewable Fixed Price Option, are assumed to have a capacity contribution to peak of 5%. The capacity contribution for Solar QF resources (Tables 6a and 6b) is assumed to be 5%. The capacity contribution for Base Load QF resources (Tables 4a and 4b) is assumed to be 100%.

The Renewable Avoided Costs during the Renewable Resource Deficiency Period reflect an increase for avoided wind integration costs, shown in Table 7.

Prices paid to the Seller under the Renewable Fixed Price Option for Wind QFs (Tables 5a and 5b) include a reduction for the wind integration costs in Table 7, which cancels out wind integration costs included in the Renewable Avoided Costs during the Renewable Resource Deficiency Period. However, if the Wind QF is outside of PGE's Balancing Authority Area as contemplated in the Commission's Order No. 14-058, the Seller is paid the wind integration charges in Table 7, in addition to the prices listed in Tables 5a and 5b.

Sellers with PPAs exceeding 15 years will receive pricing equal to the Mid-C Index Price for all years up to five in excess of the initial 15.

## SCHEDULE 201 (Continued)

## PRICING OPTIONS FOR STANDARD PPA (Continued)

## Renewable Fixed Price Option (Continued)

TABLE 4a												
Renewable Avoided Costs												
Renewable Fixed Price Option for Base Load QF												
On-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92
2021	35.25	33.33	26.96	21.68	20.97	22.02	34.07	38.99	35.53	30.39	32.69	38.84
2022	37.42	35.37	28.60	22.99	22.23	23.34	36.16	41.39	37.71	32.25	34.69	41.23
2023	37.44	35.39	28.62	23.01	22.25	23.36	36.18	41.41	37.73	32.26	34.71	41.25
2024	33.46	31.46	29.68	24.29	21.51	14.47	26.46	29.70	32.48	32.50	33.08	34.88
2025	109.78	104.72	100.19	86.52	79.49	61.62	92.04	100.26	107.30	107.36	108.82	113.41
2026	111.98	106.82	102.20	88.25	81.08	62.85	93.88	102.27	109.44	109.51	111.00	115.68
2027	114.22	108.95	104.24	90.01	82.70	64.11	95.75	104.31	111.63	111.70	113.22	117.99
2028	116.27	110.92	106.12	91.65	84.21	65.30	97.49	106.20	113.64	113.71	115.26	120.11
2029	118.83	113.35	108.45	93.65	86.04	66.70	99.62	108.52	116.14	116.20	117.79	122.75
2030	121.20	115.61	110.61	95.52	87.76	68.03	101.61	110.69	118.46	118.53	120.14	125.20
2031	123.62	117.92	112.82	97.43	89.51	69.39	103.64	112.90	120.83	120.90	122.54	127.71
2032	125.62	119.82	114.63	98.97	90.92	70.45	105.29	114.71	122.77	122.84	124.52	129.77
2033	128.61	122.69	117.38	101.36	93.12	72.19	107.82	117.46	125.70	125.78	127.49	132.86
2034	131.31	125.26	119.85	103.51	95.11	73.75	110.10	119.93	128.34	128.41	130.16	135.64
2035	133.81	127.64	122.12	105.45	96.88	75.10	112.18	122.20	130.78	130.85	132.64	138.22
2036	136.09	129.81	124.20	107.25	98.53	76.38	114.09	124.28	133.01	133.09	134.90	140.58
2037	139.21	132.79	127.05	109.71	100.80	78.14	116.70	127.13	136.06	136.14	137.99	143.80
2038	141.99	135.44	129.59	111.90	102.81	79.70	119.04	129.68	138.78	138.86	140.75	146.68
2039	144.83	138.15	132.18	114.14	104.86	81.29	121.41	132.27	141.55	141.63	143.56	149.61
2040	147.44	140.64	134.57	116.22	106.79	82.81	123.62	134.66	144.10	144.18	146.15	152.30
2041	150.67	143.73	137.51	118.75	109.10	84.57	126.32	137.61	147.26	147.35	149.36	155.65
2042	153.68	146.60	140.26	121.12	111.28	86.26	128.84	140.36	150.21	150.29	152.34	158.76
2043	156.76	149.53	143.06	123.54	113.50	87.99	131.42	143.16	153.21	153.30	155.38	161.93

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Renewable Fixed Price Option (Continued)

<b>TABLE 4b</b>												
<b>Renewable Avoided Costs</b>												
<b>Renewable Fixed Price Option for Base Load QF</b>												
<b>Off-Peak Forecast (\$/MWH)</b>												
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>2018</b>					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69
<b>2019</b>	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12
<b>2020</b>	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65
<b>2021</b>	29.15	29.38	22.96	15.91	12.23	11.81	22.79	29.92	30.49	27.83	29.70	35.15
<b>2022</b>	31.09	31.33	24.47	16.93	13.00	12.55	24.28	31.91	32.52	29.67	31.68	37.50
<b>2023</b>	31.41	31.65	24.71	17.09	13.12	12.66	24.53	32.24	32.85	29.98	32.00	37.89
<b>2024</b>	29.94	27.68	27.33	23.19	20.10	12.65	23.44	27.06	29.10	29.67	31.04	32.02
<b>2025</b>	68.81	63.08	62.21	51.70	43.86	24.97	52.32	61.52	66.70	68.13	71.61	74.10
<b>2026</b>	70.19	64.34	63.45	52.73	44.74	25.47	53.37	62.75	68.03	69.49	73.04	75.58
<b>2027</b>	71.59	65.63	64.72	53.78	45.63	25.97	54.44	64.01	69.39	70.88	74.50	77.09
<b>2028</b>	72.82	66.76	65.83	54.71	46.42	26.42	55.37	65.11	70.58	72.10	75.78	78.41
<b>2029</b>	74.48	68.28	67.33	55.95	47.47	27.02	56.63	66.59	72.19	73.74	77.50	80.20
<b>2030</b>	75.97	69.64	68.68	57.07	48.42	27.56	57.77	67.92	73.63	75.22	79.05	81.80
<b>2031</b>	77.49	71.03	70.05	58.21	49.39	28.11	58.92	69.28	75.10	76.72	80.63	83.44
<b>2032</b>	78.82	72.25	71.26	59.21	50.24	28.60	59.93	70.47	76.40	78.04	82.02	84.87
<b>2033</b>	80.61	73.90	72.88	60.56	51.38	29.25	61.30	72.08	78.14	79.82	83.89	86.80
<b>2034</b>	82.23	75.38	74.33	61.77	52.41	29.83	62.52	73.52	79.70	81.41	85.56	88.54
<b>2035</b>	83.87	76.88	75.82	63.01	53.46	30.43	63.77	74.99	81.29	83.04	87.27	90.31
<b>2036</b>	85.31	78.21	77.12	64.09	54.38	30.95	64.87	76.28	82.69	84.47	88.77	91.86
<b>2037</b>	87.25	79.99	78.88	65.55	55.62	31.66	66.35	78.01	84.57	86.39	90.80	93.95
<b>2038</b>	89.00	81.59	80.46	66.86	56.73	32.29	67.67	79.57	86.26	88.12	92.61	95.83
<b>2039</b>	90.78	83.22	82.07	68.20	57.86	32.94	69.03	81.16	87.99	89.88	94.46	97.75
<b>2040</b>	92.34	84.65	83.48	69.37	58.86	33.50	70.21	82.56	89.50	91.43	96.09	99.43
<b>2041</b>	94.44	86.57	85.38	70.95	60.20	34.27	71.81	84.44	91.54	93.51	98.28	101.69
<b>2042</b>	96.33	88.31	87.08	72.37	61.40	34.95	73.25	86.13	93.37	95.38	100.24	103.73
<b>2043</b>	98.25	90.07	88.83	73.81	62.63	35.65	74.71	87.85	95.23	97.28	102.24	105.80

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Renewable Fixed Price Option (Continued)

<b>TABLE 5a</b>												
<b>Renewable Avoided Costs</b>												
<b>Renewable Fixed Price Option for Wind QF</b>												
<b>On-Peak Forecast (\$/MWH)</b>												
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>2018</b>					14.38	16.41	28.39	34.00	29.92	24.06	24.06	30.18
<b>2019</b>	26.96	25.36	20.60	17.31	16.88	17.31	28.46	31.79	29.49	23.60	25.53	29.90
<b>2020</b>	30.82	29.10	23.42	18.71	18.08	19.01	29.76	34.15	31.06	26.48	28.53	34.02
<b>2021</b>	34.33	32.41	26.04	20.76	20.05	21.10	33.15	38.07	34.61	29.47	31.77	37.92
<b>2022</b>	36.48	34.43	27.66	22.05	21.29	22.40	35.22	40.45	36.77	31.31	33.75	40.29
<b>2023</b>	36.48	34.43	27.66	22.05	21.29	22.40	35.22	40.45	36.77	31.30	33.75	40.29
<b>2024</b>	32.48	30.48	28.70	23.31	20.53	13.49	25.48	28.72	31.50	31.52	32.10	33.90
<b>2025</b>	90.50	85.44	80.91	67.24	60.21	42.34	72.75	80.98	88.01	88.08	89.54	94.12
<b>2026</b>	92.31	87.15	82.53	68.58	61.41	43.18	74.21	82.60	89.77	89.84	91.33	96.01
<b>2027</b>	94.15	88.89	84.18	69.95	62.64	44.04	75.69	84.25	91.57	91.63	93.15	97.92
<b>2028</b>	95.81	90.45	85.66	71.19	63.75	44.84	77.03	85.73	93.18	93.25	94.79	99.65
<b>2029</b>	97.96	92.48	87.58	72.78	65.17	45.82	78.75	87.65	95.27	95.33	96.92	101.88
<b>2030</b>	99.91	94.33	89.33	74.23	66.47	46.74	80.32	89.40	97.17	97.24	98.85	103.92
<b>2031</b>	101.91	96.21	91.11	75.72	67.80	47.68	81.93	91.19	99.12	99.18	100.83	106.00
<b>2032</b>	103.61	97.81	92.62	76.96	68.91	48.44	83.28	92.70	100.76	100.83	102.51	107.76
<b>2033</b>	106.02	100.09	94.79	78.77	70.53	49.60	85.23	94.87	103.11	103.18	104.90	110.27
<b>2034</b>	108.20	102.15	96.74	80.40	72.00	50.65	86.99	96.82	105.23	105.30	107.05	112.53
<b>2035</b>	110.31	104.14	98.62	81.96	73.39	51.61	88.68	98.71	107.28	107.36	109.14	114.73
<b>2036</b>	112.19	105.92	100.30	83.35	74.63	52.48	90.19	100.39	109.11	109.19	111.00	116.68
<b>2037</b>	114.76	108.34	102.60	85.26	76.35	53.69	92.26	102.69	111.61	111.69	113.54	119.36
<b>2038</b>	117.05	110.51	104.65	86.96	77.87	54.76	94.10	104.74	113.84	113.92	115.81	121.74
<b>2039</b>	119.40	112.72	106.74	88.71	79.43	55.86	95.98	106.83	116.12	116.20	118.13	124.18
<b>2040</b>	121.49	114.70	108.62	90.28	80.84	56.86	97.68	108.72	118.16	118.24	120.20	126.36
<b>2041</b>	124.21	117.26	111.05	92.28	82.63	58.11	99.85	111.14	120.80	120.88	122.89	129.18
<b>2042</b>	126.70	119.61	113.27	94.13	84.29	59.27	101.85	113.37	123.22	123.31	125.35	131.77
<b>2043</b>	129.23	122.00	115.53	96.01	85.97	60.46	103.89	115.63	125.68	125.77	127.86	134.40

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Renewable Fixed Price Option (Continued)

<b>TABLE 5b</b>												
<b>Renewable Avoided Costs</b>												
<b>Renewable Fixed Price Option for Wind QF</b>												
<b>Off-Peak Forecast (\$/MWH)</b>												
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>2018</b>					5.71	5.71	15.04	23.04	23.55	20.49	20.49	24.82
<b>2019</b>	22.46	21.80	17.19	10.78	8.57	7.69	17.89	22.33	22.76	20.60	21.72	25.24
<b>2020</b>	24.58	24.78	19.24	13.17	10.00	9.63	19.09	25.24	25.73	23.44	25.06	29.75
<b>2021</b>	28.23	28.46	22.04	14.99	11.31	10.89	21.87	29.00	29.57	26.91	28.78	34.23
<b>2022</b>	30.15	30.39	23.53	15.99	12.06	11.61	23.34	30.97	31.58	28.73	30.74	36.56
<b>2023</b>	30.45	30.69	23.75	16.13	12.16	11.70	23.57	31.28	31.89	29.02	31.04	36.93
<b>2024</b>	28.96	26.70	26.35	22.21	19.12	11.67	22.46	26.08	28.12	28.69	30.06	31.04
<b>2025</b>	67.81	62.08	61.21	50.70	42.86	23.97	51.32	60.52	65.70	67.13	70.61	73.10
<b>2026</b>	69.17	63.32	62.43	51.71	43.72	24.45	52.35	61.73	67.01	68.47	72.02	74.56
<b>2027</b>	70.55	64.59	63.68	52.74	44.59	24.93	53.40	62.97	68.35	69.84	73.46	76.05
<b>2028</b>	71.76	65.70	64.77	53.65	45.36	25.36	54.31	64.05	69.52	71.04	74.72	77.35
<b>2029</b>	73.40	67.20	66.25	54.87	46.39	25.94	55.55	65.51	71.11	72.66	76.42	79.12
<b>2030</b>	74.87	68.54	67.58	55.97	47.32	26.46	56.67	66.82	72.53	74.12	77.95	80.70
<b>2031</b>	76.37	69.91	68.93	57.09	48.27	26.99	57.80	68.16	73.98	75.60	79.51	82.32
<b>2032</b>	77.68	71.11	70.12	58.07	49.10	27.46	58.79	69.33	75.26	76.90	80.88	83.73
<b>2033</b>	79.44	72.73	71.71	59.39	50.21	28.08	60.13	70.91	76.97	78.65	82.72	85.63
<b>2034</b>	81.04	74.19	73.14	60.58	51.22	28.64	61.33	72.33	78.51	80.22	84.37	87.35
<b>2035</b>	82.66	75.67	74.61	61.80	52.25	29.22	62.56	73.78	80.08	81.83	86.06	89.10
<b>2036</b>	84.07	76.97	75.88	62.85	53.14	29.71	63.63	75.04	81.45	83.23	87.53	90.62
<b>2037</b>	85.99	78.73	77.62	64.29	54.36	30.40	65.09	76.75	83.31	85.13	89.54	92.69
<b>2038</b>	87.71	80.30	79.17	65.57	55.44	31.00	66.38	78.28	84.97	86.83	91.32	94.54
<b>2039</b>	89.47	81.91	80.76	66.89	56.55	31.63	67.72	79.85	86.68	88.57	93.15	96.44
<b>2040</b>	91.00	83.31	82.14	68.03	57.52	32.16	68.87	81.22	88.16	90.09	94.75	98.09
<b>2041</b>	93.07	85.20	84.01	69.58	58.83	32.90	70.44	83.07	90.17	92.14	96.91	100.32
<b>2042</b>	94.94	86.92	85.69	70.98	60.01	33.56	71.86	84.74	91.98	93.99	98.85	102.34
<b>2043</b>	96.83	88.65	87.41	72.39	61.21	34.23	73.29	86.43	93.81	95.86	100.82	104.38

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Renewable Fixed Price Option (Continued)

TABLE 6a												
Renewable Avoided Costs												
Renewable Fixed Price Option for Solar QF												
On-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92
2021	35.25	33.33	26.96	21.68	20.97	22.02	34.07	38.99	35.53	30.39	32.69	38.84
2022	37.42	35.37	28.60	22.99	22.23	23.34	36.16	41.39	37.71	32.25	34.69	41.23
2023	37.44	35.39	28.62	23.01	22.25	23.36	36.18	41.41	37.73	32.26	34.71	41.25
2024	33.46	31.46	29.68	24.29	21.51	14.47	26.46	29.70	32.48	32.50	33.08	34.88
2025	89.46	84.40	79.87	66.19	59.16	41.29	71.71	79.93	86.97	87.03	88.50	93.08
2026	91.24	86.08	81.46	67.52	60.35	42.12	73.14	81.53	88.71	88.77	90.26	94.94
2027	93.07	87.80	83.09	68.86	61.55	42.96	74.60	83.16	90.48	90.55	92.07	96.84
2028	94.70	89.35	84.55	70.08	62.64	43.73	75.92	84.63	92.07	92.14	93.69	98.54
2029	96.82	91.35	86.44	71.64	64.04	44.69	77.62	86.52	94.14	94.20	95.78	100.75
2030	98.76	93.17	88.17	73.08	65.32	45.59	79.17	88.25	96.02	96.08	97.70	102.76
2031	100.73	95.03	89.93	74.54	66.62	46.50	80.75	90.01	97.94	98.00	99.65	104.82
2032	102.42	96.62	91.43	75.77	67.72	47.25	82.09	91.51	99.57	99.64	101.32	106.57
2033	104.80	98.87	93.56	77.55	69.31	48.37	84.01	93.64	101.89	101.96	103.67	109.05
2034	106.94	100.89	95.48	79.14	70.74	49.39	85.73	95.56	103.97	104.04	105.79	111.27
2035	109.03	102.86	97.34	80.68	72.11	50.33	87.40	97.43	106.00	106.08	107.86	113.45
2036	110.90	104.62	99.01	82.06	73.34	51.19	88.90	99.09	107.82	107.89	109.71	115.39
2037	113.43	107.01	101.27	83.93	75.02	52.36	90.93	101.36	110.28	110.36	112.21	118.03
2038	115.70	109.15	103.29	85.61	76.52	53.41	92.74	103.38	112.49	112.56	114.46	120.39
2039	118.01	111.33	105.36	87.32	78.05	54.47	94.60	105.45	114.73	114.81	116.74	122.79
2040	120.08	113.29	107.21	88.87	79.43	55.45	96.27	107.31	116.75	116.83	118.79	124.95
2041	122.77	115.83	109.61	90.85	81.20	56.67	98.42	109.71	119.36	119.45	121.46	127.75
2042	125.23	118.14	111.80	92.66	82.82	57.80	100.38	111.90	121.75	121.84	123.88	130.30
2043	127.73	120.50	114.04	94.51	84.48	58.96	102.39	114.14	124.18	124.27	126.36	132.91

**SCHEDULE 201 (Continued)**PRICING OPTIONS FOR STANDARD PPA (Continued)  
Renewable Fixed Price Option (Continued)

TABLE 6b												
Renewable Avoided Costs												
Renewable Fixed Price Option for Solar QF												
Off-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65
2021	29.15	29.38	22.96	15.91	12.23	11.81	22.79	29.92	30.49	27.83	29.70	35.15
2022	31.09	31.33	24.47	16.93	13.00	12.55	24.28	31.91	32.52	29.67	31.68	37.50
2023	31.41	31.65	24.71	17.09	13.12	12.66	24.53	32.24	32.85	29.98	32.00	37.89
2024	29.94	27.68	27.33	23.19	20.10	12.65	23.44	27.06	29.10	29.67	31.04	32.02
2025	68.81	63.08	62.21	51.70	43.86	24.97	52.32	61.52	66.70	68.13	71.61	74.10
2026	70.19	64.34	63.45	52.73	44.74	25.47	53.37	62.75	68.03	69.49	73.04	75.58
2027	71.59	65.63	64.72	53.78	45.63	25.97	54.44	64.01	69.39	70.88	74.50	77.09
2028	72.82	66.76	65.83	54.71	46.42	26.42	55.37	65.11	70.58	72.10	75.78	78.41
2029	74.48	68.28	67.33	55.95	47.47	27.02	56.63	66.59	72.19	73.74	77.50	80.20
2030	75.97	69.64	68.68	57.07	48.42	27.56	57.77	67.92	73.63	75.22	79.05	81.80
2031	77.49	71.03	70.05	58.21	49.39	28.11	58.92	69.28	75.10	76.72	80.63	83.44
2032	78.82	72.25	71.26	59.21	50.24	28.60	59.93	70.47	76.40	78.04	82.02	84.87
2033	80.61	73.90	72.88	60.56	51.38	29.25	61.30	72.08	78.14	79.82	83.89	86.80
2034	82.23	75.38	74.33	61.77	52.41	29.83	62.52	73.52	79.70	81.41	85.56	88.54
2035	83.87	76.88	75.82	63.01	53.46	30.43	63.77	74.99	81.29	83.04	87.27	90.31
2036	85.31	78.21	77.12	64.09	54.38	30.95	64.87	76.28	82.69	84.47	88.77	91.86
2037	87.25	79.99	78.88	65.55	55.62	31.66	66.35	78.01	84.57	86.39	90.80	93.95
2038	89.00	81.59	80.46	66.86	56.73	32.29	67.67	79.57	86.26	88.12	92.61	95.83
2039	90.78	83.22	82.07	68.20	57.86	32.94	69.03	81.16	87.99	89.88	94.46	97.75
2040	92.34	84.65	83.48	69.37	58.86	33.50	70.21	82.56	89.50	91.43	96.09	99.43
2041	94.44	86.57	85.38	70.95	60.20	34.27	71.81	84.44	91.54	93.51	98.28	101.69
2042	96.33	88.31	87.08	72.37	61.40	34.95	73.25	86.13	93.37	95.38	100.24	103.73
2043	98.25	90.07	88.83	73.81	62.63	35.65	74.71	87.85	95.23	97.28	102.24	105.80

## SCHEDULE 201 (Continued)

## WIND INTEGRATION

<b>TABLE 7</b>		
<b>Integration Costs</b>		
<b>Year</b>	<b>Wind</b>	<b>Solar</b>
<b>2018</b>	0.87	0.00
<b>2019</b>	0.88	0.00
<b>2020</b>	0.90	0.00
<b>2021</b>	0.92	0.00
<b>2022</b>	0.94	0.00
<b>2023</b>	0.96	0.00
<b>2024</b>	0.98	0.00
<b>2025</b>	1.00	0.00
<b>2026</b>	1.02	0.00
<b>2027</b>	1.04	0.00
<b>2028</b>	1.06	0.00
<b>2029</b>	1.08	0.00
<b>2030</b>	1.10	0.00
<b>2031</b>	1.12	0.00
<b>2032</b>	1.14	0.00
<b>2033</b>	1.17	0.00
<b>2034</b>	1.19	0.00
<b>2035</b>	1.21	0.00
<b>2036</b>	1.24	0.00
<b>2037</b>	1.26	0.00
<b>2038</b>	1.29	0.00
<b>2039</b>	1.31	0.00
<b>2040</b>	1.34	0.00
<b>2041</b>	1.37	0.00
<b>2042</b>	1.39	0.00
<b>2043</b>	1.42	0.00



**SCHEDULE 201 (Continued)****MONTHLY SERVICE CHARGE**

Each separately metered QF not associated with a retail Customer account will be charged \$10.00 per month.

**INSURANCE REQUIREMENTS**

The following insurance requirements are applicable to Sellers with a Standard PPA:

- 1) QFs with nameplate capacity ratings greater than 200 kW are required to secure and maintain a prudent amount of general liability insurance. The Seller must certify to the Company that it is maintaining general liability insurance coverage for each QF at prudent amounts. A prudent amount will be deemed to mean liability insurance coverage for both bodily injury and property damage liability in the amount of not less than \$1,000,000 each occurrence combined single limit, which limits may be required to be increased or decreased by the Company as the Company determines in its reasonable judgment, that economic conditions or claims experience may warrant.
- 2) Such insurance will include an endorsement naming the Company as an additional insured insofar as liability arising out of operations under this schedule and a provision that such liability policies will not be canceled or their limits reduced without 30 days' written notice to the Company. The Seller will furnish the Company with certificates of insurance together with the endorsements required herein. The Company will have the right to inspect the original policies of such insurance.
- 3) QFs with a design capacity of 200 kW or less are encouraged to pursue liability insurance on their own. The Oregon Public Utility Commission in Order No. 05-584 determined that it is inappropriate to require QFs that have a design capacity of 200 kW or less to obtain general liability insurance.

**TRANSMISSION AGREEMENTS**

If the QF is located outside the Company's service territory, the Seller is responsible for the transmission of power at its cost to the Company's service territory.

**INTERCONNECTION REQUIREMENTS**

Except as otherwise provided in a generation Interconnection Agreement between the Company and Seller, if the QF is located within the Company's service territory, switching equipment capable of isolating the QF from the Company's system will be accessible to the Company at all times. At the Company's option, the Company may operate the switching equipment described above if, in the sole opinion of the Company, continued operation of the QF in connection with the utility's system may create or contribute to a system emergency.

**SCHEDULE 201 (Continued)****INTERCONNECTION REQUIREMENTS (Continued)**

The QF owner interconnecting with the Company's distribution system must comply with all requirements for interconnection as established pursuant to Commission rule, in the Company's Rules and Regulations (Rule C) or the Company's Interconnection Procedures contained in its FERC Open Access Transmission Tariff (OATT), as applicable. The Seller will bear full responsibility for the installation and safe operation of the interconnection facilities.

**DEFINITION OF A SMALL COGENERATION FACILITY OR SMALL POWER PRODUCTION FACILITY ELIGIBLE TO RECEIVE PRICING UNDER THE STANDARD PPA**

A QF will be eligible to receive pricing under the Standard PPA if the nameplate capacity of the QF, together with any other electric generating facility using the same motive force, owned or controlled by the Same Person(s) or Affiliated Person(s), and located at the Same Site, does not exceed 10 MW. A Community-Based or Family-Owned QF is exempt from these restrictions.

**Definition of Community-Based**

- a. A community project (or a community sponsored project) must have a recognized and established organization located within the county of the project or within 50 miles of the project that has a genuine role in helping the project be developed and must have some not insignificant continuing role with or interest in the project after it is completed and placed in service.
- b. After excluding the passive investor whose ownership interests are primarily related to green tag values and tax benefits as the primary ownership benefit, the equity (ownership) interests in a community sponsored project must be owned in substantial percentage (80 percent or more) by the following persons (individuals and entities): (i) the sponsoring organization, or its controlled affiliates; (ii) members of the sponsoring organization (if it is a membership organization) or owners of the sponsorship organization (if it is privately owned); (iii) persons who live in the county in which the project is located or who live a county adjoining the county in which the project is located; or (iv) units of local government, charities, or other established nonprofit organizations active either in the county in which the project is located or active in a county adjoining the county in which the project is located.

**Definition of Family-Owned**

After excluding the ownership interest of the passive investor whose ownership interests are primarily related to green tag values and tax benefits as the primary ownership benefit, five or fewer individuals own 50 percent or more of the equity of the project entity, or fifteen or fewer individuals own 90 percent or more of the project entity. A "look through" rule applies to closely held entities that hold the project entity, so that equity held by LLCs, trusts, estates, corporations, partnerships or other similar entities is considered held by the equity owners of the look through entity. An individual is a natural person. In counting to five or fifteen, spouses or children of an equity owner of the project owner who also have an equity interest are aggregated and counted as a single individual.

**SCHEDULE 201 (Continued)****DEFINITION OF A SMALL COGENERATION FACILITY OR SMALL POWER PRODUCTION FACILITY ELIGIBLE TO RECEIVE PRICING UNDER THE STANDARD PPA (Continued)****Definition of Person(s) or Affiliated Person(s)**

As used above, the term “Same Person(s)” or “Affiliated Person(s)” means a natural person or persons or any legal entity or entities sharing common ownership, management or acting jointly or in concert with or exercising influence over the policies or actions of another person or entity. However, two facilities will not be held to be owned or controlled by the Same Person(s) or Affiliated Person(s) solely because they are developed by a single entity.

Furthermore, two facilities will not be held to be owned or controlled by the Same Person(s) or Affiliated Person(s) if such common person or persons is a “passive investor” whose ownership interest in the QF is primarily related to utilizing production tax credits, green tag values and MACRS depreciation as the primary ownership benefit and the facilities at issue are independent family-owned or community-based projects. A unit of Oregon local government may also be a “passive investor” in a community-based project if the local governmental unit demonstrates that it will not have an equity ownership interest in or exercise any control over the management of the QF and that its only interest is a share of the cash flow from the QF, which share will not exceed 20%. The 20% cash flow share limit may only be exceeded for good cause shown and only with the prior approval of the Commission.

**Definition of Same Site**

For purposes of the foregoing, generating facilities are considered to be located at the same site as the QF for which qualification for pricing under the Standard PPA is sought if they are located within a five-mile radius of any generating facilities or equipment providing fuel or motive force associated with the QF for which qualification for pricing under the Standard PPA is sought.

**Definition of Shared Interconnection and Infrastructure**

QFs otherwise meeting the above-described separate ownership test and thereby qualified for entitlement to pricing under the Standard PPA will not be disqualified by utilizing an interconnection or other infrastructure not providing motive force or fuel that is shared with other QFs qualifying for pricing under the Standard PPA so long as the use of the shared interconnection complies with the interconnecting utility’s safety and reliability standards, interconnection agreement requirements and Prudent Electrical Practices as that term is defined in the interconnecting utility’s approved Standard PPA.

**OTHER DEFINITIONS****Mid-C Index Price**

As used in this schedule, the daily Mid-C Index Price shall be the Day Ahead Intercontinental Exchange (“ICE”) for the bilateral OTC market for energy at the Mid-C Physical for Average

**SCHEDULE 201 (Continued)****OTHER DEFINITIONS (Continued)**

On-Peak Power and Average Off-Peak Power found on the following website: <https://www.theice.com/products/OTC/Physical-Energy/Electricity>. In the event ICE no longer publishes this index, PGE and the Seller agree to select an alternative successor index representative of the Mid-C trading hub.

**Definition of RPS Attributes**

As used in this schedule, RPS Attributes means all attributes related to the Net Output generated by the Facility that are required in order to provide PGE with “qualifying electricity,” as that term is defined in Oregon’s Renewable Portfolio Standard Act, Ore. Rev. Stat. 469A.010, in effect at the time of execution of this Agreement. RPS Attributes do not include Environmental Attributes that are greenhouse gas offsets from methane capture not associated with the generation of electricity and not needed to ensure that there are zero net emissions associated with the generation of electricity.

**Definition of Environmental Attributes**

As used in this schedule, Environmental Attributes shall mean any and all claims, credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, resulting from the avoidance of the emission of any gas, chemical, or other substance to the air, soil or water. Environmental Attributes include but are not limited to: (1) any avoided emissions of pollutants to the air, soil, or water such as (subject to the foregoing) sulfur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), and other pollutants; and (2) any avoided emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and other greenhouse gases (GHGs) that have been determined by the United Nations Intergovernmental Panel on Climate Change to contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere.

**Definition of Resource Sufficiency Period**

This is the period from the current year through 2020.

**Definition of Resource Deficiency Period**

This is the period from 2021.

**Definition of Renewable Resource Sufficiency Period**

This is the period from the current year through 2024.

**Definition of Renewable Resource Deficiency Period**

This is the period from 2025.

**SCHEDULE 201 (Concluded)****DISPUTE RESOLUTION**

Upon request, the QF will provide the purchasing utility with documentation verifying the ownership, management and financial structure of the QF in reasonably sufficient detail to allow the utility to make an initial determination of whether or not the QF meets the above-described criteria for entitlement to pricing under the Standard PPA.

The QF may present disputes to the Commission for resolution using the following process:

The QF may file a complaint asking the Commission to adjudicate disputes regarding the formation of the standard contract. The QF may not file such a complaint during any 15-day period in which the utility has the obligation to respond, but must wait until the 15-day period has passed.

The utility may respond to the complaint within ten days of service.

The Commission will limit its review to the issues identified in the complaint and response, and utilize a process similar to the arbitration process adopted to facilitate the execution of interconnection agreements among telecommunications carriers. See OAR 860, Division 016. The administrative law judge will not act as an arbitrator.

**SPECIAL CONDITIONS**

1. Delivery of energy by Seller will be at a voltage, phase, frequency, and power factor as specified by the Company.
2. If the Seller also receives retail Electricity Service from the Company at the same location, any payments under this schedule will be credited to the Seller's retail Electricity Service bill. At the option of the Customer, any net credit over \$10.00 will be paid by check to the Customer.
3. Unless required by state or federal law, if the 1978 Public Utility Regulatory Policies Act (PURPA) is repealed, PPAs entered into pursuant to this schedule will not terminate prior to the Standard or Negotiated PPA's termination date.

**TERM OF AGREEMENT**

Not less than one year and not to exceed 20 years.

UM 1728

Application to Update Schedule 201  
Avoided Cost Power Purchase Information

Attachment A  
Description of Standard Avoided Costs

PORTLAND GENERAL ELECTRIC COMPANY  
STANDARD AVOIDED COST STUDY  
2018 ANNUAL UPDATE

Introduction

Consistent with Commission Order No. 14-058<sup>1</sup>, annual avoided cost updates allow modification of four factors:

1. Updated natural gas prices;
2. On- and off-peak forward-looking electricity market prices;
3. Changes to the status of the Production Tax Credit; and
4. Any other action or change in an acknowledged IRP update relevant to the calculation of avoided costs.

This 2018 update will focus on three factors: (1) updated natural gas hub prices during the resource deficiency period, (2) updated electricity market projections (on- and off- peak forward-looking electricity market prices during the resource sufficiency period), and (3) updated supply-side resource costs and operating parameters, carbon offset costs, and financial parameters as acknowledged in PGE's 2016 IRP Update (LC 66).<sup>2</sup> Production tax credit assumptions and inputs do not apply to the standard avoided cost price.

Below is a summary of the approved factors:

Factor 1: Gas Price Projections

Natural gas prices are based on PGE's forward AECO price curves from February 22, 2018 for May 2018 through December 2023. For 2024 through 2050, prices align with the AECO prices from the acknowledged 2016 IRP Update as discussed in Section 8 of the IRP Update. Prices after 2050 are escalated with inflation.

The nominal average annual northwest burnertip natural gas price is expected to trend from \$1.37/MMBtu in 2019 to \$6.19/MMBtu in 2043.

The variable gas transportation costs remain unchanged from the current Schedule 201 rates.

Factor 2: Electricity Market Projections

The forward trading curves are based on market prices for electricity delivered to PGE's system and calculated according to the methodology approved by the OPUC. The forward trading curves adjusted for delivery are used to price avoided costs during a resource sufficiency period. For May 2018 through December 2021, the market prices are based on PGE's forward Mid-Columbia trading curve from February 22, 2018.

As in the current Schedule 201 prices, wheeling costs remain based on current BPA rates adjusted for inflation.

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<sup>1</sup> Order No. 14-058 at 25-26

<sup>2</sup> Acknowledged at the OPUC April 24, 2018 Public Meeting

#### Factor 4: Other Action

PGE's 2016 IRP Update (LC 66) was acknowledged at the April 24, 2018 OPUC Public Meeting. Therefore, PGE also updated supply-side resource costs and parameters, carbon offset costs, and financial parameters (including economic lives), and capacity contribution values for incremental wind and solar resources.

Consistent with Commission requirements, PGE uses a natural gas combined-cycle combustion turbine (CCCT)<sup>3</sup> as a proxy resource for standard avoided cost prices with capacity valued based on an SCCT.

- The supply-side resource costs and parameters for CCCTs and SCCTs used in this filing are based on Appendix A of the 2016 IRP Update, including: overnight capital costs, fixed and variable O&M (adjusted from new-and-clean to degraded), new-and-clean and degrade capacity and heat rates,
- Carbon offset costs are based on Appendix C of the 2016 IRP Update,
- Financial parameters (including economic lives of resources) are based on Section 7 of the IRP Update (see Table 8),
- Capacity contribution values for incremental wind and solar resources are based on Appendix D of the IRP Update.

#### Deficiency/Sufficiency Periods

There is no change to the Deficiency/Sufficiency periods as a result of this May 1 Update. The current Deficiency/Sufficiency periods approved by the Commission in Order No. 17-347 are stated below for reference purposes:

- Resource Sufficiency Period is the period from the current year through 2020.
- Resource Deficiency Period is the period from 2021.

#### Avoided Cost Pricing Estimates

Tables 1 through 3 (following) summarize the results for PGE's fixed price option. Tables 1a, 1b, 2a, 2b, 3a, and 3b<sup>4</sup> are estimates of monthly on- and off-peak avoided costs for energy and capacity over 20 years beginning in May 2018. The pricing is comprised of the energy plus the capacity costs (discussed below).<sup>5</sup>

The sufficiency period prices (expressed in \$/MWh or mills/kWh) for the years 2018 through 2020, are based on the forward electricity prices adjusted for delivery as discussed above.

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<sup>3</sup> Representing the energy portion of costs.

<sup>4</sup> Table 1: Base Load QF; Table 2: Wind QF; Table 3: Solar QF

<sup>5</sup> Avoided Cost Components section.



The deficiency period prices begin in 2021. The on-peak prices represent both capacity and energy costs, while off-peak prices represent energy costs only. The on-peak price includes the following costs of a CCCT: fuel, variable O&M, capacity, and other fixed costs. The off-peak price includes: fuel, variable O&M, and other fixed costs. The "other fixed costs" represent the energy portion of the fixed costs of a CCCT. Other fixed costs are calculated by taking the fixed costs of a CCCT minus the real levelized capital carrying cost and fixed O&M of an SCCT. The result (other fixed costs) represents the energy portion of the fixed costs of a CCCT. On-peak periods are from 6 a.m. through 10 p.m. Mondays through Saturdays. The off-peak hours are from 10 p.m. until 6 a.m. Mondays through Saturdays and all twenty-four hours on Sunday.<sup>6</sup> Table 4 provides integration costs avoided. Tables 4 and 5 show the projected on- and off-peak resource sufficiency period forward market prices.

### Avoided Cost Components

#### *Energy:*

Tables 6 through 13 in the work papers show the other fixed costs, variable O&M, fuel costs, gas forecast avoided cost components (with and without transportation), and capacity.

Table 6 contains the energy portion of a CCCT, calculated using fixed costs of a CCCT minus the real levelized capital carrying cost and fixed O&M of an SCCT.

Table 7 shows the variable O&M associated with the CCCT and Table 8 shows the projected fuel costs.

Table 9a and 9b contains the forecasted gas prices in \$/MMBtu.

Tables 4, 6, 7 and 8 can be summed to equal the total on-peak avoided costs in Table 1a. Tables 5, 6, 7 and 8 can be summed to equal the total off-peak avoided costs in Table 1b.

#### *Capacity:*

The on- and off-peak SCCT-related capacity component costs are shown in Tables 10a and 10b, 11a and 11b, and 12a and 12b. Tables 10b, 11b, and 12b are blank since no capacity value is calculated for the off-peak period. The capacity values are applicable only to on-peak hours.

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<sup>6</sup> Schedule 201, Sheet 201-3.

## **Standard Energy Tables**

PGE's 2018 Standard AVOIDED COST ANNUAL UPDATE  
WORKPAPERS – Page 5

**Portland General Electric  
Avoided Cost Study  
On-Peak Energy, Base Load**

**Table S.1a**

Year	Nominal \$/MWh												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05	
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78	25.33
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92	27.86
2021	23.55	23.41	23.01	20.77	20.65	20.80	20.97	21.03	21.00	21.17	22.35	23.27	21.83
2022	24.28	24.14	23.76	21.65	21.54	21.70	21.88	22.00	22.01	22.18	23.53	24.47	22.76
2023	25.47	25.32	24.94	23.05	22.92	23.09	23.26	23.42	23.43	23.60	24.16	25.12	23.97
2024	25.82	25.91	25.95	25.07	25.15	25.23	25.31	25.39	25.47	25.55	26.64	26.72	25.68
2025	27.37	27.46	27.18	26.26	26.30	26.33	26.42	26.51	26.59	26.71	27.80	27.89	26.90
2026	28.57	28.66	28.27	27.30	27.31	27.40	27.49	27.59	27.68	27.77	28.93	29.02	28.00
2027	29.71	29.81	29.87	28.89	28.98	29.08	29.17	29.27	29.37	29.47	30.71	30.81	29.60
2028	31.50	31.60	31.70	30.77	30.88	30.98	31.08	31.20	31.30	31.56	32.72	32.84	31.51
2029	33.70	33.82	33.92	33.06	33.30	33.63	33.74	33.86	33.99	34.14	35.51	35.64	34.03
2030	36.67	38.19	38.32	37.26	37.40	37.55	37.69	37.83	37.97	38.22	39.67	39.81	38.04
2031	40.80	40.95	41.11	39.82	39.95	40.11	40.27	40.43	40.59	40.80	42.37	42.54	40.81
2032	43.58	43.74	43.75	42.25	42.41	42.57	42.73	42.92	43.08	43.26	44.99	45.17	43.38
2033	46.33	46.52	46.11	44.69	44.86	44.82	45.00	45.17	45.35	45.54	47.35	47.54	45.77
2034	48.72	48.91	46.73	45.30	45.48	45.56	45.74	45.92	46.11	46.28	48.13	48.32	46.75
2035	49.51	49.71	47.50	45.28	45.47	44.60	44.77	44.96	45.11	45.47	47.04	47.22	46.38
2036	50.89	51.09	48.81	46.52	46.71	45.83	46.00	46.17	46.36	46.70	48.34	48.53	47.66
2037	52.35	52.56	50.19	47.86	48.03	47.13	47.31	47.50	47.68	48.03	49.72	49.91	49.00
2038	53.83	54.04	51.61	49.19	49.37	48.45	48.63	48.82	49.01	49.38	51.10	51.31	50.37
2039	55.36	55.57	53.06	50.58	50.77	49.80	49.98	50.18	50.40	50.77	52.55	52.76	51.79
2040	56.89	57.12	54.52	51.96	52.18	51.17	51.38	51.56	51.77	52.18	54.01	54.21	53.23
2041	58.52	58.76	56.09	53.45	53.66	52.64	52.83	53.04	53.26	53.66	55.56	55.77	54.75
2042	60.20	60.44	57.68	54.95	55.17	54.11	54.31	54.54	54.76	55.17	57.11	57.35	56.30
2043	61.91	62.16	59.32	56.51	56.73	55.63	55.85	56.08	56.31	56.73	58.73	58.98	57.89

**Portland General Electric  
Avoided Cost Study  
Off-Peak Energy, Base Load**

**Table S.1b**

Year	Nominal \$/MWh												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69	
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12	19.13
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65	21.70
2021	23.55	23.41	23.01	20.77	20.65	20.80	20.97	21.03	21.00	21.17	22.35	23.27	21.82
2022	24.28	24.14	23.76	21.65	21.54	21.70	21.88	22.00	22.01	22.18	23.53	24.47	22.75
2023	25.47	25.32	24.94	23.05	22.92	23.09	23.26	23.42	23.43	23.60	24.16	25.12	23.98
2024	25.82	25.91	25.95	25.07	25.15	25.23	25.31	25.39	25.47	25.55	26.64	26.72	25.69
2025	27.37	27.46	27.18	26.26	26.30	26.33	26.42	26.51	26.59	26.71	27.80	27.89	26.90
2026	28.57	28.66	28.27	27.30	27.31	27.40	27.49	27.59	27.68	27.77	28.93	29.02	28.00
2027	29.71	29.81	29.87	28.89	28.98	29.08	29.17	29.27	29.37	29.47	30.71	30.81	29.59
2028	31.50	31.60	31.70	30.77	30.88	30.98	31.08	31.20	31.30	31.56	32.72	32.84	31.51
2029	33.70	33.82	33.92	33.06	33.30	33.63	33.74	33.86	33.99	34.14	35.51	35.64	34.03
2030	36.67	38.19	38.32	37.26	37.40	37.55	37.69	37.83	37.97	38.22	39.67	39.81	38.05
2031	40.80	40.95	41.11	39.82	39.95	40.11	40.27	40.43	40.59	40.80	42.37	42.54	40.82
2032	43.58	43.74	43.75	42.25	42.41	42.57	42.73	42.92	43.08	43.26	44.99	45.17	43.36
2033	46.33	46.52	46.11	44.69	44.86	44.82	45.00	45.17	45.35	45.54	47.35	47.54	45.77
2034	48.72	48.91	46.73	45.30	45.48	45.56	45.74	45.92	46.11	46.28	48.13	48.32	46.76
2035	49.51	49.71	47.50	45.28	45.47	44.60	44.77	44.96	45.11	45.47	47.04	47.22	46.36
2036	50.89	51.09	48.81	46.52	46.71	45.83	46.00	46.17	46.36	46.70	48.34	48.53	47.65
2037	52.35	52.56	50.19	47.86	48.03	47.13	47.31	47.50	47.68	48.03	49.72	49.91	49.00
2038	53.83	54.04	51.61	49.19	49.37	48.45	48.63	48.82	49.01	49.38	51.10	51.31	50.38
2039	55.36	55.57	53.06	50.58	50.77	49.80	49.98	50.18	50.40	50.77	52.55	52.76	51.80
2040	56.89	57.12	54.52	51.96	52.18	51.17	51.38	51.56	51.77	52.18	54.01	54.21	53.24
2041	58.52	58.76	56.09	53.45	53.66	52.64	52.83	53.04	53.26	53.66	55.56	55.77	54.75
2042	60.20	60.44	57.68	54.95	55.17	54.11	54.31	54.54	54.76	55.17	57.11	57.35	56.29
2043	61.91	62.16	59.32	56.51	56.73	55.63	55.85	56.08	56.31	56.73	58.73	58.98	57.89

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**Portland General Electric  
Avoided Cost Study  
On-Peak Energy, Wind**

**Table S.2a**

													Nominal \$/MWh
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					14.38	16.41	28.39	34.00	29.92	24.06	24.06	30.18	
2019	26.96	25.36	20.60	17.31	16.88	17.31	28.46	31.79	29.49	23.60	25.53	29.90	24.45
2020	30.82	29.10	23.42	18.71	18.08	19.01	29.76	34.15	31.06	26.48	28.53	34.02	26.96
2021	22.63	22.49	22.09	19.85	19.73	19.88	20.05	20.11	20.08	20.25	21.43	22.35	20.91
2022	23.34	23.20	22.82	20.71	20.60	20.76	20.94	21.06	21.07	21.24	22.59	23.53	21.82
2023	24.51	24.36	23.98	22.09	21.96	22.13	22.30	22.46	22.47	22.64	23.20	24.16	23.01
2024	24.84	24.93	24.97	24.09	24.17	24.25	24.33	24.41	24.49	24.57	25.66	25.74	24.70
2025	26.37	26.46	26.18	25.26	25.30	25.33	25.42	25.51	25.59	25.71	26.80	26.89	25.90
2026	27.55	27.64	27.25	26.28	26.29	26.38	26.47	26.57	26.66	26.75	27.91	28.00	26.98
2027	28.67	28.77	28.83	27.85	27.94	28.04	28.13	28.23	28.33	28.43	29.67	29.77	28.56
2028	30.44	30.54	30.64	29.71	29.82	29.92	30.02	30.14	30.24	30.50	31.66	31.78	30.45
2029	32.62	32.74	32.84	31.98	32.22	32.55	32.66	32.78	32.91	33.06	34.43	34.56	32.95
2030	35.57	37.09	37.22	36.16	36.30	36.45	36.59	36.73	36.87	37.12	38.57	38.71	36.94
2031	39.68	39.83	39.99	38.70	38.83	38.99	39.15	39.31	39.47	39.68	41.25	41.42	39.69
2032	42.44	42.60	42.61	41.11	41.27	41.43	41.59	41.78	41.94	42.12	43.85	44.03	42.24
2033	45.16	45.35	44.94	43.52	43.69	43.65	43.83	44.00	44.18	44.37	46.18	46.37	44.60
2034	47.53	47.72	45.54	44.11	44.29	44.37	44.55	44.73	44.92	45.09	46.94	47.13	45.56
2035	48.30	48.50	46.29	44.07	44.26	43.39	43.56	43.75	43.90	44.26	45.83	46.01	45.17
2036	49.65	49.85	47.57	45.28	45.47	44.59	44.76	44.93	45.12	45.46	47.10	47.29	46.42
2037	51.09	51.30	48.93	46.60	46.77	45.87	46.05	46.24	46.42	46.77	48.46	48.65	47.74
2038	52.54	52.75	50.32	47.90	48.08	47.16	47.34	47.53	47.72	48.09	49.81	50.02	49.08
2039	54.05	54.26	51.75	49.27	49.46	48.49	48.67	48.87	49.09	49.46	51.24	51.45	50.48
2040	55.55	55.78	53.18	50.62	50.84	49.83	50.04	50.22	50.43	50.84	52.67	52.87	51.89
2041	57.15	57.39	54.72	52.08	52.29	51.27	51.46	51.67	51.89	52.29	54.19	54.40	53.38
2042	58.81	59.05	56.29	53.56	53.78	52.72	52.92	53.15	53.37	53.78	55.72	55.96	54.91
2043	60.49	60.74	57.90	55.09	55.31	54.21	54.43	54.66	54.89	55.31	57.31	57.56	56.47

**Portland General Electric  
Avoided Cost Study  
Off-Peak Energy, Wind**

**Table S.2b**

													Nominal \$/MWh
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					5.71	5.71	15.04	23.04	23.55	20.49	20.49	24.82	
2019	22.46	21.80	17.19	10.78	8.57	7.69	17.89	22.33	22.76	20.60	21.72	25.24	18.25
2020	24.58	24.78	19.24	13.17	10.00	9.63	19.09	25.24	25.73	23.44	25.06	29.75	20.80
2021	22.63	22.49	22.09	19.85	19.73	19.88	20.05	20.11	20.08	20.25	21.43	22.35	20.90
2022	23.34	23.20	22.82	20.71	20.60	20.76	20.94	21.06	21.07	21.24	22.59	23.53	21.81
2023	24.51	24.36	23.98	22.09	21.96	22.13	22.30	22.46	22.47	22.64	23.20	24.16	23.02
2024	24.84	24.93	24.97	24.09	24.17	24.25	24.33	24.41	24.49	24.57	25.66	25.74	24.71
2025	26.37	26.46	26.18	25.26	25.30	25.33	25.42	25.51	25.59	25.71	26.80	26.89	25.90
2026	27.55	27.64	27.25	26.28	26.29	26.38	26.47	26.57	26.66	26.75	27.91	28.00	26.98
2027	28.67	28.77	28.83	27.85	27.94	28.04	28.13	28.23	28.33	28.43	29.67	29.77	28.55
2028	30.44	30.54	30.64	29.71	29.82	29.92	30.02	30.14	30.24	30.50	31.66	31.78	30.45
2029	32.62	32.74	32.84	31.98	32.22	32.55	32.66	32.78	32.91	33.06	34.43	34.56	32.95
2030	35.57	37.09	37.22	36.16	36.30	36.45	36.59	36.73	36.87	37.12	38.57	38.71	36.95
2031	39.68	39.83	39.99	38.70	38.83	38.99	39.15	39.31	39.47	39.68	41.25	41.42	39.70
2032	42.44	42.60	42.61	41.11	41.27	41.43	41.59	41.78	41.94	42.12	43.85	44.03	42.22
2033	45.16	45.35	44.94	43.52	43.69	43.65	43.83	44.00	44.18	44.37	46.18	46.37	44.60
2034	47.53	47.72	45.54	44.11	44.29	44.37	44.55	44.73	44.92	45.09	46.94	47.13	45.57
2035	48.30	48.50	46.29	44.07	44.26	43.39	43.56	43.75	43.90	44.26	45.83	46.01	45.15
2036	49.65	49.85	47.57	45.28	45.47	44.59	44.76	44.93	45.12	45.46	47.10	47.29	46.41
2037	51.09	51.30	48.93	46.60	46.77	45.87	46.05	46.24	46.42	46.77	48.46	48.65	47.74
2038	52.54	52.75	50.32	47.90	48.08	47.16	47.34	47.53	47.72	48.09	49.81	50.02	49.09
2039	54.05	54.26	51.75	49.27	49.46	48.49	48.67	48.87	49.09	49.46	51.24	51.45	50.49
2040	55.55	55.78	53.18	50.62	50.84	49.83	50.04	50.22	50.43	50.84	52.67	52.87	51.90
2041	57.15	57.39	54.72	52.08	52.29	51.27	51.46	51.67	51.89	52.29	54.19	54.40	53.38
2042	58.81	59.05	56.29	53.56	53.78	52.72	52.92	53.15	53.37	53.78	55.72	55.96	54.90
2043	60.49	60.74	57.90	55.09	55.31	54.21	54.43	54.66	54.89	55.31	57.31	57.56	56.47

PGE's 2018 Standard AVOIDED COST ANNUAL UPDATE  
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**Portland General Electric  
Avoided Cost Study  
On-Peak Energy, Solar**

**Table S.3a**

													Nominal \$/MWh
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05	
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78	25.33
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92	27.86
2021	23.55	23.41	23.01	20.77	20.65	20.80	20.97	21.03	21.00	21.17	22.35	23.27	21.83
2022	24.28	24.14	23.76	21.65	21.54	21.70	21.88	22.00	22.01	22.18	23.53	24.47	22.76
2023	25.47	25.32	24.94	23.05	22.92	23.09	23.26	23.42	23.43	23.60	24.16	25.12	23.97
2024	25.82	25.91	25.95	25.07	25.15	25.23	25.31	25.39	25.47	25.55	26.64	26.72	25.68
2025	27.37	27.46	27.18	26.26	26.30	26.33	26.42	26.51	26.59	26.71	27.80	27.89	26.90
2026	28.57	28.66	28.27	27.30	27.31	27.40	27.49	27.59	27.68	27.77	28.93	29.02	28.00
2027	29.71	29.81	29.87	28.89	28.98	29.08	29.17	29.27	29.37	29.47	30.71	30.81	29.60
2028	31.50	31.60	31.70	30.77	30.88	30.98	31.08	31.20	31.30	31.56	32.72	32.84	31.51
2029	33.70	33.82	33.92	33.06	33.30	33.63	33.74	33.86	33.99	34.14	35.51	35.64	34.03
2030	36.67	38.19	38.32	37.26	37.40	37.55	37.69	37.83	37.97	38.22	39.67	39.81	38.04
2031	40.80	40.95	41.11	39.82	39.95	40.11	40.27	40.43	40.59	40.80	42.37	42.54	40.81
2032	43.58	43.74	43.75	42.25	42.41	42.57	42.73	42.92	43.08	43.26	44.99	45.17	43.38
2033	46.33	46.52	46.11	44.69	44.86	44.82	45.00	45.17	45.35	45.54	47.35	47.54	45.77
2034	48.72	48.91	46.73	45.30	45.48	45.56	45.74	45.92	46.11	46.28	48.13	48.32	46.75
2035	49.51	49.71	47.50	45.28	45.47	44.60	44.77	44.96	45.11	45.47	47.04	47.22	46.38
2036	50.89	51.09	48.81	46.52	46.71	45.83	46.00	46.17	46.36	46.70	48.34	48.53	47.66
2037	52.35	52.56	50.19	47.86	48.03	47.13	47.31	47.50	47.68	48.03	49.72	49.91	49.00
2038	53.83	54.04	51.61	49.19	49.37	48.45	48.63	48.82	49.01	49.38	51.10	51.31	50.37
2039	55.36	55.57	53.06	50.58	50.77	49.80	49.98	50.18	50.40	50.77	52.55	52.76	51.79
2040	56.89	57.12	54.52	51.96	52.18	51.17	51.38	51.56	51.77	52.18	54.01	54.21	53.23
2041	58.52	58.76	56.09	53.45	53.66	52.64	52.83	53.04	53.26	53.66	55.56	55.77	54.75
2042	60.20	60.44	57.68	54.95	55.17	54.11	54.31	54.54	54.76	55.17	57.11	57.35	56.30
2043	61.91	62.16	59.32	56.51	56.73	55.63	55.85	56.08	56.31	56.73	58.73	58.98	57.89

**Portland General Electric  
Avoided Cost Study  
Off-Peak Energy, Solar**

**Table S.3b**

													Nominal \$/MWh
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69	
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12	19.13
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65	21.70
2021	23.55	23.41	23.01	20.77	20.65	20.80	20.97	21.03	21.00	21.17	22.35	23.27	21.82
2022	24.28	24.14	23.76	21.65	21.54	21.70	21.88	22.00	22.01	22.18	23.53	24.47	22.75
2023	25.47	25.32	24.94	23.05	22.92	23.09	23.26	23.42	23.43	23.60	24.16	25.12	23.98
2024	25.82	25.91	25.95	25.07	25.15	25.23	25.31	25.39	25.47	25.55	26.64	26.72	25.69
2025	27.37	27.46	27.18	26.26	26.30	26.33	26.42	26.51	26.59	26.71	27.80	27.89	26.90
2026	28.57	28.66	28.27	27.30	27.31	27.40	27.49	27.59	27.68	27.77	28.93	29.02	28.00
2027	29.71	29.81	29.87	28.89	28.98	29.08	29.17	29.27	29.37	29.47	30.71	30.81	29.59
2028	31.50	31.60	31.70	30.77	30.88	30.98	31.08	31.20	31.30	31.56	32.72	32.84	31.51
2029	33.70	33.82	33.92	33.06	33.30	33.63	33.74	33.86	33.99	34.14	35.51	35.64	34.03
2030	36.67	38.19	38.32	37.26	37.40	37.55	37.69	37.83	37.97	38.22	39.67	39.81	38.05
2031	40.80	40.95	41.11	39.82	39.95	40.11	40.27	40.43	40.59	40.80	42.37	42.54	40.82
2032	43.58	43.74	43.75	42.25	42.41	42.57	42.73	42.92	43.08	43.26	44.99	45.17	43.36
2033	46.33	46.52	46.11	44.69	44.86	44.82	45.00	45.17	45.35	45.54	47.35	47.54	45.77
2034	48.72	48.91	46.73	45.30	45.48	45.56	45.74	45.92	46.11	46.28	48.13	48.32	46.76
2035	49.51	49.71	47.50	45.28	45.47	44.60	44.77	44.96	45.11	45.47	47.04	47.22	46.36
2036	50.89	51.09	48.81	46.52	46.71	45.83	46.00	46.17	46.36	46.70	48.34	48.53	47.65
2037	52.35	52.56	50.19	47.86	48.03	47.13	47.31	47.50	47.68	48.03	49.72	49.91	49.00
2038	53.83	54.04	51.61	49.19	49.37	48.45	48.63	48.82	49.01	49.38	51.10	51.31	50.38
2039	55.36	55.57	53.06	50.58	50.77	49.80	49.98	50.18	50.40	50.77	52.55	52.76	51.80
2040	56.89	57.12	54.52	51.96	52.18	51.17	51.38	51.56	51.77	52.18	54.01	54.21	53.24
2041	58.52	58.76	56.09	53.45	53.66	52.64	52.83	53.04	53.26	53.66	55.56	55.77	54.75
2042	60.20	60.44	57.68	54.95	55.17	54.11	54.31	54.54	54.76	55.17	57.11	57.35	56.29
2043	61.91	62.16	59.32	56.51	56.73	55.63	55.85	56.08	56.31	56.73	58.73	58.98	57.89





PGE's 2018 Standard AVOIDED COST ANNUAL UPDATE  
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**Portland General Electric**  
**Avoided Cost Study**  
**Total Projected Avoided Fuel Costs**

Table S.8

Nominal \$/MWh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018	-	-	-	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	13.17	13.03	12.63	10.39	10.28	10.43	10.59	10.66	10.62	10.79	11.97	12.89	11.45
2022	13.68	13.54	13.15	11.05	10.94	11.10	11.28	11.40	11.41	11.58	12.93	13.86	12.16
2023	14.65	14.51	14.13	12.24	12.11	12.27	12.45	12.60	12.61	12.79	13.35	14.30	13.17
2024	14.81	14.90	14.94	14.06	14.14	14.22	14.30	14.38	14.46	14.53	15.63	15.71	14.67
2025	16.12	16.21	15.93	15.01	15.05	15.08	15.17	15.26	15.34	15.46	16.55	16.64	15.65
2026	17.10	17.18	16.80	15.83	15.84	15.93	16.02	16.11	16.20	16.29	17.46	17.55	16.53
2027	18.01	18.11	18.16	17.18	17.27	17.38	17.47	17.57	17.67	17.77	19.01	19.11	17.89
2028	19.58	19.68	19.78	18.86	18.96	19.06	19.17	19.28	19.38	19.65	20.80	20.92	19.59
2029	21.52	21.64	21.74	20.88	21.12	21.45	21.57	21.69	21.81	21.97	23.33	23.46	21.85
2030	24.25	25.77	25.90	24.84	24.98	25.13	25.27	25.41	25.55	25.80	27.25	27.39	25.63
2031	28.14	28.28	28.44	27.15	27.28	27.44	27.60	27.76	27.92	28.14	29.71	29.88	28.14
2032	30.68	30.84	30.85	29.35	29.51	29.67	29.84	30.02	30.18	30.36	32.09	32.27	30.47
2033	33.15	33.34	32.93	31.51	31.68	31.64	31.82	32.00	32.17	32.36	34.17	34.36	32.59
2034	35.28	35.47	33.29	31.86	32.04	32.11	32.30	32.48	32.67	32.84	34.68	34.88	33.32
2035	35.80	36.00	33.79	31.57	31.76	30.89	31.06	31.24	31.40	31.76	33.32	33.51	32.68
2036	36.93	37.13	34.85	32.56	32.75	31.86	32.04	32.21	32.40	32.74	34.38	34.56	33.70
2037	38.09	38.29	35.92	33.59	33.77	32.87	33.04	33.24	33.41	33.77	35.45	35.65	34.76
2038	39.28	39.49	37.06	34.64	34.82	33.90	34.08	34.27	34.46	34.83	36.55	36.76	35.84
2039	40.52	40.73	38.22	35.74	35.93	34.96	35.14	35.34	35.56	35.93	37.71	37.92	36.97
2040	41.77	42.01	39.40	36.85	37.06	36.06	36.26	36.45	36.66	37.06	38.90	39.10	38.13
2041	43.08	43.32	40.65	38.01	38.22	37.20	37.39	37.60	37.82	38.22	40.12	40.33	39.33
2042	44.45	44.69	41.94	39.20	39.42	38.37	38.56	38.79	39.02	39.42	41.36	41.60	40.57
2043	45.85	46.10	43.26	40.45	40.66	39.57	39.78	40.02	40.25	40.66	42.67	42.92	41.85





## **Standard Capacity Tables**







UM 1728

Application to Update Schedule 201  
Avoided Cost Power Purchase Information

Attachment B  
Description of Renewable Avoided Costs

PORTLAND GENERAL ELECTRIC COMPANY  
RENEWABLE AVOIDED COST STUDY  
2018 ANNUAL UPDATE

Introduction

Consistent with Commission Order No. 14-058<sup>1</sup>, annual renewable avoided cost updates allow modifications of four factors:

1. Updated natural gas prices;
2. On- and off-peak forward-looking electricity market prices;
3. Changes to the status of the Production Tax Credit; and
4. Any other action or change in an acknowledged IRP update relevant to the calculation of avoided costs.

This 2018 update will focus on two factors: (1) updated forward electricity market prices for the renewable resource sufficiency period, and (2) updated supply-side resource costs and operating parameters, financial parameters, and capacity contribution values for incremental wind and solar resources as acknowledged in PGE's 2016 IRP Update.<sup>2</sup>

Below is a summary of the approved factors:

Factor 2: Electricity Market Projections

The forward trading curves are based on market prices for electricity delivered to PGE's system and calculated according to the methodology approved by the OPUC. The forward trading curves adjusted for delivery are used to price avoided costs during a resource sufficiency period. For May 2018 through December 2023, the market prices are based on PGE's forward trading curve from February 22, 2018. For 2024, the market prices are based on Aurora prices from the acknowledged 2016 IRP Update, as discussed in Section 9 of the IRP Update.

Wheeling costs, as included in PGE's Schedule 201 prices, remain based on current BPA rates adjusted for inflation.

Factor 3: Production Tax Credits

There are no changes since PGE's last avoided cost update in September 2017.

Factor 4: Other Action

PGE's 2016 IRP Update was acknowledged at the April 24, 2018 OPUC Public Meeting. Therefore, PGE also updated supply-side resource costs and operating parameters, financial parameters, and capacity contribution values for incremental wind and solar resources.

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<sup>1</sup> Order No. 14-058 at 25-26.

<sup>2</sup> Acknowledged at OPUC April 24, 2018 Public Meeting.

- Supply-side resource costs and parameters are based on Appendix A (for SCCT) and Appendix B (for Wind and Solar) of the IRP Update, including: overnight capital cost, on-going capital expenditures, fixed O&M, and annual capacity factor.
- Financial parameters are based on Section 7 of the IRP update (see Table 8).
- Capacity contribution values for incremental wind and solar resources are based on Appendix D of the IRP Update.

### Deficiency/Sufficiency Periods

There is no change to the Deficiency/Sufficiency periods as a result of this May 1 Update. The current Deficiency/Sufficiency periods approved by the Commission in Order No. 17-347 are stated below for reference purposes:

- Renewable Resource Sufficiency Period is the period from the current year through 2024.
- Renewable Resource Deficiency Period is the period from 2025.

### Summary of Avoided Cost Estimates

Tables R.1 through R.3 (following) summarize PGE avoided cost prices. Tables R.1a, R.1b, R.2a, R.2b, R.3a, R.3b<sup>3</sup> are estimates of monthly on- and off-peak renewable avoided costs for over twenty years beginning in May 2018. The renewable resource sufficiency period prices (expressed in \$/MWh or mills/kWh) for the years 2018 through 2024 are based on the forward electricity curves adjusted for delivery as discussed above.

Renewable avoided cost prices beginning January 2025 are represented by the fully allocated costs of a renewable wind resource based on PGE's acknowledged 2016 IRP Update<sup>4</sup> with applicable adjustments for capacity value. As in current Schedule 201 prices, the energy portion of the on- and off-peak prices are shaped using the on- and off-peak monthly shape factors based on the 2024 market prices. On-peak periods are from 6 a.m. through 10 p.m. Mondays through Saturdays.<sup>5</sup> The off-peak hours are from 10 p.m. until 6 a.m. Mondays through Saturdays and all twenty-four hours on Sunday.<sup>6</sup> Table R.4 provides the wind integration costs. Tables R.5 and R.6 show the on- and off-peak resource sufficiency rates.

### Avoided Cost Components

#### *Energy:*

Tables R.7, R.8 and R.9 are the basis for energy during the deficiency period. Table R.8 shows the full value of a wind resource (as flat \$/MWh). Table 7 isolates the value of wind capacity. Tables R.9 shows the full value of a wind resource less wind capacity value (Table 8 less Table 7 equates to Table 9).

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3 R1: Base Load QF; R2: Wind QF; R3: Solar QF.

4 Acknowledged at the April 24, 2018 OPUC Public Meeting.

5 Schedule 201, Sheet 201-3.

6 Id.



To arrive at final renewable energy pricing, the full value of a wind resource less the capacity value of wind is shaped via monthly shape factors as described above.

*Capacity:*

Table R10a and b, R.1a and b, and R.12a and b isolate the capacity portion of avoided cost prices for Base Load, Wind, and Solar QFs (both on- and off-peak).

## **Renewable Energy Tables**

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**Portland General Electric  
Renewable Avoided Cost Study  
On-Peak Energy, Base Load**

Table R.1a

Nominal \$/MWh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05	
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78	25.33
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92	27.86
2021	35.25	33.33	26.96	21.68	20.97	22.02	34.07	38.99	35.53	30.39	32.69	38.84	30.90
2022	37.42	35.37	28.60	22.99	22.23	23.34	36.16	41.39	37.71	32.25	34.69	41.23	32.81
2023	37.44	35.39	28.62	23.01	22.25	23.36	36.18	41.41	37.73	32.26	34.71	41.25	32.79
2024	33.46	31.46	29.68	24.29	21.51	14.47	26.46	29.70	32.48	32.50	33.08	34.88	28.69
2025	77.74	72.68	68.15	54.48	47.45	29.57	59.99	68.22	75.25	75.32	76.78	81.36	65.66
2026	79.29	74.13	69.51	55.56	48.39	30.17	61.19	69.58	76.76	76.82	78.31	82.99	66.91
2027	80.88	75.61	70.90	56.67	49.36	30.77	62.41	70.97	78.29	78.36	79.88	84.65	68.22
2028	82.27	76.91	72.12	57.65	50.21	31.30	63.49	72.19	79.64	79.70	81.25	86.10	69.37
2029	84.14	78.66	73.76	58.96	51.35	32.01	64.93	73.84	81.45	81.52	83.10	88.07	70.97
2030	85.82	80.24	75.24	60.14	52.38	32.65	66.23	75.31	83.08	83.15	84.76	89.83	72.45
2031	87.54	81.84	76.74	61.34	53.43	33.30	67.55	76.82	84.74	84.81	86.46	91.62	73.94
2032	89.04	83.25	78.06	62.40	54.34	33.88	68.72	78.14	86.20	86.27	87.94	93.20	75.18
2033	91.07	85.14	79.84	63.82	55.58	34.65	70.28	79.92	88.16	88.23	89.95	95.32	76.86
2034	92.89	86.84	81.43	65.09	56.69	35.34	71.69	81.51	89.92	90.00	91.74	97.22	78.30
2035	94.75	88.58	83.06	66.39	57.83	36.05	73.12	83.14	91.72	91.80	93.58	99.17	79.92
2036	96.38	90.10	84.49	67.54	58.82	36.67	74.38	84.57	93.30	93.37	95.19	100.87	81.43
2037	98.57	92.16	86.41	69.08	60.16	37.50	76.07	86.50	95.42	95.50	97.36	103.17	83.19
2038	100.54	94.00	88.14	70.46	61.36	38.25	77.59	88.23	97.33	97.41	99.30	105.23	84.81
2039	102.55	95.88	89.90	71.86	62.59	39.02	79.14	89.99	99.28	99.36	101.29	107.33	86.54
2040	104.32	97.53	91.45	73.10	63.67	39.69	80.50	91.54	100.98	101.06	103.03	109.18	87.97
2041	106.69	99.75	93.53	74.76	65.12	40.59	82.33	93.62	103.28	103.37	105.37	111.67	90.06
2042	108.82	101.74	95.40	76.26	66.42	41.40	83.98	95.50	105.35	105.43	107.48	113.90	91.92
2043	111.00	103.77	97.31	77.78	67.74	42.23	85.66	97.40	107.45	107.54	109.63	116.18	93.67
<b>Capacity Removed, Aurora Shaping</b>													

**Portland General Electric  
Renewable Avoided Cost Study  
Off-Peak Energy, Base Load**

Table R.1b

Nominal \$/MWh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69	
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12	19.13
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65	21.70
2021	29.15	29.38	22.96	15.91	12.23	11.81	22.79	29.92	30.49	27.83	29.70	35.15	24.77
2022	31.09	31.33	24.47	16.93	13.00	12.55	24.28	31.91	32.52	29.67	31.68	37.50	26.37
2023	31.41	31.65	24.71	17.09	13.12	12.66	24.53	32.24	32.85	29.98	32.00	37.89	26.70
2024	29.94	27.68	27.33	23.19	20.10	12.65	23.44	27.06	29.10	29.67	31.04	32.02	26.10
2025	68.81	63.08	62.21	51.70	43.86	24.97	52.32	61.52	66.70	68.13	71.61	74.10	59.04
2026	70.19	64.34	63.45	52.73	44.74	25.47	53.37	62.75	68.03	69.49	73.04	75.58	60.30
2027	71.59	65.63	64.72	53.78	45.63	25.97	54.44	64.01	69.39	70.88	74.50	77.09	61.52
2028	72.82	66.76	65.83	54.71	46.42	26.42	55.37	65.11	70.58	72.10	75.78	78.41	62.64
2029	74.48	68.28	67.33	55.95	47.47	27.02	56.63	66.59	72.19	73.74	77.50	80.20	64.01
2030	75.97	69.64	68.68	57.07	48.42	27.56	57.77	67.92	73.63	75.22	79.05	81.80	65.21
2031	77.49	71.03	70.05	58.21	49.39	28.11	58.92	69.28	75.10	76.72	80.63	83.44	66.48
2032	78.82	72.25	71.26	59.21	50.24	28.60	59.93	70.47	76.40	78.04	82.02	84.87	67.69
2033	80.61	73.90	72.88	60.56	51.38	29.25	61.30	72.08	78.14	79.82	83.89	86.80	69.22
2034	82.23	75.38	74.33	61.77	52.41	29.83	62.52	73.52	79.70	81.41	85.56	88.54	70.72
2035	83.87	76.88	75.82	63.01	53.46	30.43	63.77	74.99	81.29	83.04	87.27	90.31	72.08
2036	85.31	78.21	77.12	64.09	54.38	30.95	64.87	76.28	82.69	84.47	88.77	91.86	73.20
2037	87.25	79.99	78.88	65.55	55.62	31.66	66.35	78.01	84.57	86.39	90.80	93.95	74.96
2038	89.00	81.59	80.46	66.86	56.73	32.29	67.67	79.57	86.26	88.12	92.61	95.83	76.47
2039	90.78	83.22	82.07	68.20	57.86	32.94	69.03	81.16	87.99	89.88	94.46	97.75	77.95
2040	92.34	84.65	83.48	69.37	58.86	33.50	70.21	82.56	89.50	91.43	96.09	99.43	79.43
2041	94.44	86.57	85.38	70.95	60.20	34.27	71.81	84.44	91.54	93.51	98.28	101.69	81.07
2042	96.33	88.31	87.08	72.37	61.40	34.95	73.25	86.13	93.37	95.38	100.24	103.73	82.64
2043	98.25	90.07	88.83	73.81	62.63	35.65	74.71	87.85	95.23	97.28	102.24	105.80	84.41
<b>Capacity Removed, Aurora Shaping</b>													

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Portland General Electric  
Renewable Avoided Cost Study  
On-Peak Energy, Wind

Table R.2a

Year	Nominal \$/MWh												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2018					14.38	16.41	28.39	34.00	29.92	24.06	24.06	30.18	
2019	26.96	25.36	20.60	17.31	16.88	17.31	28.46	31.79	29.49	23.60	25.53	29.90	24.45
2020	30.82	29.10	23.42	18.71	18.08	19.01	29.76	34.15	31.06	26.48	28.53	34.02	26.96
2021	34.33	32.41	26.04	20.76	20.05	21.10	33.15	38.07	34.61	29.47	31.77	37.92	29.98
2022	36.48	34.43	27.66	22.05	21.29	22.40	35.22	40.45	36.77	31.31	33.75	40.29	31.87
2023	36.48	34.43	27.66	22.05	21.29	22.40	35.22	40.45	36.77	31.30	33.75	40.29	31.83
2024	32.48	30.48	28.70	23.31	20.53	13.49	25.48	28.72	31.50	31.52	32.10	33.90	27.71
2025	76.74	71.68	67.15	53.48	46.45	28.57	58.99	67.22	74.25	74.32	75.78	80.36	64.66
2026	78.27	73.11	68.49	54.54	47.37	29.15	60.17	68.56	75.74	75.80	77.29	81.97	65.89
2027	79.84	74.57	69.86	55.63	48.32	29.73	61.37	69.93	77.25	77.32	78.84	83.61	67.18
2028	81.21	75.85	71.06	56.59	49.15	30.24	62.43	71.13	78.58	78.64	80.19	85.04	68.31
2029	83.06	77.58	72.68	57.88	50.27	30.93	63.85	72.76	80.37	80.44	82.02	86.99	69.89
2030	84.72	79.14	74.14	59.04	51.28	31.55	65.13	74.21	81.98	82.05	83.66	88.73	71.35
2031	86.42	80.72	75.62	60.22	52.31	32.18	66.43	75.70	83.62	83.69	85.34	90.50	72.82
2032	87.90	82.11	76.92	61.26	53.20	32.74	67.58	77.00	85.06	85.13	86.80	92.06	74.04
2033	89.90	83.97	78.67	62.65	54.41	33.48	69.11	78.75	86.99	87.06	88.78	94.15	75.69
2034	91.70	85.65	80.24	63.90	55.50	34.15	70.50	80.32	88.73	88.81	90.55	96.03	77.11
2035	93.54	87.37	81.85	65.18	56.62	34.84	71.91	81.93	90.51	90.59	92.37	97.96	78.71
2036	95.14	88.86	83.25	66.30	57.58	35.43	73.14	83.33	92.06	92.13	93.95	99.63	80.19
2037	97.31	90.90	85.15	67.82	58.90	36.24	74.81	85.24	94.16	94.24	96.10	101.91	81.93
2038	99.25	92.71	86.85	69.17	60.07	36.96	76.30	86.94	96.04	96.12	98.01	103.94	83.52
2039	101.24	94.57	88.59	70.55	61.28	37.71	77.83	88.68	97.97	98.05	99.98	106.02	85.23
2040	102.98	96.19	90.11	71.76	62.33	38.35	79.16	90.20	99.64	99.72	101.69	107.84	86.63
2041	105.32	98.38	92.16	73.39	63.75	39.22	80.96	92.25	101.91	102.00	104.00	110.30	88.69
2042	107.43	100.35	94.01	74.87	65.03	40.01	82.59	94.11	103.96	104.04	106.09	112.51	90.53
2043	109.58	102.35	95.89	76.36	66.32	40.81	84.24	95.98	106.03	106.12	108.21	114.76	92.25
<b>Capacity Removed, Aurora Shaping, Integration Removed</b>													

Portland General Electric  
Renewable Avoided Cost Study  
Off-Peak Energy, Wind

Table R.2b

Year	Nominal \$/MWh												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2018					5.71	5.71	15.04	23.04	23.55	20.49	20.49	24.82	
2019	22.46	21.80	17.19	10.78	8.57	7.69	17.89	22.33	22.76	20.60	21.72	25.24	18.25
2020	24.58	24.78	19.24	13.17	10.00	9.63	19.09	25.24	25.73	23.44	25.06	29.75	20.80
2021	28.23	28.46	22.04	14.99	11.31	10.89	21.87	29.00	29.57	26.91	28.78	34.23	23.85
2022	30.15	30.39	23.53	15.99	12.06	11.61	23.34	30.97	31.58	28.73	30.74	36.56	25.43
2023	30.45	30.69	23.75	16.13	12.16	11.70	23.57	31.28	31.89	29.02	31.04	36.93	25.74
2024	28.96	26.70	26.35	22.21	19.12	11.67	22.46	26.08	28.12	28.69	30.06	31.04	25.12
2025	67.81	62.08	61.21	50.70	42.86	23.97	51.32	60.52	65.70	67.13	70.61	73.10	58.04
2026	69.17	63.32	62.43	51.71	43.72	24.45	52.35	61.73	67.01	68.47	72.02	74.56	59.28
2027	70.55	64.59	63.68	52.74	44.59	24.93	53.40	62.97	68.35	69.84	73.46	76.05	60.48
2028	71.76	65.70	64.77	53.65	45.36	25.36	54.31	64.05	69.52	71.04	74.72	77.35	61.58
2029	73.40	67.20	66.25	54.87	46.39	25.94	55.55	65.51	71.11	72.66	76.42	79.12	62.93
2030	74.87	68.54	67.58	55.97	47.32	26.46	56.67	66.82	72.53	74.12	77.95	80.70	64.11
2031	76.37	69.91	68.93	57.09	48.27	26.99	57.80	68.16	73.98	75.60	79.51	82.32	65.36
2032	77.68	71.11	70.12	58.07	49.10	27.46	58.79	69.33	75.26	76.90	80.88	83.73	66.55
2033	79.44	72.73	71.71	59.39	50.21	28.08	60.13	70.91	76.97	78.65	82.72	85.63	68.05
2034	81.04	74.19	73.14	60.58	51.22	28.64	61.33	72.33	78.51	80.22	84.37	87.35	69.53
2035	82.66	75.67	74.61	61.80	52.25	29.22	62.56	73.78	80.08	81.83	86.06	89.10	70.87
2036	84.07	76.97	75.88	62.85	53.14	29.71	63.63	75.04	81.45	83.23	87.53	90.62	71.96
2037	85.99	78.73	77.62	64.29	54.36	30.40	65.09	76.75	83.31	85.13	89.54	92.69	73.70
2038	87.71	80.30	79.17	65.57	55.44	31.00	66.38	78.28	84.97	86.83	91.32	94.54	75.18
2039	89.47	81.91	80.76	66.89	56.55	31.63	67.72	79.85	86.68	88.57	93.15	96.44	76.64
2040	91.00	83.31	82.14	68.03	57.52	32.16	68.87	81.22	88.16	90.09	94.75	98.09	78.09
2041	93.07	85.20	84.01	69.58	58.83	32.90	70.44	83.07	90.17	92.14	96.91	100.32	79.70
2042	94.94	86.92	85.69	70.98	60.01	33.56	71.86	84.74	91.98	93.99	98.85	102.34	81.25
2043	96.83	88.65	87.41	72.39	61.21	34.23	73.29	86.43	93.81	95.86	100.82	104.38	82.99
<b>Capacity Removed, Aurora Shaping, Integration Removed</b>													

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**Portland General Electric**  
**Renewable Avoided Cost Study**  
**On-Peak Energy, Solar**

**Table R.3a**

Nominal \$/MWh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					15.25	17.28	29.26	34.87	30.79	24.93	24.93	31.05	
2019	27.84	26.24	21.48	18.19	17.76	18.19	29.34	32.67	30.37	24.48	26.41	30.78	25.33
2020	31.72	30.00	24.32	19.61	18.98	19.91	30.66	35.05	31.96	27.38	29.43	34.92	27.86
2021	35.25	33.33	26.96	21.68	20.97	22.02	34.07	38.99	35.53	30.39	32.69	38.84	30.90
2022	37.42	35.37	28.60	22.99	22.23	23.34	36.16	41.39	37.71	32.25	34.69	41.23	32.81
2023	37.44	35.39	28.62	23.01	22.25	23.36	36.18	41.41	37.73	32.26	34.71	41.25	32.79
2024	33.46	31.46	29.68	24.29	21.51	14.47	26.46	29.70	32.48	32.50	33.08	34.88	28.69
2025	77.74	72.68	68.15	54.48	47.45	29.57	59.99	68.22	75.25	75.32	76.78	81.36	65.66
2026	79.29	74.13	69.51	55.56	48.39	30.17	61.19	69.58	76.76	76.82	78.31	82.99	66.91
2027	80.88	75.61	70.90	56.67	49.36	30.77	62.41	70.97	78.29	78.36	79.88	84.65	68.22
2028	82.27	76.91	72.12	57.65	50.21	31.30	63.49	72.19	79.64	79.70	81.25	86.10	69.37
2029	84.14	78.66	73.76	58.96	51.35	32.01	64.93	73.84	81.45	81.52	83.10	88.07	70.97
2030	85.82	80.24	75.24	60.14	52.38	32.65	66.23	75.31	83.08	83.15	84.76	89.83	72.45
2031	87.54	81.84	76.74	61.34	53.43	33.30	67.55	76.82	84.74	84.81	86.46	91.62	73.94
2032	89.04	83.25	78.06	62.40	54.34	33.88	68.72	78.14	86.20	86.27	87.94	93.20	75.18
2033	91.07	85.14	79.84	63.82	55.58	34.65	70.28	79.92	88.16	88.23	89.95	95.32	76.86
2034	92.89	86.84	81.43	65.09	56.69	35.34	71.69	81.51	89.92	90.00	91.74	97.22	78.30
2035	94.75	88.58	83.06	66.39	57.83	36.05	73.12	83.14	91.72	91.80	93.58	99.17	79.92
2036	96.38	90.10	84.49	67.54	58.82	36.67	74.38	84.57	93.30	93.37	95.19	100.87	81.43
2037	98.57	92.16	86.41	69.08	60.16	37.50	76.07	86.50	95.42	95.50	97.36	103.17	83.19
2038	100.54	94.00	88.14	70.46	61.36	38.25	77.59	88.23	97.33	97.41	99.30	105.23	84.81
2039	102.55	95.88	89.90	71.86	62.59	39.02	79.14	89.99	99.28	99.36	101.29	107.33	86.54
2040	104.32	97.53	91.45	73.10	63.67	39.69	80.50	91.54	100.98	101.06	103.03	109.18	87.97
2041	106.69	99.75	93.53	74.76	65.12	40.59	82.33	93.62	103.28	103.37	105.37	111.67	90.06
2042	108.82	101.74	95.40	76.26	66.42	41.40	83.98	95.50	105.35	105.43	107.48	113.90	91.92
2043	111.00	103.77	97.31	77.78	67.74	42.23	85.66	97.40	107.45	107.54	109.63	116.18	93.67

*Capacity Removed, Aurora Shaping, Integration Removed*

**Portland General Electric**  
**Renewable Avoided Cost Study**  
**Off-Peak Energy, Solar**

**Table R.3b**

Nominal \$/MWh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018					6.58	6.58	15.91	23.91	24.42	21.36	21.36	25.69	
2019	23.34	22.68	18.07	11.66	9.45	8.57	18.77	23.21	23.64	21.48	22.60	26.12	19.13
2020	25.48	25.68	20.14	14.07	10.90	10.53	19.99	26.14	26.63	24.34	25.96	30.65	21.70
2021	29.15	29.38	22.96	15.91	12.23	11.81	22.79	29.92	30.49	27.83	29.70	35.15	24.77
2022	31.09	31.33	24.47	16.93	13.00	12.55	24.28	31.91	32.52	29.67	31.68	37.50	26.37
2023	31.41	31.65	24.71	17.09	13.12	12.66	24.53	32.24	32.85	29.98	32.00	37.89	26.70
2024	29.94	27.68	27.33	23.19	20.10	12.65	23.44	27.06	29.10	29.67	31.04	32.02	26.10
2025	68.81	63.08	62.21	51.70	43.86	24.97	52.32	61.52	66.70	68.13	71.61	74.10	59.04
2026	70.19	64.34	63.45	52.73	44.74	25.47	53.37	62.75	68.03	69.49	73.04	75.58	60.30
2027	71.59	65.63	64.72	53.78	45.63	25.97	54.44	64.01	69.39	70.88	74.50	77.09	61.52
2028	72.82	66.76	65.83	54.71	46.42	26.42	55.37	65.11	70.58	72.10	75.78	78.41	62.64
2029	74.48	68.28	67.33	55.95	47.47	27.02	56.63	66.59	72.19	73.74	77.50	80.20	64.01
2030	75.97	69.64	68.68	57.07	48.42	27.56	57.77	67.92	73.63	75.22	79.05	81.80	65.21
2031	77.49	71.03	70.05	58.21	49.39	28.11	58.92	69.28	75.10	76.72	80.63	83.44	66.48
2032	78.82	72.25	71.26	59.21	50.24	28.60	59.93	70.47	76.40	78.04	82.02	84.87	67.69
2033	80.61	73.90	72.88	60.56	51.38	29.25	61.30	72.08	78.14	79.82	83.89	86.80	69.22
2034	82.23	75.38	74.33	61.77	52.41	29.83	62.52	73.52	79.70	81.41	85.56	88.54	70.72
2035	83.87	76.88	75.82	63.01	53.46	30.43	63.77	74.99	81.29	83.04	87.27	90.31	72.08
2036	85.31	78.21	77.12	64.09	54.38	30.95	64.87	76.28	82.69	84.47	88.77	91.86	73.20
2037	87.25	79.99	78.88	65.55	55.62	31.66	66.35	78.01	84.57	86.39	90.80	93.95	74.96
2038	89.00	81.59	80.46	66.86	56.73	32.29	67.67	79.57	86.26	88.12	92.61	95.83	76.47
2039	90.78	83.22	82.07	68.20	57.86	32.94	69.03	81.16	87.99	89.88	94.46	97.75	77.95
2040	92.34	84.65	83.48	69.37	58.86	33.50	70.21	82.56	89.50	91.43	96.09	99.43	79.43
2041	94.44	86.57	85.38	70.95	60.20	34.27	71.81	84.44	91.54	93.51	98.28	101.69	81.07
2042	96.33	88.31	87.08	72.37	61.40	34.95	73.25	86.13	93.37	95.38	100.24	103.73	82.64
2043	98.25	90.07	88.83	73.81	62.63	35.65	74.71	87.85	95.23	97.28	102.24	105.80	84.41

*Capacity Removed, Aurora Shaping, Integration Removed*

<b>Portland General Electric Renewable Avoided Cost Study Integration Costs</b>		
<b>Table R.4</b>	Nominal \$/MWh	
Year	Wind	Solar
2018	0.87	-
2019	0.88	-
2020	0.90	-
2021	0.92	-
2022	0.94	-
2023	0.96	-
2024	0.98	-
2025	1.00	-
2026	1.02	-
2027	1.04	-
2028	1.06	-
2029	1.08	-
2030	1.10	-
2031	1.12	-
2032	1.14	-
2033	1.17	-
2034	1.19	-
2035	1.21	-
2036	1.24	-
2037	1.26	-
2038	1.29	-
2039	1.31	-
2040	1.34	-
2041	1.37	-
2042	1.39	-
2043	1.42	-









## **Renewable Capacity Tables**







**Workbook tab: Plant Capital Cost Inputs**

	5-01-18 Filing				9-14-17 Filing	
	Value	Units	\$ Year	Source	Value	\$ Year
<b>SCCT (1x0 FE 7F.05):</b>						
Clean Capacity	231	MW		2016 IRP Update Appendix A	230	
Degraded Capacity	218	MW		2016 IRP Update Appendix A	224	
Overnight capital cost	143,696	(\$000s)	2017	2016 IRP Update Appendix A	136,100	2015
CO2 offset	3,172	(\$000s)	2017	2016 IRP Update Appendix C	-	
Economic life	38	yrs.		2016 IRP Update, Section 7	30	
Tax life	15	yrs.		No change	15	
Decommissioning cost	1,379	(\$000s)	2017	2016 IRP Update Appendix A	-5.5%	
In-service date	2021			No change	2021	
Start construction date	2019			No change	2019	
EPC period	24	months		No change	24	
<b>CCCT Production Equipment (1x1 GE 7HA.01):</b>						
Clean Capacity	424	MW		2016 IRP Update Appendix A	400	
Degraded Capacity	400	MW		2016 IRP Update Appendix A	387	
Overnight capital cost	562,835	(\$000s)	2017	2016 IRP Update Appendix A	420,100	2015
CO2 offset	6,755	(\$000s)	2017	2016 IRP Update Appendix C	-	
Economic life	38	yrs.		2016 IRP Update, Section 7	35	
Tax life	20			No change	20	
Decommissioning cost	9,798	(\$000s)	2017	2016 IRP Update Appendix A	-7.5%	
In-service date	2021			No change	2021	
Start construction date	2018			No change	2018	
EPC period	30	months		No change	30	
<b>Wind Equipment (Gorge wind):</b>						
Capacity	332	MW		2016 IRP Update Table 7	338	
Turbines	166	turbines		2016 IRP Update Appendix B	169	
Overnight capital cost	457,088	(\$000s)	2017	2016 IRP Update Appendix B	507,780	2015
Annual capital reinvestment	12,500	\$/MW	2017	2016 IRP Update Appendix B	18,757	2015
Economic life	30			2016 IRP Update, Section 7	27	
Tax life	5			No change	5	
Decommissioning cost	0			No change	0	
In-service date	2025			No change	2025	
Start construction date	2023			No change	2023	
EPC period	16	months		No change	16	
Plant retirement	2054			No change	2054	

**Workbook tab: Plant Operating Parameters**

	Value	Units	5-01-18 Filing		9-14-17 Filing	
			\$ Year	Source	Value	\$ Year
<b>SCCT 1x0 GE 7F.05</b>						
Heat Rate (Degraded)	10,170	Btu/kWh		IRP Update Appendix A	9,981	
Fixed O&M	7.10	\$/kW-yr	2017	Appendix A, new&clean converted to degr.	3.22	2015
Variable O&M	7.31	\$/MWh	2017	Appendix A, new&clean converted to degr.	9.29	2015
<b>CCCT 1x1 GE FHA.01</b>						
Heat Rate (Degraded)	6,450	Btu/kWh		IRP Update Appendix A	6,503	
Fixed O&M	7.84	\$/kW-yr	2017	Appendix A, new&clean converted to degr.	8.53	2015
Variable O&M	3.50	\$/MWh	2017	Appendix A, new&clean converted to degr.	2.60	2015
Availability factor	90.43%	%		2016 IRP Update Table 7	94.81%	
Start up costs	950	MMBtu/start		No change	950	
<b>Gorge Wind</b>						
Fixed O&M	33.00	\$/kW-yr	2017	IRP Update Appendix B	34.00	2015
Capacity factor (flat)	35.00%			IRP Update Appendix B	34.00%	
Capacity factor (peak)	35.24%			No change	35.24%	
Annual output	1,017,912	MWh			988,829	
Land royalties	5.50	\$/kw-yr	2017	2016 IRP Update Appendix B	5.50	2015
Capacity contribution	16.73%			2016 IRP Update Appendix D	18.59%	
<b>Solar</b>						
Capacity factor (peak)	35.61%			2016 IRP, Section 5.1.5 (no change)	35.61%	
Capacity contribution	14.40%			2016 IRP Update, Appendix D	15.33%	
<b>BPA Line Loss</b>						
BPA line loss	1.9%			No change	1.9%	

**Workbook tab: Financial and Tax Parameters**

	Value	5-01-18 Filing		9-14-17 Filing	
		Value	Source	Value	Source
Federal Income Tax Rate	21.00%		2016 IRP Update, Section 7	35.00%	
State Income Tax Rate	7.69%		2016 IRP Update, Section 7	7.69%	
Composite Income Tax Rate	27.08%		calculation	40.00%	
Debt Portion of Capitalization	50.00%		2016 IRP Update, Section 7	50.00%	
Common Stock Portion of Capitalization	50.00%		2016 IRP Update, Section 7	50.00%	
Property Tax Rate	1.45%		2016 IRP Update, Section 7	1.41%	
Inflation Rate	2.00%		2016 IRP Update, Section 7	2.00%	
Common Return	9.50%		2016 IRP Update, Section 7	9.60%	
Debt Return	4.97%		2016 IRP Update, Section 7	4.68%	
Pre-Tax Nominal Cost of Capital	7.24%		calculation	7.14%	
Equityportion	65.64%		calculation	67.23%	
After-Tax Nominal Cost of Capital	6.56%		calculation	6.20%	
After-Tax Real Cost of Capital	4.48%		calculation	4.12%	

**BEFORE THE PUBLIC UTILITY COMMISSION  
OF OREGON**

UM 1728

In the Matter of

PORTLAND GENERAL ELECTRIC  
COMPANY

Application to Update Schedule 201  
Qualifying Facility Information.

**DECLARATION OF  
RYIN KHANDOKER**

I, Ryin Khandoker, declare under penalty of perjury under the laws of the state of Oregon:

1. My full name is Ryin Khandoker. I am employed by Portland General Electric Company (PGE or the Company) as an Originator within Structuring and Origination. I am responsible for administering applications for qualifying facility (QF) contracts.

2. PGE is currently processing 125 QF applications and the pace of new applications continues to be robust. For example, PGE has received 99 applications since its last May 1 avoided cost filing and 51 applications since the September 18, 2017 effective date of PGE's post-IRP acknowledgment avoided cost filing.

3. Almost all of the applications are from out-of-state, developers for solar QF facilities ranging in size from 1 to 3 MW, the size eligible for standard prices.

4. Each 3 MW solar project that PGE executes between now and the time new avoided cost prices are approved results in customers paying approximately \$770,000.00 more to QF developers than they would otherwise pay if the contracts were based on updated and accurate avoided costs.



5. I prepared the following table which shows the estimated customer price impacts if the Commission were to delay updating PGE's avoided cost prices until either the regularly scheduled May 22, 2018 or June 19, 2018 public meetings:

<b>Public Meeting</b>	<b>Avoided Cost Effective Date</b>	<b>Contracts Executed Since May 8th</b>	<b>Customer Price Impact (Millions)</b>
May 22nd	May 23rd	11	\$8.5
June 19th	June 20th	14	\$10.8

I hereby declare that the above statement is true to the best of my knowledge and belief, and that I understand it is made for use as evidence before the Public Utility Commission of Oregon and is subject to penalty for perjury.

SIGNED this 1<sup>st</sup> day of May, 2018, at Portland, Oregon.



---

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