

**PUBLIC UTILITY COMMISSION OF OREGON  
STAFF REPORT  
PUBLIC MEETING DATE: May 19, 2020**

REGULAR  X  CONSENT \_\_\_\_\_ EFFECTIVE DATE  May 20, 2020

**DATE:** May 12, 2020

**TO:** Public Utility Commission

**FROM:** Max St. Brown

**THROUGH:** Bryan Conway, Michael Dougherty, JP Batmale, and Kim Herb **SIGNED**

**SUBJECT:** PORTLAND GENERAL ELECTRIC:  
(Docket No. UM 1728)  
Update to Schedule 201 Qualifying Facility Information.

**STAFF RECOMMENDATION:**

The Public Utility Commission of Oregon (OPUC or Commission) should adopt Portland General Electric's (PGE or Company) filing, which updates Schedule 201 avoided cost payments, with the modification recommended by Staff and waive PGE's obligation to file a May 1 Update.

**DISCUSSION:**

Issue

Whether the Commission should approve PGE's post-IRP update to its Schedule 201 standard avoided costs, with a modified deficiency period start date for the renewable avoided cost price stream.

Applicable Law or Rule

OAR 860-029-0040(4)(a) requires utilities to file updated avoided cost prices for qualifying facilities (QF) under PURPA<sup>1</sup> within 30 days of Commission integrated resource plan (IRP)<sup>2</sup> acknowledgment.<sup>3</sup>

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<sup>1</sup> Public Utility Regulatory Policies Act of 1978.

<sup>2</sup> Integrated Resource Plan and least-cost plan are synonymous.

<sup>3</sup> "In the same manner as rates are published for electricity sales each public utility shall file with the Commission, within 30 days of Commission acknowledgement of its least-cost plan pursuant to Order

The Commission added another avoided cost update in Order No. 14-058,

[W]e adopt a new requirement for an annual update on a specific day each year, in addition to the current complete avoided cost update following each IRP [Integrated Resource Plan] acknowledgement order. We direct electric utilities to update their avoided cost rates 30 days after IRP acknowledgement, and on May 1 of every year. In the event that an IRP is acknowledged within 60 days of May 1 in a particular year, the Commission will use its discretion at that time to direct a utility to waive its 30-day post IRP update.

Annual updates, filed every May 1, will include 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* IRP update relevant to the calculation of avoided costs.

Electric utilities' annual updates will be presented at a public meeting, with a rate effective date within 60 days of the May 1 filing.<sup>4</sup>

## Analysis

### *Background*

On April 7, 2020, PGE made a filing to update its PURPA avoided cost prices based on the Commission's acknowledgement of its 2019 IRP. On April 23, PGE emailed parties stating, "it recently came to our attention that PGE's April 7 filing did not include interconnection costs for the proxy resource." PGE made a supplemental filing to include these costs on April 24 and requested a waiver of its May 1 annual filing.

### *Review*

PGE's initial filing identified two main drivers for price changes versus the prices currently in effect. First, the non-renewable deficiency period was moved from 2021 to 2025 and the renewable deficiency period was moved from 2025 to 2030. Second, the

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No. 89-507, standard rates for purchases from qualifying facilities with a nameplate capacity of one megawatt or less, to become effective 30 days after filing. The publication shall contain all the terms and conditions of the purchase. Except when a public utility fails to make a good faith effort to comply with the request of a qualifying facility to wheel, the public utility's standard rate shall apply to purchases from qualifying facilities with a nameplate capacity of one megawatt or less."

<sup>4</sup> *In the Matter of the Public Utility Commission of Oregon Staff Investigation into Qualifying Facility Contracting and Pricing* (UM 1610), Order No. 14-058, pp. 25-26.

kW capital costs of building new plants decreased. Both of these impacts decrease avoided cost prices.

Staff issued 12 requests for information and reviewed the company's workpapers. Versus its 2016 IRP, PGE's 2018 IRP, which was acknowledged at the March 16, 2020, Special Public Meeting, changes several inputs related to the assumed resources that PGE would be avoiding. For example, the wind on-peak capacity contribution increases from 16.7 percent to 28.6 percent and the wind on-peak capacity factor increases from 35.61 percent to 36.87 percent. Also new with PGE's 2018 IRP are separate solar integration charges distinct from the wind integration charges.

After PGE's revised filing, PGE, the Community Renewable Energy Association (CREA), Renewable Energy Coalition (the Coalition), New Sun Energy, and Staff met twice to discuss PGE's filing and issues raised by Staff and interveners.<sup>5</sup> Staff appreciates PGE's willingness to meet with all known interested parties via teleconferences. As a result of these conferences, the participating parties came to agreement on issues with PGE's filing identified by Staff and other interveners. PGE agreed to support 2025 as the start date of the renewable deficiency period and other parties agreed that certain other inputs would not be changed.

Staff has reviewed the inputs relied on by PGE for its post-IRP update and concludes they are consistent with PGE's recently acknowledged IRP. Staff's review of three inputs is discussed below.

### **Renewable and non-renewable deficiency periods.**

In its initial and revised avoided cost price update filed in April 2020, PGE based its renewable avoided cost price stream on a proxy wind farm with a deficiency period start date of 2030. PGE based its non-renewable avoided cost price stream on a CCCT with a deficiency period start date of 2025.

PGE's IRP shows PGE plans to conduct upwards of two RFPs to acquire new resources by 2025, one of which will be limited to renewable resources. However, PGE included 2030 as the start of the renewable deficiency period because that is the year in which PGE would need to acquire a resource to be in physical compliance with the RPS.<sup>6</sup> As noted above, REC, CREA, New Sun Energy, Staff, and PGE met by telephone to discuss whether the planned acquisition of an RPS compliant resource in 2025 should demarcate 2025 as the start of the resource deficiency period for the renewable avoided cost price stream.

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<sup>5</sup> The workshops were held on April 23, 2020 and May 5, 2020.

<sup>6</sup> PGE has sufficient RECs to comply with the RPS well into the 2030's.

Ultimately, the parties participating in the calls agreed to support 2025 as the start of the deficiency period for the renewable avoided cost price stream.

Staff recommends that the Commission adopt 2025 as the start date of the renewable deficiency period start date and require PGE to make a compliance filing with new renewable avoided cost prices based on that date. PGE has already provided the prices that would be in its compliance filing; please see Attachment A for PGE's avoided cost prices based on a 2025 renewable deficiency date.

- Acquisition of a renewable resource vs. need for a renewable resource.

Staff acknowledges that the Commission has previously noted some uncertainty about whether acquisition of a renewable resource should trigger the renewable deficiency period when the renewable resource is acquired for capacity rather than RPS compliance. Staff does not think basing PGE's renewable avoided cost prices on a deficiency period starting 2030 (physical compliance) or a date later in the 2030's (non-physical compliance) is appropriate for these renewable avoided cost prices. PGE, interveners, and Staff support using the year by which PGE's next planned renewable resource will be on-line (2025), as the renewable deficiency period start date. Using 2025 is consistent with Commission Order No. 11-505, in which the Commission determined that the planned acquisition of a renewable resource (without qualification as to why the resource is being acquired) demarcates the beginning of the renewable deficiency period.<sup>7</sup> Accordingly, it is unnecessary to delve into the issue of whether planned acquisition of a renewable resource always triggers a resource deficiency period.

The Commission has opened a general investigation into PURPA implementation issues. Staff plans to bring forward the issue of whether a renewable resource (meaning one that is RPS compliant) triggers a deficiency period for the renewable avoided cost price stream if the acquisition is not prompted by the need for RECs for RPS compliance.

### **Inputs related to PGE proxy resources.**

Staff and other parties expressed concerns with the proxy resource-related inputs from PGE's recently acknowledged 2018 IRP, for example transmission availability for the Gorge-wind resource proxy. Some parties also had concerns regarding the PGE capacity factor assumption of the wind proxy resource. PGE noted that the assumptions are consistent with its most recently-approved IRP. For purposes of settlement, all parties agreed to the PGE inputs.

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<sup>7</sup> Order No. 11-505, p. 6.

**Granularity of Peak Prices.**

Another issue identified by Staff, which was not discussed extensively with other parties, deals with the granularity of peak pricing. In Staff DR 8, Staff asked PGE to explore adding greater granularity to the Schedule 201 on-peak hours. The peak hours are identified as 6 am to 10 pm, which to Staff seems very broad. Defining a shorter on-peak period is likely to reflect costs better and reflect LOLP analysis. In addition, one outcome of having greater granularity of peak hours may help improve the payback period for investments in battery storage. Staff believes that this issue, which represents a methodological change to PGE’s price calculation, should be explored further outside of this docket, such as in UM 2011.

*Impact of the Schedule 201 price changes*

The overall effect of using 2025 as the start date of the renewable avoided cost price deficiency period start date is to keep Schedule 201 prices more similar to current prices. The graph below provides an example of current renewable avoided cost prices versus PGE’s April 24 proposed prices versus PGE’s April 24 proposed prices with a 2025 renewable resource deficiency period start date:

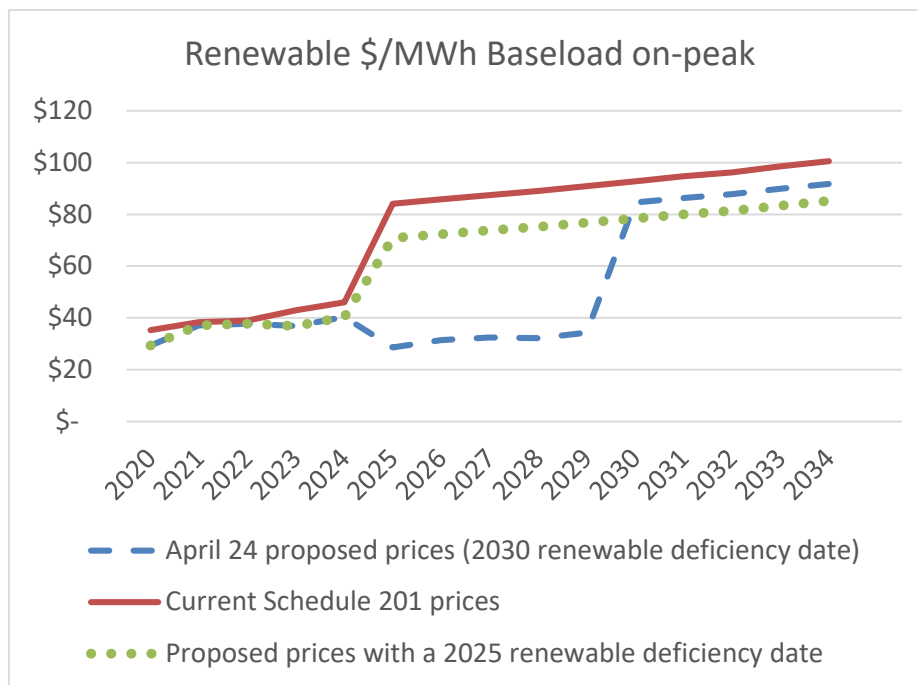


Table 1 shows the proposed avoided cost prices (with a 2025 renewable deficiency date) for both renewable and non-renewable price streams versus the current avoided

cost prices. PGE computes the levelized price per kWh a PURPA qualifying facility (QF) would receive if its proportion of production during on-peak hours equaled the proportion of on-peak hours in a year (flat forecast). QFs with production more (less) concentrated to on-peak hours would receive higher (lower) prices per kWh. For example, in 2025, the on-peak renewable wind price is about 87 percent higher than its off-peak price.

Table 1. Current and Proposed Levelized Avoided Costs (2021 - 2035) with flat forecast

Nonrenewable \$/MWh

	Baseload	Wind	Solar
Current	\$34.27	\$25.11	\$25.67
Proposed	\$31.62	\$28.45	\$27.58
Difference	-7.7%	13.3%	7.4%

Renewable \$/MWh

	Baseload	Wind	Solar
Current	\$52.49	\$46.08	\$46.92
Proposed	\$43.69	\$40.53	\$41.76
Difference	-16.8%	-12.0%	-11.0%

A noticeable change in Table 1 is that the non-renewable wind price is now higher than the non-renewable solar price. The primary factor causing this is the new solar integration charge. In response to Staff DR 11, which asked why the solar integration costs are greater than the wind integration costs, PGE indicated that it is “examining the drivers of solar integration costs in an enabling analysis for the next IRP cycle.”<sup>8</sup> In addition, PGE is studying this issue as part of its next IRP.

Staff concludes PGE has appropriately calculated its renewable and non-renewable avoided cost prices. Staff is aware of no party that opposes PGE’s proposed updates.

PGE also requested that given the nearness of its annual avoided cost update filing and this filing, made 30 days after its IRP, that PGE be excused from having to file an annual update. Staff supports that request.

<sup>8</sup> See Attachment B for PGE’s response to Staff DR 11.

Conclusion

Staff supports PGE's request to waive its May 1 filing because the current filing already updates gas and electricity market prices.

Staff supports PGE's revised avoided cost filing as well as PGE's request to treat this post-IRP update filing as its annual avoided cost update filing.

**PROPOSED COMMISSION MOTION:**

Adopt 2025 as the start date of the renewable deficiency period and require PGE to make a compliance filing with new Schedule 201 avoided cost prices based on that date, with prices effective on May 20, 2020, and waive PGE's obligation to file an annual May 1 update to its avoided cost prices.

## Attachment A

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
2020	23.73	23.47	18.89	16.59	14.55	19.40	42.59	53.29	36.47	29.08	30.10	42.59
2021	41.32	38.29	28.90	19.56	17.79	22.39	53.86	64.43	45.21	33.93	34.84	44.48
2022	44.63	38.76	30.62	25.68	23.21	27.98	48.39	57.17	41.77	34.23	35.20	44.78
2023	43.46	38.76	30.62	25.68	23.21	31.43	46.17	52.44	40.72	34.56	35.06	40.59
2024	45.08	41.97	35.02	30.60	29.48	33.61	49.42	56.15	43.58	36.97	37.51	43.44
2025	43.98	44.05	44.12	43.40	43.47	43.55	43.63	43.70	43.78	43.86	44.88	44.96
2026	47.31	47.41	47.50	46.60	46.69	46.78	46.87	46.97	47.06	47.25	48.32	48.41
2027	49.50	49.60	49.36	48.37	48.46	48.34	48.43	48.53	48.63	48.72	46.42	46.50
2028	47.44	46.64	46.62	45.69	45.77	45.84	45.92	46.00	46.08	46.16	47.27	47.36
2029	48.43	48.51	47.81	46.85	46.93	47.02	47.10	47.18	47.27	47.38	48.49	48.57
2030	49.67	49.77	49.76	48.76	48.85	48.94	49.03	49.12	49.21	49.30	50.50	50.59
2031	51.75	51.85	51.94	50.87	50.97	51.07	51.16	51.26	51.36	51.49	52.86	52.97
2032	53.99	54.10	54.20	53.11	53.22	53.33	53.43	53.54	53.65	53.79	55.12	55.24
2033	56.69	56.81	56.65	54.53	54.64	54.75	54.86	54.98	55.09	55.25	56.57	56.68
2034	58.05	58.17	58.80	55.66	55.77	55.89	56.00	56.11	56.23	56.37	57.76	57.88
2035	59.10	59.22	58.63	57.38	57.49	57.61	57.73	57.85	57.97	58.25	59.54	59.66
2036	60.89	61.03	59.84	58.64	58.75	58.88	59.00	59.12	59.25	59.55	60.85	60.98
2037	62.52	62.65	62.58	61.38	61.51	61.64	62.16	62.33	62.47	64.07	66.20	66.35
2038	67.92	68.08	66.37	65.04	65.18	65.33	65.48	65.63	65.79	67.54	69.82	69.99
2039	71.68	71.86	71.72	70.27	70.44	70.61	70.79	70.96	71.14	72.50	74.32	74.51
2040	77.27	77.47	76.20	74.68	74.86	75.06	75.24	75.44	75.63	76.70	78.60	78.80
2041	78.87	79.07	77.78	76.23	76.41	76.61	76.80	77.00	77.20	78.29	80.23	80.43
2042	80.48	80.69	79.38	77.79	77.98	78.18	78.37	78.58	78.78	79.89	81.87	82.08
2043	82.13	82.35	81.00	79.38	79.58	79.78	79.98	80.19	80.39	81.53	83.55	83.76
2044	83.70	83.92	82.54	80.89	81.09	81.30	81.50	81.71	81.92	83.08	85.14	85.36
2045	85.65	85.88	84.48	82.79	82.99	83.20	83.41	83.63	83.84	85.02	87.13	87.35

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
2020	18.89	18.89	15.32	11.50	6.65	8.95	22.45	28.06	27.55	25.51	25.51	35.45
2021	33.16	30.67	24.27	14.37	10.89	12.46	26.59	31.81	29.62	27.92	28.80	35.12
2022	36.87	30.01	25.55	20.02	17.84	18.59	27.15	31.45	30.11	28.01	28.52	31.94
2023	33.93	30.30	25.79	20.20	18.00	18.76	27.41	31.75	30.39	28.28	28.79	32.25
2024	37.12	33.13	28.17	22.04	19.62	20.45	29.96	34.73	33.23	30.91	31.47	35.27
2025	18.86	18.94	19.01	18.28	18.36	18.44	18.51	18.59	18.67	18.75	19.77	19.85
2026	21.68	21.78	21.87	20.97	21.06	21.16	21.25	21.34	21.43	21.62	22.69	22.79
2027	23.35	23.45	23.21	22.21	22.31	22.19	22.28	22.38	22.47	22.57	20.27	20.35
2028	20.75	19.95	19.93	19.00	19.08	19.16	19.23	19.31	19.39	19.47	20.58	20.67
2029	21.19	21.28	20.57	19.62	19.70	19.78	19.86	19.95	20.03	20.14	21.25	21.34
2030	21.88	21.97	21.96	20.97	21.06	21.15	21.23	21.33	21.42	21.51	22.70	22.80
2031	23.38	23.48	23.57	22.51	22.61	22.71	22.80	22.90	23.00	23.13	24.50	24.60
2032	25.23	25.34	25.44	24.35	24.46	24.57	24.67	24.78	24.89	25.03	26.36	26.48
2033	27.15	27.27	26.11	25.00	25.10	25.22	25.33	25.44	25.55	25.71	27.03	27.15
2034	27.81	27.94	26.56	25.42	25.53	25.65	25.76	25.87	25.99	26.13	27.53	27.64
2035	28.34	28.46	27.87	26.62	26.73	26.85	26.97	27.09	27.21	27.49	28.78	28.90
2036	29.60	29.74	28.55	27.35	27.47	27.59	27.71	27.83	27.96	28.26	29.56	29.69
2037	30.49	30.62	30.55	29.35	29.48	29.61	30.12	30.30	30.44	32.04	34.16	34.32
2038	35.23	35.40	33.68	32.35	32.49	32.64	32.79	32.94	33.10	34.85	37.13	37.30
2039	38.32	38.50	38.36	36.91	37.08	37.25	37.43	37.61	37.79	39.14	40.96	41.15
2040	43.23	43.43	42.16	40.64	40.82	41.02	41.20	41.40	41.59	42.66	44.56	44.76
2041	44.13	44.34	43.04	41.49	41.68	41.87	42.06	42.26	42.46	43.55	45.49	45.70
2042	45.03	45.24	43.92	42.34	42.53	42.73	42.92	43.13	43.33	44.44	46.42	46.63
2043	45.96	46.17	44.82	43.20	43.40	43.60	43.80	44.01	44.22	45.35	47.37	47.59
2044	46.90	47.12	45.74	44.09	44.29	44.50	44.70	44.91	45.12	46.28	48.34	48.56
2045	47.86	48.08	46.68	44.99	45.20	45.41	45.62	45.83	46.05	47.23	49.33	49.56



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
2020	23.40	23.15	18.56	16.27	14.23	19.07	42.26	52.96	36.14	28.75	29.77	42.26
2021	40.99	37.96	28.56	19.23	17.45	22.06	53.53	64.10	44.88	33.59	34.51	44.15
2022	44.29	38.42	30.28	25.35	22.87	27.64	48.05	56.83	41.43	33.89	34.86	44.44
2023	43.11	38.42	30.28	25.34	22.86	31.08	45.82	52.10	40.38	34.21	34.71	40.24
2024	44.73	41.62	34.66	30.25	29.13	33.26	49.06	55.80	43.23	36.62	37.15	43.09
2025	35.38	35.46	35.53	34.80	34.87	34.95	35.03	35.11	35.19	35.26	36.28	36.36
2026	38.54	38.64	38.72	37.83	37.92	38.01	38.10	38.19	38.29	38.48	39.54	39.64
2027	40.55	40.65	40.40	39.41	39.51	39.39	39.48	39.58	39.67	39.77	37.47	37.55
2028	38.30	37.50	37.48	36.55	36.63	36.71	36.78	36.86	36.95	37.03	38.14	38.22
2029	39.10	39.19	38.48	37.53	37.61	37.69	37.77	37.86	37.94	38.05	39.16	39.25
2030	40.16	40.25	40.24	39.25	39.33	39.42	39.51	39.60	39.70	39.79	40.98	41.08
2031	42.04	42.14	42.23	41.16	41.26	41.36	41.45	41.55	41.65	41.78	43.15	43.26
2032	44.14	44.25	44.35	43.26	43.37	43.48	43.58	43.69	43.80	43.94	45.27	45.39
2033	46.57	46.69	45.54	44.42	44.53	44.64	44.75	44.86	44.98	45.14	46.45	46.57
2034	47.70	47.82	46.45	45.31	45.42	45.53	45.65	45.76	45.88	46.02	47.41	47.53
2035	48.57	48.69	48.10	46.85	46.96	47.08	47.20	47.32	47.44	47.72	49.00	49.13
2036	50.18	50.31	49.12	47.92	48.04	48.16	48.28	48.41	48.54	48.84	50.14	50.27
2037	51.55	51.69	51.61	50.41	50.54	50.68	51.19	51.36	51.50	53.10	55.23	55.38
2038	56.73	56.89	55.18	53.85	53.99	54.14	54.29	54.44	54.60	56.35	58.63	58.80
2039	60.26	60.44	60.30	58.85	59.02	59.19	59.37	59.54	59.72	61.08	62.90	63.09
2040	65.62	65.82	64.55	63.03	63.21	63.40	63.59	63.78	63.98	65.05	66.95	67.15
2041	66.98	67.18	65.89	64.33	64.52	64.72	64.91	65.11	65.31	66.39	68.33	68.54
2042	68.35	68.56	67.24	65.65	65.84	66.04	66.24	66.44	66.64	67.75	69.73	69.95
2043	69.75	69.96	68.62	67.00	67.19	67.40	67.59	67.80	68.01	69.14	71.16	71.38
2044	71.10	71.32	69.94	68.29	68.49	68.70	68.90	69.11	69.32	70.48	72.54	72.76
2045	72.72	72.94	71.54	69.85	70.05	70.27	70.47	70.69	70.91	72.09	74.19	74.41

TABLE 2b												
Avoided Costs												
Fixed Price Option for Wind QF												
Off-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	18.56	18.56	14.99	11.17	6.33	8.62	22.13	27.74	27.23	25.19	25.19	35.13
2021	32.83	30.33	23.94	14.04	10.56	12.13	26.26	31.48	29.29	27.59	28.47	34.79
2022	36.54	29.68	25.21	19.68	17.50	18.25	26.82	31.11	29.77	27.67	28.18	31.60
2023	33.58	29.96	25.44	19.86	17.66	18.41	27.07	31.41	30.05	27.93	28.45	31.90
2024	36.76	32.78	27.82	21.68	19.26	20.10	29.60	34.37	32.88	30.55	31.12	34.92
2025	18.50	18.58	18.65	17.92	18.00	18.08	18.15	18.23	18.31	18.39	19.41	19.49
2026	21.32	21.42	21.50	20.61	20.70	20.79	20.88	20.97	21.07	21.26	22.32	22.42
2027	22.97	23.08	22.83	21.84	21.93	21.81	21.91	22.00	22.10	22.20	19.89	19.97
2028	20.36	19.57	19.55	18.62	18.70	18.77	18.85	18.93	19.01	19.09	20.20	20.28
2029	20.80	20.89	20.18	19.23	19.31	19.39	19.47	19.56	19.64	19.75	20.86	20.95
2030	21.48	21.57	21.56	20.57	20.66	20.75	20.84	20.93	21.02	21.11	22.31	22.40
2031	22.98	23.08	23.17	22.11	22.20	22.30	22.40	22.50	22.60	22.72	24.10	24.20
2032	24.82	24.93	25.03	23.94	24.04	24.15	24.26	24.37	24.48	24.61	25.95	26.06
2033	26.73	26.85	25.69	24.57	24.68	24.79	24.90	25.02	25.13	25.29	26.61	26.72
2034	27.38	27.50	26.13	24.99	25.10	25.22	25.33	25.44	25.56	25.70	27.09	27.21
2035	27.90	28.02	27.43	26.18	26.29	26.41	26.53	26.65	26.77	27.05	28.34	28.46
2036	29.16	29.29	28.10	26.90	27.02	27.14	27.26	27.38	27.51	27.81	29.11	29.24
2037	30.03	30.16	30.09	28.89	29.02	29.15	29.27	29.39	29.52	31.58	33.70	33.86
2038	34.76	34.93	33.22	31.88	32.02	32.18	32.32	32.48	32.63	34.39	36.66	36.83
2039	37.84	38.02	37.88	36.43	36.60	36.78	36.95	37.13	37.31	38.66	40.48	40.67
2040	42.74	42.94	41.67	40.15	40.33	40.53	40.71	40.91	41.10	42.17	44.07	44.27
2041	43.63	43.84	42.54	40.99	41.18	41.37	41.56	41.76	41.96	43.05	44.99	45.20
2042	44.53	44.74	43.42	41.83	42.02	42.22	42.42	42.62	42.82	43.93	45.91	46.12
2043	45.44	45.65	44.31	42.69	42.88	43.09	43.28	43.49	43.70	44.83	46.85	47.07
2044	46.37	46.59	45.21	43.56	43.76	43.97	44.17	44.38	44.59	45.75	47.81	48.03
2045	47.32	47.54	46.14	44.45	44.66	44.87	45.08	45.29	45.51	46.69	48.79	49.02

TABLE 3a												
Avoided Costs												
Fixed Price Option for Solar QF												
On-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	22.37	22.12	17.53	15.24	13.20	18.04	41.23	51.93	35.11	27.72	28.74	41.23
2021	39.94	36.91	27.51	18.18	16.40	21.01	52.48	63.04	43.83	32.54	33.46	43.10
2022	43.21	37.35	29.21	24.27	21.79	26.57	46.98	55.76	40.35	32.82	33.79	43.37
2023	42.02	37.32	29.18	24.24	21.76	29.99	44.73	51.00	39.28	33.12	33.62	39.15
2024	43.61	40.50	33.55	29.13	28.01	32.14	47.95	54.68	42.11	35.50	36.04	41.97
2025	27.47	27.54	27.61	26.89	26.96	27.04	27.11	27.19	27.27	27.35	28.37	28.45
2026	30.46	30.56	30.65	29.75	29.84	29.93	30.02	30.12	30.21	30.40	31.47	31.56
2027	32.31	32.41	32.16	31.17	31.27	31.14	31.24	31.34	31.43	31.53	29.22	29.31
2028	29.89	29.09	29.07	28.15	28.22	28.30	28.37	28.46	28.54	28.62	29.73	29.81
2029	30.52	30.61	29.90	28.95	29.03	29.11	29.19	29.28	29.36	29.47	30.58	30.67
2030	31.40	31.49	31.48	30.49	30.58	30.67	30.76	30.85	30.94	31.03	32.22	32.32
2031	33.10	33.20	33.29	32.23	32.32	32.42	32.52	32.62	32.72	32.84	34.22	34.32
2032	35.07	35.18	35.28	34.19	34.30	34.41	34.51	34.62	34.73	34.87	36.20	36.32
2033	37.27	37.39	36.23	35.11	35.22	35.33	35.44	35.56	35.67	35.83	37.15	37.26
2034	38.18	38.30	36.92	35.79	35.90	36.01	36.12	36.24	36.35	36.50	37.89	38.01
2035	38.87	39.00	38.41	37.15	37.27	37.39	37.51	37.63	37.75	38.03	39.31	39.44
2036	40.32	40.45	39.26	38.06	38.18	38.30	38.42	38.55	38.67	38.97	40.27	40.40
2037	41.46	41.59	41.52	40.32	40.45	40.58	41.10	41.27	41.41	43.01	45.14	45.29
2038	46.43	46.59	44.88	43.55	43.69	43.84	43.99	44.14	44.30	46.05	48.33	48.50
2039	49.75	49.93	49.79	48.33	48.50	48.68	48.85	49.03	49.21	50.57	52.39	52.58
2040	54.89	55.09	53.82	52.30	52.48	52.68	52.86	53.06	53.25	54.32	56.22	56.42
2041	56.03	56.23	54.94	53.39	53.57	53.77	53.96	54.16	54.36	55.45	57.39	57.59
2042	57.18	57.39	56.07	54.48	54.67	54.87	55.07	55.27	55.47	56.58	58.56	58.77
2043	58.35	58.56	57.22	55.60	55.79	56.00	56.20	56.40	56.61	57.74	59.76	59.98
2044	59.50	59.72	58.34	56.69	56.89	57.10	57.30	57.51	57.72	58.88	60.94	61.16
2045	60.81	61.04	59.63	57.95	58.15	58.36	58.57	58.79	59.00	60.18	62.29	62.51

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
2020	17.53	17.53	13.96	10.14	5.30	7.59	21.10	26.71	26.20	24.16	24.16	34.10
2021	31.78	29.28	22.89	12.99	9.51	11.07	25.21	30.43	28.24	26.54	27.42	33.74
2022	35.46	28.60	24.14	18.61	16.43	17.18	25.74	30.04	28.69	26.60	27.11	30.53
2023	32.49	28.86	24.35	18.76	16.56	17.32	25.97	30.31	28.95	26.84	27.35	30.81
2024	35.65	31.66	26.70	20.57	18.15	18.98	28.49	33.26	31.76	29.44	30.00	33.80
2025	17.36	17.44	17.51	16.78	16.86	16.94	17.01	17.09	17.17	17.25	18.27	18.35
2026	20.15	20.25	20.34	19.44	19.53	19.62	19.72	19.81	19.90	20.09	21.16	21.25
2027	21.79	21.89	21.64	20.65	20.75	20.62	20.72	20.81	20.91	21.01	18.70	18.79
2028	19.15	18.35	18.34	17.41	17.49	17.56	17.64	17.72	17.80	17.88	18.99	19.07
2029	19.56	19.65	18.94	17.99	18.07	18.15	18.24	18.32	18.40	18.52	19.63	19.71
2030	20.22	20.31	20.30	19.31	19.40	19.49	19.57	19.67	19.76	19.85	21.04	21.14
2031	21.69	21.79	21.88	20.82	20.91	21.01	21.11	21.21	21.31	21.44	22.81	22.91
2032	23.50	23.61	23.71	22.62	22.73	22.84	22.94	23.05	23.17	23.30	24.63	24.75
2033	25.39	25.51	24.35	23.23	23.34	23.45	23.56	23.67	23.79	23.95	25.27	25.38
2034	26.01	26.14	24.76	23.62	23.73	23.85	23.96	24.07	24.19	24.33	25.72	25.84
2035	26.50	26.63	26.03	24.78	24.90	25.02	25.13	25.25	25.38	25.65	26.94	27.06
2036	27.73	27.86	26.67	25.47	25.59	25.71	25.83	25.96	26.09	26.38	27.69	27.81
2037	28.57	28.71	28.64	27.43	27.56	27.70	28.21	28.38	28.52	30.12	32.25	32.40
2038	33.28	33.44	31.73	30.40	30.54	30.69	30.84	30.99	31.15	32.90	35.18	35.35
2039	36.33	36.51	36.37	34.92	35.09	35.26	35.43	35.61	35.79	37.15	38.97	39.16
2040	41.20	41.40	40.13	38.60	38.79	38.98	39.17	39.36	39.56	40.63	42.53	42.73
2041	42.06	42.26	40.97	39.41	39.60	39.80	39.99	40.19	40.39	41.47	43.41	43.62
2042	42.92	43.13	41.81	40.22	40.41	40.61	40.81	41.01	41.21	42.32	44.30	44.51
2043	43.80	44.01	42.66	41.04	41.24	41.44	41.64	41.85	42.06	43.19	45.21	45.43
2044	44.69	44.91	43.54	41.88	42.08	42.29	42.50	42.71	42.92	44.08	46.14	46.36
2045	45.61	45.83	44.43	42.74	42.95	43.16	43.37	43.58	43.80	44.98	47.08	47.31

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
2020	23.73	23.47	18.89	16.59	14.55	19.40	42.59	53.29	36.47	29.08	30.10	42.59
2021	41.32	38.29	28.90	19.56	17.79	22.39	53.86	64.43	45.21	33.93	34.84	44.48
2022	44.63	38.76	30.62	25.68	23.21	27.98	48.39	57.17	41.77	34.23	35.20	44.78
2023	43.46	38.76	30.62	25.68	23.21	31.43	46.17	52.44	40.72	34.56	35.06	40.59
2024	45.08	41.97	35.02	30.60	29.48	33.61	49.42	56.15	43.58	36.97	37.51	43.44
2025	76.34	72.81	64.90	59.88	58.61	63.31	81.27	88.92	74.63	67.12	67.73	74.47
2026	77.91	74.30	66.23	61.11	59.81	64.60	82.93	90.74	76.16	68.50	69.12	76.00
2027	79.50	75.82	67.59	62.36	61.03	65.93	84.63	92.60	77.72	69.90	70.54	77.55
2028	80.98	77.23	68.86	63.54	62.19	67.17	86.20	94.31	79.17	71.21	71.86	79.00
2029	82.79	78.96	70.39	64.94	63.56	68.65	88.13	96.43	80.94	72.79	73.45	80.76
2030	84.49	80.58	71.83	66.27	64.86	70.06	89.94	98.41	82.60	74.29	74.96	82.42
2031	86.22	82.23	73.30	67.63	66.19	71.50	91.78	100.42	84.29	75.81	76.50	84.11
2032	87.64	83.58	74.49	68.72	67.26	72.66	93.30	102.09	85.67	77.04	77.74	85.49
2033	89.79	85.63	76.33	70.43	68.93	74.46	95.58	104.58	87.78	78.95	79.66	87.59
2034	91.73	87.48	77.99	71.97	70.44	76.08	97.63	106.82	89.67	80.66	81.39	89.48
2035	93.51	89.17	79.49	73.35	71.78	77.54	99.54	108.91	91.41	82.21	82.96	91.21
2036	95.15	90.74	80.89	74.63	73.04	78.90	101.28	110.82	93.01	83.65	84.41	92.81
2037	97.38	92.87	82.78	76.38	74.76	80.75	103.66	113.41	95.19	85.62	86.39	94.99
2038	99.37	94.77	84.48	77.95	76.29	82.40	105.78	115.74	97.14	87.37	88.16	96.94
2039	101.41	96.71	86.21	79.54	77.85	84.09	107.95	118.11	99.13	89.16	89.97	98.92
2040	103.29	98.51	87.83	81.04	79.32	85.67	109.95	120.29	100.98	90.83	91.65	100.77
2041	105.60	100.71	89.78	82.84	81.07	87.57	112.41	123.00	103.24	92.85	93.69	103.02
2042	107.77	102.78	91.62	84.53	82.73	89.36	114.72	125.52	105.35	94.75	95.61	105.13
2043	109.98	104.88	93.49	86.26	84.43	91.20	117.07	128.09	107.51	96.69	97.57	107.28
2044	111.91	106.72	95.13	87.77	85.91	92.79	119.12	130.34	109.40	98.39	99.28	109.16
2045	114.65	109.34	97.49	89.96	88.04	95.09	122.03	133.51	112.08	100.82	101.73	111.84

TABLE 4b												
Renewable Avoided Costs												
Renewable Fixed Price Option for Base Load QF												
Off-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	18.89	18.89	15.32	11.50	6.65	8.95	22.45	28.06	27.55	25.51	25.51	35.45
2021	33.16	30.67	24.27	14.37	10.89	12.46	26.59	31.81	29.62	27.92	28.80	35.12
2022	36.87	30.01	25.55	20.02	17.84	18.59	27.15	31.45	30.11	28.01	28.52	31.94
2023	33.93	30.30	25.79	20.20	18.00	18.76	27.41	31.75	30.39	28.28	28.79	32.25
2024	37.12	33.13	28.17	22.04	19.62	20.45	29.96	34.73	33.23	30.91	31.47	35.27
2025	42.18	37.65	32.01	25.04	22.29	23.24	34.04	39.46	37.76	35.12	35.76	40.08
2026	43.04	38.42	32.67	25.55	22.75	23.71	34.74	40.27	38.54	35.84	36.50	40.90
2027	43.92	39.21	33.34	26.08	23.21	24.20	35.45	41.09	39.33	36.57	37.24	41.74
2028	44.70	39.90	33.93	26.54	23.62	24.63	36.08	41.82	40.02	37.22	37.90	42.48
2029	45.74	40.83	34.72	27.16	24.17	25.20	36.92	42.79	40.95	38.09	38.78	43.47
2030	46.68	41.67	35.43	27.71	24.67	25.72	37.67	43.67	41.79	38.87	39.58	44.36
2031	47.63	42.52	36.15	28.28	25.18	26.24	38.44	44.57	42.65	39.66	40.39	45.27
2032	48.48	43.27	36.79	28.78	25.62	26.71	39.12	45.35	43.40	40.37	41.10	46.07
2033	49.60	44.28	37.65	29.45	26.22	27.33	40.03	46.41	44.42	41.31	42.06	47.14
2034	50.62	45.19	38.42	30.05	26.75	27.89	40.86	47.36	45.33	42.15	42.92	48.11
2035	51.66	46.11	39.21	30.67	27.30	28.46	41.69	48.33	46.25	43.02	43.80	49.09
2036	52.57	46.93	39.90	31.21	27.79	28.96	42.43	49.19	47.07	43.78	44.58	49.96
2037	53.80	48.02	40.83	31.94	28.43	29.64	43.42	50.33	48.17	44.80	45.62	51.12
2038	54.90	49.00	41.67	32.59	29.01	30.25	44.31	51.36	49.16	45.71	46.55	52.17
2039	56.02	50.01	42.52	33.26	29.61	30.87	45.22	52.42	50.16	46.65	47.50	53.24
2040	57.01	50.89	43.28	33.85	30.13	31.41	46.02	53.34	51.05	47.48	48.34	54.18
2041	58.34	52.08	44.28	34.64	30.83	32.14	47.09	54.58	52.24	48.58	49.47	55.44
2042	59.54	53.15	45.19	35.35	31.47	32.80	48.05	55.70	53.31	49.58	50.48	56.58
2043	60.76	54.23	46.12	36.07	32.11	33.47	49.04	56.84	54.40	50.59	51.52	57.74
2044	61.83	55.19	46.93	36.71	32.68	34.07	49.90	57.85	55.36	51.49	52.43	58.76
2045	63.27	56.48	48.03	37.56	33.44	34.86	51.07	59.20	56.65	52.69	53.65	60.13

TABLE 5a												
Renewable Avoided Costs												
Renewable Fixed Price Option for Wind QF												
On-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	23.40	23.15	18.56	16.27	14.23	19.07	42.26	52.96	36.14	28.75	29.77	42.26
2021	40.99	37.96	28.56	19.23	17.45	22.06	53.53	64.10	44.88	33.59	34.51	44.15
2022	44.29	38.42	30.28	25.35	22.87	27.64	48.05	56.83	41.43	33.89	34.86	44.44
2023	43.11	38.42	30.28	25.34	22.86	31.08	45.82	52.10	40.38	34.21	34.71	40.24
2024	44.73	41.62	34.66	30.25	29.13	33.26	49.06	55.80	43.23	36.62	37.15	43.09
2025	67.74	64.21	56.30	51.29	50.01	54.71	72.67	80.32	66.03	58.53	59.13	65.87
2026	69.13	65.52	57.46	52.34	51.04	55.83	74.16	81.96	67.39	59.72	60.35	67.22
2027	70.55	66.87	58.63	53.41	52.08	56.97	75.68	83.64	68.77	60.95	61.58	68.60
2028	71.85	68.10	59.72	54.40	53.05	58.03	77.06	85.17	70.03	62.07	62.72	69.86
2029	73.47	69.63	61.06	55.62	54.24	59.33	78.81	87.11	71.61	63.47	64.13	71.44
2030	74.97	71.06	62.31	56.76	55.35	60.55	80.42	88.89	73.08	64.77	65.44	72.90
2031	76.51	72.52	63.59	57.92	56.48	61.79	82.07	90.71	74.58	66.10	66.79	74.40
2032	77.79	73.73	64.64	58.87	57.41	62.81	83.45	92.25	75.83	67.20	67.90	75.64
2033	79.68	75.52	66.22	60.32	58.82	64.34	85.47	94.47	77.66	68.83	69.55	77.48
2034	81.37	77.13	67.64	61.62	60.09	65.73	87.28	96.47	79.32	70.31	71.04	79.13
2035	82.98	78.64	68.96	62.82	61.25	67.01	89.00	98.38	80.88	71.68	72.43	80.68
2036	84.43	80.03	70.17	63.92	62.33	68.18	90.57	100.11	82.30	72.94	73.70	82.10
2037	86.41	81.90	71.82	65.42	63.79	69.78	92.69	102.45	84.23	74.65	75.43	84.02
2038	88.18	83.58	73.29	66.76	65.10	71.21	94.59	104.55	85.95	76.18	76.97	85.75
2039	89.99	85.29	74.79	68.12	66.43	72.67	96.53	106.69	87.71	77.74	78.55	87.50
2040	91.64	86.86	76.17	69.39	67.67	74.02	98.30	108.64	89.33	79.18	80.00	89.11
2041	93.71	88.82	77.89	70.94	69.18	75.68	100.52	111.11	91.34	80.96	81.80	91.12
2042	95.63	90.64	79.48	72.40	70.60	77.23	102.58	113.38	93.22	82.62	83.48	92.99
2043	97.59	92.50	81.11	73.88	72.04	78.81	104.68	115.70	95.12	84.31	85.19	94.90
2044	99.30	94.12	82.53	75.17	73.31	80.19	106.52	117.74	96.80	85.79	86.68	96.56
2045	101.71	96.41	84.55	77.02	75.11	82.15	109.10	120.57	99.14	87.88	88.79	98.90

TABLE 5b												
Renewable Avoided Costs												
Renewable Fixed Price Option for Wind QF												
Off-Peak Forecast (\$/MWH)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	18.56	18.56	14.99	11.17	6.33	8.62	22.13	27.74	27.23	25.19	25.19	35.13
2021	32.83	30.33	23.94	14.04	10.56	12.13	26.26	31.48	29.29	27.59	28.47	34.79
2022	36.54	29.68	25.21	19.68	17.50	18.25	26.82	31.11	29.77	27.67	28.18	31.60
2023	33.58	29.96	25.44	19.86	17.66	18.41	27.07	31.41	30.05	27.93	28.45	31.90
2024	36.76	32.78	27.82	21.68	19.26	20.10	29.60	34.37	32.88	30.55	31.12	34.92
2025	41.82	37.29	31.65	24.68	21.93	22.88	33.68	39.10	37.40	34.76	35.40	39.72
2026	42.67	38.05	32.30	25.19	22.38	23.35	34.37	39.90	38.17	35.47	36.13	40.53
2027	43.55	38.83	32.96	25.70	22.84	23.82	35.07	40.72	38.95	36.20	36.87	41.36
2028	44.32	39.52	33.55	26.16	23.24	24.24	35.69	41.44	39.64	36.84	37.52	42.10
2029	45.35	40.44	34.33	26.77	23.78	24.81	36.53	42.40	40.56	37.70	38.39	43.08
2030	46.28	41.27	35.03	27.31	24.27	25.32	37.27	43.27	41.40	38.47	39.18	43.96
2031	47.23	42.11	35.75	27.87	24.77	25.84	38.04	44.16	42.24	39.26	39.98	44.86
2032	48.06	42.86	36.38	28.37	25.21	26.29	38.71	44.94	42.99	39.95	40.69	45.65
2033	49.18	43.86	37.23	29.03	25.79	26.91	39.61	45.99	43.99	40.88	41.64	46.72
2034	50.19	44.75	37.99	29.62	26.32	27.46	40.42	46.93	44.89	41.72	42.49	47.67
2035	51.22	45.67	38.77	30.23	26.86	28.02	41.25	47.89	45.81	42.57	43.36	48.65
2036	52.12	46.48	39.45	30.76	27.34	28.51	41.98	48.74	46.62	43.33	44.13	49.51
2037	53.34	47.56	40.37	31.48	27.97	29.18	42.96	49.87	47.71	44.34	45.16	50.66
2038	54.43	48.54	41.20	32.12	28.55	29.78	43.84	50.89	48.69	45.25	46.08	51.70
2039	55.55	49.53	42.04	32.78	29.13	30.39	44.74	51.94	49.68	46.17	47.03	52.76
2040	56.53	50.41	42.79	33.36	29.65	30.92	45.53	52.85	50.56	46.99	47.86	53.69
2041	57.84	51.58	43.79	34.14	30.34	31.65	46.59	54.09	51.74	48.08	48.97	54.94
2042	59.03	52.64	44.68	34.84	30.96	32.29	47.54	55.19	52.80	49.07	49.98	56.07
2043	60.24	53.72	45.60	35.55	31.59	32.95	48.52	56.33	53.88	50.07	51.00	57.22
2044	61.30	54.66	46.40	36.18	32.15	33.54	49.37	57.32	54.83	50.96	51.90	58.23
2045	62.73	55.94	47.48	37.02	32.90	34.32	50.53	58.66	56.11	52.15	53.11	59.59

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
2020	22.37	22.12	17.53	15.24	13.20	18.04	41.23	51.93	35.11	27.72	28.74	41.23
2021	39.94	36.91	27.51	18.18	16.40	21.01	52.48	63.04	43.83	32.54	33.46	43.10
2022	43.21	37.35	29.21	24.27	21.79	26.57	46.98	55.76	40.35	32.82	33.79	43.37
2023	42.02	37.32	29.18	24.24	21.76	29.99	44.73	51.00	39.28	33.12	33.62	39.15
2024	43.61	40.50	33.55	29.13	28.01	32.14	47.95	54.68	42.11	35.50	36.04	41.97
2025	59.83	56.30	48.39	43.37	42.10	46.79	64.75	72.41	58.12	50.61	51.22	57.96
2026	61.06	57.45	49.38	44.26	42.96	47.75	66.08	73.89	59.31	51.65	52.27	59.15
2027	62.31	58.63	50.39	45.17	43.84	48.73	67.43	75.40	60.53	52.71	53.34	60.36
2028	63.44	59.69	51.31	45.99	44.64	49.62	68.65	76.76	61.62	53.66	54.31	61.45
2029	64.89	61.05	52.48	47.04	45.65	50.75	70.23	78.52	63.03	54.89	55.55	62.86
2030	66.22	62.30	53.56	48.00	46.59	51.79	71.66	80.13	64.32	56.01	56.69	64.15
2031	67.57	63.58	54.65	48.98	47.54	52.85	73.13	81.77	65.64	57.16	57.85	65.46
2032	68.72	64.66	55.57	49.80	48.34	53.74	74.38	83.17	66.76	58.13	58.83	66.57
2033	70.37	66.21	56.91	51.01	49.51	55.04	76.16	85.16	68.36	59.53	60.24	68.17
2034	71.85	67.61	58.12	52.10	50.57	56.20	77.76	86.94	69.80	60.79	61.52	69.61
2035	73.28	68.95	59.27	53.12	51.56	57.32	79.31	88.68	71.19	61.99	62.74	70.99
2036	74.57	70.16	60.31	54.05	52.46	58.32	80.71	90.24	72.44	63.08	63.84	72.24
2037	76.32	71.81	61.72	55.32	53.70	59.69	82.60	92.35	74.13	64.56	65.33	73.93
2038	77.88	73.28	62.99	56.46	54.80	60.91	84.29	94.25	75.65	65.88	66.67	75.45
2039	79.48	74.78	64.28	57.61	55.92	62.16	86.01	96.18	77.20	67.23	68.04	76.99
2040	80.91	76.13	65.45	58.66	56.94	63.29	87.57	97.91	78.60	68.45	69.27	78.39
2041	82.76	77.87	66.94	60.00	58.23	64.73	89.57	100.16	80.40	70.01	70.85	80.18
2042	84.46	79.47	68.31	61.23	59.43	66.06	91.41	102.21	82.04	71.45	72.31	81.82
2043	86.19	81.10	69.71	62.48	60.64	67.41	93.28	104.30	83.73	72.91	73.79	83.50
2044	87.70	82.52	70.93	63.57	61.70	68.59	94.92	106.14	85.19	74.19	75.08	84.96
2045	89.81	84.50	72.64	65.11	63.20	70.25	97.19	108.67	87.24	75.98	76.89	87.00

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
2020	17.53	17.53	13.96	10.14	5.30	7.59	21.10	26.71	26.20	24.16	24.16	34.10
2021	31.78	29.28	22.89	12.99	9.51	11.07	25.21	30.43	28.24	26.54	27.42	33.74
2022	35.46	28.60	24.14	18.61	16.43	17.18	25.74	30.04	28.69	26.60	27.11	30.53
2023	32.49	28.86	24.35	18.76	16.56	17.32	25.97	30.31	28.95	26.84	27.35	30.81
2024	35.65	31.66	26.70	20.57	18.15	18.98	28.49	33.26	31.76	29.44	30.00	33.80
2025	40.68	36.15	30.51	23.54	20.79	21.74	32.54	37.96	36.26	33.62	34.26	38.58
2026	41.51	36.89	31.14	24.02	21.22	22.18	33.21	38.74	37.01	34.31	34.96	39.37
2027	42.36	37.64	31.78	24.51	21.65	22.64	33.89	39.53	37.76	35.01	35.68	40.18
2028	43.11	38.31	32.33	24.94	22.03	23.03	34.48	40.23	38.43	35.63	36.31	40.88
2029	44.11	39.20	33.09	25.53	22.55	23.57	35.29	41.17	39.33	36.46	37.16	41.84
2030	45.02	40.01	33.77	26.05	23.01	24.06	36.01	42.01	40.13	37.21	37.92	42.70
2031	45.94	40.82	34.46	26.59	23.48	24.55	36.75	42.87	40.96	37.97	38.70	43.57
2032	46.75	41.54	35.07	27.05	23.89	24.98	37.40	43.63	41.68	38.64	39.38	44.34
2033	47.84	42.51	35.89	27.69	24.45	25.57	38.27	44.65	42.65	39.54	40.30	45.38
2034	48.82	43.39	36.62	28.25	24.95	26.09	39.05	45.56	43.52	40.35	41.12	46.30
2035	49.82	44.27	37.37	28.83	25.47	26.62	39.85	46.49	44.42	41.18	41.97	47.25
2036	50.70	45.05	38.03	29.34	25.91	27.09	40.56	47.31	45.20	41.90	42.70	48.08
2037	51.88	46.11	38.92	30.03	26.52	27.73	41.50	48.42	46.26	42.88	43.70	49.21
2038	52.95	47.05	39.72	30.64	27.06	28.29	42.35	49.41	47.20	43.76	44.60	50.22
2039	54.03	48.02	40.53	31.27	27.62	28.87	43.22	50.42	48.17	44.66	45.51	51.25
2040	54.98	48.86	41.24	31.82	28.10	29.38	43.98	51.31	49.02	45.44	46.31	52.15
2041	56.27	50.00	42.21	32.56	28.76	30.07	45.01	52.51	50.16	46.51	47.40	53.37
2042	57.42	51.03	43.07	33.23	29.35	30.68	45.93	53.59	51.19	47.46	48.37	54.46
2043	58.60	52.07	43.96	33.91	29.95	31.31	46.87	54.68	52.24	48.43	49.36	55.58
2044	59.63	52.99	44.73	34.50	30.47	31.86	47.70	55.65	53.16	49.28	50.22	56.55
2045	61.02	54.23	45.77	35.31	31.19	32.61	48.82	56.95	54.40	50.44	51.40	57.88

Attachment B

May 1, 2020

TO: Max St. Brown  
Public Utility Commission of Oregon

FROM: Robert Macfarlane  
Manager, Pricing and Tariffs

**PORTLAND GENERAL ELECTRIC  
UM 1728  
PGE Response to OPUC Data Request No. 011  
Dated April 22, 2020**

**Request:**

Please explain the wind and solar integration charges with respect to derivation and the basis for why the solar integration costs are greater than the wind integration costs. If the integration costs in previous studies had solar at a lower cost than wind integration costs, please explain why the relative relationship changed.

**Response:**

PGE objects to this request to the extent that it is unduly burdensome, seeks new analysis, calls for speculation, and seeks information outside the scope of this proceeding. Without waiving these objections, PGE responds as follows.

Integration costs are impacted by several attributes of variable renewable resources and the systems into which they are being integrated. Key determinants of integration costs include the nature and timing of hourly ramps, subhourly variability, forecast errors of the variable resource, and the variable cost associated with the resources that mitigate these operational challenges (e.g., fuel, variable O&M, and start costs). It is not a straightforward exercise to attribute a difference in integration costs between two different resources to one or more of these factors due to the computational complexity of the integration cost calculation and the interactions between the various potential drivers. However, to improve understanding, PGE is examining the drivers of solar integration costs in an enabling analysis for the next IRP cycle. While PGE hopes that this analysis will provide additional transparency and support improved understanding, PGE does not expect the study to necessarily result in materially different solar integration costs than were quantified in the 2019 IRP.

The wind and solar integration costs are from the 2019 IRP. The variable resource integration costs are discussed in Section 6.1.3 of the 2019 IRP and additional information is provided in Appendix I, Section I.5.

Docket No. UM 1728  
May 12, 2020  
Page 15

UM 1728 PGE Response to OPUC DR 011  
Page 2  
May 1, 2020

In the 2016 IRP, the integration costs for solar were not examined separately from the integration costs for wind. Variable resource integration costs are discussed in Section 7.2.1.1 of the 2016 IRP.