PACIFICORP

Pacific Power |
Rocky Mountain Power
825 NE Multnomah, Suite 1600
Portland, Oregon 97232

October 7, 2021

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

RE: *PacifiCorp*
Updated Distribution System Loss Factor, Docket No. ER22-___-000

Dear Secretary Bose:

Pursuant to Section 205 of the Federal Power Act ("FPA"),[1] Part 35 of the Federal Energy Regulatory Commission's ("FERC" or the "Commission") regulations,[2] and Order No. 714,[3] PacifiCorp hereby submits a proposed amendment to Schedule 10 of its Open Access Transmission Tariff ("OATT") to reflect an updated loss factor for Real Power Losses for use of PacifiCorp's Distribution System (the "Distribution System loss factor") of 4.14%. PacifiCorp respectfully requests that the amended Schedule 10 become effective January 1, 2022.

I. Background and Reason for Filing

Schedule 10 of the PacifiCorp OATT provides separate loss factors for service over transmission facilities and for service over the PacifiCorp distribution system, which includes facilities that have a voltage of 34.5 kV or less. Moreover, Schedule 10 specifies a combined loss factor, which is the sum of the transmission loss factor and distribution system loss factor, for customers that take service over both facilities. PacifiCorp's current Distribution System loss factor of 3.56% was last updated over twenty-five years ago, pursuant to a filing in Docket No. ER96-8-000.[4]

When PacifiCorp filed to implement a formula rate for transmission service in 2011, PacifiCorp also proposed to update the loss factor for service over transmission facilities, while maintaining the same 3.56% loss factor for service over distribution facilities. In particular, on May 26, 2011, PacifiCorp submitted its transmission and ancillary service rate case filing in Docket No. ER11-3643, in which PacifiCorp sought to

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[1] 16 U.S.C. § 824d (2018)
[2] 18 C.F.R. Part 35 (2021).
[3] *Electronic Tariff Filings*, Order No. 714, 124 FERC ¶ 61,270 (2008).
[4] PacifiCorp's Distribution System loss factor was established pursuant to a settlement agreement in Docket No. ER96-8-000, which was approved by the Commission. *See PacifiCorp*, 83 FERC ¶ 61,059 (1998).

modify its transmission rates and adopt a formula transmission rate, and, among other things, update the loss factor for transmission service.[5] A settlement agreement was reached in Docket No. ER11-3643 and was approved by the Commission in a Letter Order dated May 23, 2013 (the settlement agreement is referred to herein as the "ER11-3643 Settlement Agreement"). As part of the ER11-3643 Settlement Agreement, PacifiCorp agreed that the loss factor for service over transmission facilities would be updated in the future pursuant to a process set forth in Appendix 16 and 17 to the Settlement Agreement. However, the loss factor for service over distribution facilities was not an issue in the proceeding and was not addressed in the ER11-3643 Settlement Agreement. Since the ER11-3643 Settlement Agreement, PacifiCorp has made several filings to adjust the Transmission System loss factor, such as in Docket Nos. ER15-1524 and ER21-2711,[6] but has not updated the loss factor for service over distribution facilities.

Recently, PacifiCorp performed an updated study of the losses on the distribution system as part of state-jurisdictional rate cases. In particular, PacifiCorp filed to update its retail rates in Wyoming, Utah, Oregon, and Idaho using an updated loss factor for the PacifiCorp distribution system supported by testimony and a line loss study filed in that proceeding. PacifiCorp conducted the line loss study in 2020 using 2018 data (herein referred to as the "Line Loss Study"). Rates have been set in Utah, Wyoming and Oregon in reliance upon the Line Loss Study.

As discussed more fully below, PacifiCorp proposes to update its Distribution System loss factor in Schedule 10 of the OATT based on an aggregate of the states' loss factor used in retail rates. The change in Distribution System loss factor will in turn change the combined loss factor, which, as noted above, is the sum of the transmission and distribution loss factors. To be clear, PacifiCorp is proposing no change to the transmission loss factor recently accepted by the Commission in Docket No. ER21-1711.

II. Summary of Proposed Changes and Loss Factor Methodology

a. Changes in loss factor.

In place for more than two decades, the current Distribution System loss factor in Schedule 10 of the OATT is no longer reflective of real power losses on PacifiCorp's distribution facilities. PacifiCorp proposes to revise Schedule 10 of its OATT to reflect a Distribution System loss factor of 4.14%, which is an increase from the current Distribution System loss factor of 3.56%. The revised Distribution System loss factor is just and reasonable as it will ensure that Schedule 10 provides an accurate loss factor. Moreover, making the change will ensure an alignment with the distribution loss factor used in state rates.

[5] As PacifiCorp explained in its initial filing in Docket No. ER11-3643-000, no changes were proposed to the distribution loss factor. *See* PacifiCorp, Revisions to Open Access Transmission Tariff, transmittal letter at 12-13, Docket No. ER11-3643-000, (May 26, 2011) ("the existing loss factor in Schedule 10 for the distribution system at a voltage of 34.5 kV (or less) at 3.56% remains unchanged.").

[6] The Commission accepted both filings in letter orders issued on March 11, 2016 and June 4, 2021, respectively.

As noted earlier, Schedule 10 also provides a combined loss factor, which is the sum of the Distribution System loss factor and the transmission system loss factor. With the change to the Distribution System loss factor, and use of the existing transmission system loss factor of 3.75%, the resulting combined loss factor is 7.89%, as summarized in Table 1, below.

Table 1: Illustration of Schedule 10 Losses with Distribution Update

Voltage	Proposed Upcoming Filing (Energy)
Transmission Losses	3.75%
Distribution Losses	4.14%
Total Losses	7.89%

b. Loss calculation and methodology.

The Distribution System losses calculation and methodology are explained in the accompanying Line Loss Study and testimony of Mr. Jake S. Barker, PacifiCorp's director of field engineering and area transmission planning. Mr. Barker introduces the Line Loss Study that previously has been filed at PacifiCorp's state jurisdictions and he provides an overview of the methodology and results of the Line Loss Study. A full description of the methodology of the study is also included within the Line Loss Study.

Due to the impracticality of performing line loss calculations for each level of the system for every hour of the year, PacifiCorp selected four hours that broadly represent different conditions on its electric system and conducted power flow analyses for these four hours.[7] As Mr. Barker explains the total hourly losses for each state and loss category are calculated across the entire year and then, once summed, are divided by the appropriate total load to determine the annual loss percentage for each category. Supporting data and calculations are found in the Line Loss Study.[8] Table 2 shows the final calculation of the distribution loss factor of 4.14%.

[7] *See* Enclosure 3, Line Loss Study (Exhibit No. PAC-0001), at 1; Enclosure 4 (Exhibit No. PAC-0002), Direct Testimony of Jake S. Barker at 2-3.
[8] Testimony of J. Barker at 3.

Table 2: Overview of Energy Loss Factor

Functional Category	Energy Loss Factor
Distribution Substation Transformers	0.65%
Primary Lines	1.88%
Service Transformers	1.40%
Secondary Lines	0.14%
Meters	0.07%
Aggregated Distribution loss (for all states)	**4.14%**

Mr. Barker explains that there have been no changes to the PacifiCorp distribution system since the Line Loss Study was performed in 2020 that would materially impact the results of the Line Loss Study.[9]

III. Rate Impact to Customers and Statements BG/BH

PacifiCorp has calculated an estimated revenue impact of the revised Distribution System loss factor and the estimated impact to transmission customers. To determine the effect, PacifiCorp calculated the estimated change in annual revenue if the proposed Distribution System loss factor of 4.14% had been in effect in 2020 instead of the current Distribution System loss factor of 3.56%.

The estimated revenue impact of the proposed Distribution System loss factor is shown in Enclosure 1 to the filing: Statement BG (Revenue data to reflect changed rates) and Statement BH (Revenue data to reflect present rates). The billing determinants for the Statements BG/BH revenue calculation reflect the actual billing units of services provided to transmission customers in 2020. The estimated impact on revenue (using 2020 data) is an increase of approximately $16,991, which is approximately 0.006% of total annual revenue for the 12-month period ending December 31, 2020.

IV. Enclosures

The following enclosures are included in this filing:

- Enclosure 1 – Statements BG and BH demonstrating the revenue impact of the proposed change to Schedule 10 of PacifiCorp's OATT;
- Enclosure 2 – Revised Schedule 10 of PacifiCorp's OATT (clean and redlined versions);
- Enclosure 3 – Line Loss Study (Exhibit No. PAC-0001)

[9] Testimony of J. Barker at 4.

- Enclosure 4 – Testimony of Jake S. Barker (Exhibit No. PAC-0002)

In addition to the items provided in the enclosures described above, the Line Loss Study provided in Enclosure 3 has been made available on PacifiCorp's OASIS website at the address listed in Section VII below.

V. Effective Date and Requests for Waiver

As noted above, PacifiCorp respectfully requests the Commission accept the revisions to the OATT reflecting the Distribution System loss factor effective January 1, 2022. PacifiCorp's update to the loss factor for service over low voltage facilities is supported by the accompanying affidavit/testimony and study, consistent with the cost support accepted by the Commission in past filings for real power loss factor changes.[10] In addition, PacifiCorp is providing Statements BG and BH to demonstrate the rate impact of the revisions. To the extent necessary, PacifiCorp requests waiver of the full requirements of 18 C.F.R. § 35.13, as good cause exists for granting a waiver of the requirement to file the full range of information required by Section 35.13. PacifiCorp respectfully requests waiver of any requirements of the Commission's rules and regulations, as well as any authorizations as may be necessary or required, to permit the revised Distribution System loss factor to be accepted by FERC and made effective in the manner proposed herein.

VI. Communications

All communications and correspondence regarding this filing should be forwarded to the following persons:

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[10] *See, e.g., NorthWestern Corporation*, Montana OATT Formula Rate, Docket No. ER19-1756-000 (May 1, 2019); *Public Service Company of New Mexico*, Notice of Transmission Rate Changes, Docket No. ER11-1915-000 (Oct. 27, 2010).

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VII. Service

PacifiCorp is providing an electronic copy of this filing to all transmission customers pursuant to PacifiCorp's OATT, if such customers have provided PacifiCorp an e-mail contact address. To the extent that any such customers have not provided PacifiCorp a contact e-mail, PacifiCorp has served such customers with a hard copy of this filing to the last customer mailing address on file.

In addition, PacifiCorp posts this filing on its OASIS website: http://www.oatioasis.com/ppw/. The filing is centralized in the following folder on the OASIS site: "2021 Distribution System Loss Factor."[11] As indicated above, the posting includes not only the items included in this filing but also the Line Loss Study in Enclosure 3.

For the foregoing reasons, PacifiCorp respectfully requests that the Commission accept PacifiCorp's this filing, effective January 1, 2022 as requested. If you have any questions, or if I can be of further assistance, please do not hesitate to contact me.

Respectfully Submitted,

/s/
Riley Peck

Attorney for PacifiCorp

[11] See following folder location: PacifiCorp OASIS Tariff/Company Information/OATT Pricing/2021 Distribution System Loss Factor.

CERTIFICATE OF SERVICE

I hereby certify that I have on this day caused a copy of the foregoing document to be served via first-class mail or electronic mail upon each of the parties listed in the enclosed Service List.

Dated at Portland, Oregon this 7th day of October 2021.

__*/s/ Christian Marble*____
Christian Marble
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Enclosure 1

Statements BG and BH

PACIFICORP
ANNUAL COMPARISON
OATT PARTS III SERVICE AND LEGACY AGREEMENTS
2020

Line	Service/ Customer: Service Agreement ("SA") No.	**Present** (revenues under current loss system factor)	**Changed** (revenues under proposed loss system factor)	**Absolute difference** (changed *minus* present)	Percent difference	
	OATT Part III - Network Service (these loads already include losses)					
1	PacifiCorp: SA 66 [1]	$ 264,667,905	$ 264,667,905	$ -	0.00%	
2	BPA Yakama: SA 328	$ 164,580	$ 165,088	508	0.31%	
3	BPA Gazely: SA 229	$ 99,844	$ 100,383	540	0.54%	
4	BPA Clark: SA 735	$ 686,122	$ 689,830	3,708	0.54%	
5	BPA Benton/Rimrock: SA 539	$ 21,114	$ 21,114	-	0.00%	
6	BPA Ore Wind: SA 538	$ 4,862	$ 4,862	-	0.00%	
7	BPA S. Idaho: SA 746	$ 6,659,912	$ 6,659,912	-	0.00%	
8	BPA Idaho Falls SA 747	$ 2,886,765	$ 2,886,765	-	0.00%	
9	Tri State: SA 628	$ 530,145	$ 531,308	1,164	0.22%	
10	Calpine Energy Solutions: SA 299	$ 441,158	$ 443,542	2,384	0.54%	
11	Basin: SA 505	$ 298,002	$ 299,613	1,611	0.54%	
12	Black Hills: SA 347 [1]	$ 1,440,051	$ 1,440,051	-	0.00%	
13	USBR (Burbank): SA 506	$ 8,306	$ 8,351	45	0.54%	
14	WAPA: SA 175	$ 40,705	$ 40,925	220	0.54%	
15	Exelon Generation: SA 943	$ 33,045	$ 33,224	179	0.54%	
16	Avangrid Renewables, LLC: SA 742	$ 1,016,021	$ 1,021,513	5,491	0.54%	
17	BPA CEC SA 827	$ 1,412	$ 1,412	-	0.00%	
18	BPA Airport Solar SA 865	$ 1,404	$ 1,404	-	0.00%	
19	BPA WEID SA 975	$ 1,516	$ 1,516	-	0.00%	
20	3 Phases Renewables Inc. SA 876	$ 7,596	$ 7,637	41	0.54%	
21	NTUA SA 894	$ 73,002	$ 73,060	59	0.08%	
22	Subtotal	$ 279,083,468	$ 279,099,417	$ 15,950	0.006%	
	Legacy Agreements (these loads already include losses)					
23	UAMPS: RS 297	$ 16,419,668	$ 16,420,709	$ 1,041	0.01%	
24	UMPA: RS 637	$ 2,471,512	$ 2,471,512	-	0.00%	
25	DGT: RS 280	$ 4,203,781	$ 4,203,781	-	0.00%	
26	WAPA OIS: RS 262/RS263	$ -	$ -	-	0.00%	N/A
27	Subtotal (Legacy Agreements)	$ 23,094,961	$ 23,096,003	$ 1,041	0.00%	
	Total	$ 302,178,429	$ 302,195,420	$ 16,991	0.006%	

PACIFICORP
STATEMENT BH — REVENUE DATA TO REFLECT PRESENT RATES
OATT PARTS III SERVICE AND LEGACY AGREEMENTS
2020

Current Transmission and Distribution Loss System Factor

Line	Service/ Customer: Service Agreement ("SA")/Rate Schedule ("RS") No.	January	February	March	April	May	June	July	August	September	October	November	December	Total
	OATT Part III - Network Service (these loads already include losses)	Jan												
1	PacifiCorp: SA 66 [1]	21,249,893	20,981,299	19,544,765	17,669,578	22,330,201	24,120,555	26,735,728	26,915,255	24,546,351	19,845,153	19,612,354	21,116,773	264,667,905
2	BPA Yakama: SA 328	18,885	18,189	14,753	13,090	11,135	10,548	13,005	14,200	12,587	14,503	12,531	11,155	164,580
3	BPA Gazely: SA 229	8,278	8,720	8,902	7,061	7,599	8,677	9,473	9,044	9,151	7,685	7,594	7,660	99,844
4	BPA Clark: SA 735	74,057	79,106	60,827	57,592	36,129	43,347	45,933	43,375	43,750	67,326	63,522	71,157	686,122
5	BPA Benton/Rimrock: SA 539	3,437	3,199	2,847	2,365	933	859	1,009	933	869	2,330	2,332	-	21,114
6	BPA Ore Wind: SA 538	-	-	-	132	418	1,011	-	900	-	966	-	1,435	4,862
7	BPA S. Idaho: SA 746	670,189	763,819	635,103	510,228	334,654	410,509	438,924	412,451	349,175	691,532	614,980	828,348	6,659,912
8	BPA Idaho Falls SA 747	245,529	266,843	266,073	168,000	218,283	213,888	267,476	278,971	253,317	210,075	239,809	258,501	2,886,765
9	Tri State: SA 628	53,407	53,672	50,362	51,161	29,650	40,414	39,366	41,144	34,315	50,901	41,591	44,161	530,145
10	Calpine Energy Solutions: SA 299	35,467	35,064	35,170	34,450	42,260	44,711	41,948	41,410	40,873	30,360	31,410	28,035	441,158
11	Basin: SA 505	27,087	27,186	26,260	22,822	19,029	25,193	24,483	27,277	23,857	24,754	23,405	26,648	298,002
12	Black Hills: SA 347 [1]	131,406	121,248	109,254	111,219	92,869	121,784	135,795	156,084	117,369	124,260	102,031	116,731	1,440,051
13	USBR (Burbank): SA 506	15	13	13	629	1,397	1,359	1,732	1,559	1,552	13	13	13	8,306
14	WAPA: SA 175	18	28	13	13	8,263	8,644	7,962	7,972	7,754	13	10	18	40,705
15	Exelon Generation: SA 943	2,939	2,690	2,774	2,660	2,751	3,172	3,055	2,830	3,050	2,348	2,049	2,728	33,045
16	Avangrid Renewables, LLC: SA 742	83,690	83,036	82,508	83,624	83,064	84,570	85,637	84,636	86,096	86,897	86,773	85,490	1,016,021
17	BPA CEC SA 827	423	119	-	-	-	-	-	-	-	-	408	461	1,412
18	BPA Airport Solar SA 865	446	302	-	112	-	35	-	-	-	-	253	256	1,404
19	BPA WEID SA 975	-	-	-	-	-	-	-	-	-	-	1,491	25	1,516
20	3 Phases Renewables Inc. SA 876	624	596	614	477	667	753	875	789	723	520	423	538	7,596
21	NTUA SA 894	6,661	6,477	5,648	4,938	5,403	5,627	6,786	6,817	6,283	5,745	5,987	6,630	73,002
22	Subtotal	22,612,451	22,451,605	20,845,886	18,740,149	23,224,704	25,145,658	27,859,186	28,045,646	25,537,072	21,165,380	20,848,968	22,606,763	279,083,468
	Legacy Agreements (these loads already include losses)													
23	UAMPS: RS 297	962,300	1,093,810	896,248	869,717	1,711,626	1,711,544	2,000,616	2,173,161	1,889,941	926,257	1,035,978	1,148,470	16,419,668
24	UMPA: RS 637	148,285	158,422	125,827	78,389	256,051	281,357	385,356	399,196	293,778	104,951	119,314	120,587	2,471,512
25	DGT: RS 280	228,093	226,184	166,119	297,734	392,841	398,696	378,805	608,756	567,397	320,516	309,593	309,049	4,203,781
26	WAPA OIS: RS 262/RS263	-	-	-	-	-	-	-	-	-	-	-	-	-
27	**Subtotal** (Legacy Agreements)	1,338,678	1,478,416	1,188,193	1,245,839	2,360,518	2,391,597	2,764,777	3,181,112	2,751,116	1,351,724	1,464,885	1,578,107	23,094,961
	Change													
28	Updated revenues with proposed loss factor (From Statement BG)	$ 23,952,632	$ 23,931,516	$ 22,035,464	$ 19,987,316	$ 25,586,508	$ 27,538,699	$ 30,625,438	$ 31,228,237	$ 28,289,607	$ 22,518,510	$ 22,315,217	$ 24,186,275	$ 302,195,420
29	Revenues with current loss factor	23,951,129	23,930,021	22,034,079	19,985,988	25,585,221	27,537,255	30,623,963	31,226,758	28,288,188	22,517,104	22,313,853	24,184,870	302,178,429
30	Absolute Difference (*proposed* minus *current*)	$ 1,502	$ 1,495	$ 1,385	$ 1,328	$ 1,286	$ 1,444	$ 1,476	$ 1,479	$ 1,419	$ 1,406	$ 1,365	$ 1,406	$ 16,991
31	Percent Difference	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%

Note [1] Per customers' contract agreements, no losses, or losses only applicable to certain load, are included in customers' billing determinants.
Note [2] A value of zero in a month (designated by "-") indicates that the customer did not take service for that month.

PACIFICORP
STATEMENT BG — REVENUE DATA TO REFLECT CHANGED RATES
OATT PARTS III SERVICE AND LEGACY AGREEMENTS
2020

Proposed Distribution Loss System Factor

Line	Service/ Customer: Service Agreement ("SA")/Rate Schedule ("RS") No.	January	February	March	April	May	June	July	August	September	October	November	December	Total
	OATT Part III - Network Service (these loads already include losses)													
1	PacifiCorp: SA 66 [1]	21,249,893.5	20,981,299.4	19,544,765.2	17,669,577.9	22,330,200.9	24,120,555.2	26,735,727.6	26,915,254.9	24,546,351.1	19,845,152.9	19,612,354.0	21,116,772.9	264,667,905.4
2	BPA Yakama: SA 328	18,957	18,227	14,789	13,115	11,175	10,588	13,054	14,253	12,635	14,542	12,564	11,188	165,087.7
3	BPA Gazely: SA 229	8,323	8,767	8,950	7,100	7,640	8,723	9,524	9,093	9,200	7,727	7,635	7,701	100,383.4
4	BPA Clark: SA 735	74,458	79,533	61,156	57,903	36,324	43,582	46,182	43,610	43,987	67,690	63,866	71,541	689,830.4
5	BPA Benton/Rimrock: SA 539	3,437	3,199	2,847	2,365	933	859	1,009	933	869	2,330	2,332	-	21,113.7
6	BPA Ore Wind: SA 538	-	-	-	132	418	1,011	-	900	-	966	-	1,435	4,862.0
7	BPA S. Idaho: SA 746	670,189	763,819	635,103	510,228	334,654	410,509	438,924	412,451	349,175	691,532	614,980	828,348	6,659,911.9
8	BPA Idaho Falls SA 747	245,529	266,843	266,073	168,000	218,283	213,888	267,476	278,971	253,317	210,075	239,809	258,501	2,886,765.2
9	Tri State: SA 628	53,514	53,774	50,472	51,273	29,709	40,524	39,470	41,251	34,402	51,005	41,680	44,232	531,308.3
10	Calpine Energy Solutions: SA 299	35,659	35,253	35,360	34,636	42,488	44,953	42,174	41,634	41,094	30,524	31,580	28,187	443,542.1
11	Basin: SA 505	27,233	27,333	26,402	22,946	19,132	25,329	24,615	27,425	23,986	24,888	23,532	26,792	299,612.9
12	Black Hills: SA 347 [1]	131,406	121,248	109,254	111,219	92,869	121,784	135,795	156,084	117,369	124,260	102,031	116,731	1,440,050.9
13	USBR (Burbank): SA 506	15	13	13	632	1,405	1,366	1,741	1,568	1,560	13	13	13	8,351.3
14	WAPA: SA 175	18	28	13	13	8,308	8,690	8,005	8,015	7,796	13	10	18	40,925.3
15	Exelon Generation: SA 943	2,955	2,705	2,789	2,674	2,766	3,189	3,072	2,845	3,067	2,361	2,060	2,743	33,224.0
16	Avangrid Renewables, LLC: SA 742	84,142	83,485	82,954	84,076	83,513	85,027	86,100	85,093	86,561	87,367	87,242	85,952	1,021,512.6
17	BPA CEC SA 827	423	119	-	-	-	-	-	-	-	-	408	461	1,412.0
18	BPA Airport Solar SA 865	446	302	-	112	-	35	-	-	-	-	253	256	1,404.4
19	BPA WEID SA 975	-	-	-	-	-	-	-	-	-	-	1,491	25	1,515.9
20	3 Phases Renewables Inc. SA 876	627	599	617	479	670	757	879	793	727	523	426	540	7,637.5
21	NTUA SA 894	6,666	6,482	5,653	4,943	5,408	5,632	6,791	6,822	6,286	5,750	5,992	6,635	73,060.4
22	Subtotal	22,613,890.1	22,453,028.5	20,847,209.9	18,741,423.6	23,225,895.6	25,147,004.9	27,860,539.0	28,046,994.5	25,538,382.0	21,166,716.5	20,850,258.4	22,608,073.9	279,099,417.0
	Legacy Agreements (these loads already include losses)													
23	UAMPS: RS 297	962,364.0	1,093,881.8	896,309.0	869,770.1	1,711,720.2	1,711,641.1	2,000,738.5	2,173,290.9	1,890,050.5	926,326.3	1,036,052.1	1,148,564.8	16,420,709.4
24	UMPA: RS 637	148,284.9	158,421.7	125,826.8	78,389.1	256,050.7	281,357.0	385,356.0	399,195.8	293,777.8	104,950.9	119,313.9	120,587.4	2,471,511.9
25	DGT: RS 280	228,092.9	226,184.0	166,118.7	297,733.5	392,841.1	398,695.6	378,804.8	608,755.6	567,396.9	320,515.8	309,593.0	309,049.4	4,203,781.3
26	WAPA OIS: RS 262/RS263	-	-	-	-	-	-	-	-	-	-	-	-	-
27	**Subtotal** (Legacy Agreements)	1,338,741.8	1,478,487.5	1,188,254.4	1,245,892.7	2,360,612.1	2,391,693.7	2,764,899.3	3,181,242.3	2,751,225.3	1,351,793.0	1,464,959.0	1,578,201.6	23,096,002.6
	Change													
28	Updated revenues with proposed loss factor	$ 23,952,632	$ 23,931,516	$ 22,035,464	$ 19,987,316	$ 25,586,508	$ 27,538,699	$ 30,625,438	$ 31,228,237	$ 28,289,607	$ 22,518,510	$ 22,315,217	$ 24,186,275	$ 302,195,420
29	Revenues with current loss factor (From Statement BH)	23,951,129	23,930,021	22,034,079	19,985,988	25,585,221	27,537,255	30,623,963	31,226,758	28,288,188	22,517,104	22,313,853	24,184,870	302,178,429
30	Absolute Difference (*proposed* minus *current*)	$ 1,502	$ 1,495	$ 1,385	$ 1,328	$ 1,286	$ 1,444	$ 1,476	$ 1,479	$ 1,419	$ 1,406	$ 1,365	$ 1,406	$ 16,991
31	Percent Difference	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%

Note [1] Per customers' contract agreements, no losses, or losses only applicable to certain load, are included in customers' billing determinants.
Note [2] A value of zero in a month (designated by "-") indicates that the customer did not take service for that month.

PACIFICORP
PRESENT LOADS AT CURRENT TRANSMISSION RATE (CURRENT DISTRIBUTION RATE)
OATT PARTS III SERVICE AND LEGACY AGREEMENTS
2020

Line	Service/ Customer: Service Agreement ("SA")/Rate Schedule ("RS") No.	January	February	March	April	May	June	July	August	September	October	November	December	Total
	OATT Part III - Network Service (these loads already include losses)													
1	PacifiCorp: SA 66 [1]	8,326.57	8,221.32	7,658.43	6,923.65	8,749.87	9,451.41	10,476.14	10,546.48	9,618.25	7,776.13	7,684.91	8,274.40	103,707.56
2	BPA Yakama: SA 328	7.40	7.13	5.78	5.13	4.36	4.13	5.10	5.56	4.93	5.68	4.91	4.37	64.49
3	BPA Gazely: SA 229	3.24	3.42	3.49	2.77	2.98	3.40	3.71	3.54	3.59	3.01	2.98	3.00	39.12
4	BPA Clark: SA 735	29.02	31.00	23.83	22.57	14.16	16.99	18.00	17.00	17.14	26.38	24.89	27.88	268.85
5	BPA Benton/Rimrock: SA 539	1.35	1.25	1.12	0.93	0.37	0.34	0.40	0.37	0.34	0.91	0.91	-	8.27
6	BPA Ore Wind: SA 538	-	-	-	0.05	0.16	0.40	-	0.35	-	0.38	-	0.56	1.91
7	BPA S. Idaho: SA 746	262.61	299.30	248.86	199.93	131.13	160.85	171.99	161.62	136.82	270.97	240.97	324.58	2,609.62
8	BPA Idaho Falls SA 747	96.21	104.56	104.26	65.83	85.53	83.81	104.81	109.31	99.26	82.32	93.97	101.29	1,131.15
9	Tri State: SA 628	20.93	21.03	19.73	20.05	11.62	15.84	15.43	16.12	13.45	19.95	16.30	17.30	207.73
10	Calpine Energy Solutions: SA 299	13.90	13.74	13.78	13.50	16.56	17.52	16.44	16.23	16.02	11.90	12.31	10.99	172.86
11	Basin: SA 505	10.61	10.65	10.29	8.94	7.46	9.87	9.59	10.69	9.35	9.70	9.17	10.44	116.77
12	Black Hills: SA 347 [1]	51.49	47.51	42.81	43.58	36.39	47.72	53.21	61.16	45.99	48.69	39.98	45.74	564.27
13	USBR (Burbank): SA 506	0.01	0.00	0.00	0.25	0.55	0.53	0.68	0.61	0.61	0.00	0.00	0.00	3.25
14	WAPA: SA 175	0.01	0.01	0.00	0.00	3.24	3.39	3.12	3.12	3.04	0.00	0.00	0.01	15.95
15	Exelon Generation: SA 943	1.15	1.05	1.09	1.04	1.08	1.24	1.20	1.11	1.20	0.92	0.80	1.07	12.95
16	Avangrid Renewables, LLC: SA 742	32.79	32.54	32.33	32.77	32.55	33.14	33.56	33.16	33.74	34.05	34.00	33.50	398.12
17	BPA CEC SA 827	0.17	0.05	-	-	-	-	-	-	-	-	0.16	0.18	0.55
18	BPA Airport Solar SA 865	0.17	0.12	-	0.04	-	0.01	-	-	-	-	0.10	0.10	0.55
19	BPA WEID SA 975	-	-	-	-	-	-	-	-	-	-	0.58	0.01	0.59
20	3 Phases Renewables Inc. SA 876	0.24	0.23	0.24	0.19	0.26	0.30	0.34	0.31	0.28	0.20	0.17	0.21	2.98
21	NTUA SA 894	2.61	2.54	2.21	1.94	2.12	2.21	2.66	2.67	2.46	2.25	2.35	2.60	28.61
22	Subtotal	8,860.47	8,797.44	8,168.26	7,343.15	9,100.38	9,853.08	10,916.35	10,989.41	10,006.45	8,293.45	8,169.47	8,858.24	109,356.15
	Legacy Agreements (these loads already include losses)													
23	UAMPS: RS 297	377.1	428.6	351.2	340.8	670.7	670.7	783.9	851.5	740.6	362.9	405.9	450.0	6,433.9
24	UMPA: RS 637	58.1	62.1	49.3	30.7	100.3	110.2	151.0	156.4	115.1	41.1	46.8	47.3	968.4
25	DGT: RS 280	89.4	88.6	65.1	116.7	153.9	156.2	148.4	238.5	222.3	125.6	121.3	121.1	1,647.2
26	WAPA OIS: RS 262/RS263	-	-	-	-	-	-	-	-	-	-	-	-	-
27	**Subtotal** (Legacy Agreements)	524.5	579.3	465.6	488.2	924.9	937.1	1,083.4	1,246.5	1,078.0	529.7	574.0	618.4	9,049.5
	Change													
28	Updated revenues with proposed loss factor	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
29	Revenues with current loss factor (From Statement BH)	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Absolute Difference (*proposed* minus *current*)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
31	Percent Difference	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note [1] Per customers' contract agreements, no losses, or losses only applicable to certain load, are included in customers' billing determinants.
Note [2] A value of zero in a month (designated by "-") indicates that the customer did not take service for that month.

SCHEDULE 10

Real Power Losses

For Service Over the Transmission Provider's Transmission System:

Any use of the Transmission Provider's Transmission System, excluding EIM participation, shall be assessed Real Power Losses in the following amounts:

Use of any portion of the Transmission System at a voltage of 46kV or greater	3.75%
Use of any portion of the Distribution System at a voltage 34.5 kV or less	4.14%
Use of a combination of the Transmission System and the Distribution System	7.89%

For Service on the PacifiCorp COI Segment:

Real Power Losses shall be calculated in accordance with Attachment S for Transmission Service on the PacifiCorp COI Segment.

Service Over PacifiCorp Facilities in Other Control Areas: For Transmission Service provided over PacifiCorp lines located in another control area, any Real Power Losses assessed to PacifiCorp by the adjacent control area associated with the Customer's service will be passed through to the Transmission Customer. In instances where service is provided by PacifiCorp and an adjacent control area, any Real Power Losses assessed by the adjacent control area to PacifiCorp will be passed through to the Transmission Customer in addition to PacifiCorp Real Power Losses identified in this section.

Settlement of Transmission Losses: Unless Transmission Service is subject to Attachment S of the Tariff, a Transmission Customer taking Network Integration Transmission Service, Firm or Non-Firm Point-to-Point Transmission Service shall be responsible for Real Power Losses as provided for in Section 15.7 of the Tariff, this Schedule 10 and the Transmission Provider's business practices posted on OASIS. A Transmission Customer shall have the option to settle Real Power Losses pursuant to section (a) (Financial Settlement) or section (b) (Physical Delivery) subject to the Transmission Provider's business practices posted on OASIS.

(a) **Financial Settlement**.

(i) **Charges for Transmission Losses**. For each hour where the Transmission Provider provides loss service, the Transmission Customer shall compensate the Transmission Provider at a rate equal to the average hourly LAP price for the PACE and PACW BAAs, as established by the MO under Section 29.11(b)(3)(C) of the MO Tariff, multiplied by the energy for such hour based on a Transmission Customer's metered load actual amounts (for a Transmission Customer taking Network Integration Transmission Service) or actual amounts of power scheduled to be delivered at Point(s) of Delivery (for a Transmission Customer taking Point-to-Point Transmission Service).

A spreadsheet showing the average LAP prices for each hour of the previous month shall be accessible through the Transmission Provider's OASIS.

(b) **Physical Delivery**. Transmission Customers opting for physical delivery shall schedule losses to the Transmission Provider concurrently with transmission schedules. The Transmission Provider shall deliver to the Point(s) of Delivery the amount of power received from a Transmission Customer at Point(s) of Receipt, reduced for losses from the Point(s) of Receipt to the Point(s) of Delivery. The amount delivered to the Point(s) of Delivery shall be determined to be the amount of power received from a Transmission Customer at the Point(s) of Receipt divided by (1 + Real Power Losses rate) and the amount of losses shall be determined to be the amount of power received from a Transmission Customer at Point(s) of Receipt multiplied by (1 - 1/ (1 + Real Power Losses rate). Any hourly differences between the amounts of power scheduled to be delivered at Point(s) of Delivery (plus applicable Real Power Losses) and the actual amounts of energy received at Point(s) of Receipt shall be accounted for as Energy Imbalance subject to charges pursuant to Schedule 4.

Real Power Losses Updates: PacifiCorp shall update Schedule 10 factors for Real Power Losses following completion of every two Energy Gateway Project segments (or substantially similar transmission segments or combination thereof) which have been placed into commercial operation for at least one full calendar year. PacifiCorp's update to the Transmission System loss factor shall be filed on or before April 1 following the full calendar year of commercial operation for the second of every two Energy Gateway Project segments (or substantially similar transmission segments or combination thereof) with a request to the Commission that the updated Transmission System loss factor be made effective June 1 of the calendar year in which the filing is made. Such filing shall be based on the most recent FERC Form No. 1 data for the prior calendar year. The update calculation shall be consistent with the methodology agreed upon in ER11-3643 and shall be based on annual sources and uses of energy from FERC Form No. 1, p. 401a, with adjustments to remove any energy source and corresponding energy use (i) which is not scheduled or otherwise transacted using PacifiCorp's transmission system, (ii) which is duplicative of, in part or whole, another energy source or energy use already represented in the data on FERC Form No. 1, p. 401a, and (iii) which represent financially settled losses (i.e., no actual physical losses).

SCHEDULE 10

Real Power Losses

For Service Over the Transmission Provider's Transmission System:

Any use of the Transmission Provider's Transmission System, excluding EIM participation, shall be assessed Real Power Losses in the following amounts:

Use of any portion of the Transmission System at a voltage of 46kV or greater	3.75%
Use of any portion of the Distribution System at a voltage 34.5 kV or less	~~3.56%~~4.14%
Use of a combination of the Transmission System and the Distribution System	~~7.31%~~7.89%

For Service on the PacifiCorp COI Segment:

Real Power Losses shall be calculated in accordance with Attachment S for Transmission Service on the PacifiCorp COI Segment.

Service Over PacifiCorp Facilities in Other Control Areas: For Transmission Service provided over PacifiCorp lines located in another control area, any Real Power Losses assessed to PacifiCorp by the adjacent control area associated with the Customer's service will be passed through to the Transmission Customer. In instances where service is provided by PacifiCorp and an adjacent control area, any Real Power Losses assessed by the adjacent control area to PacifiCorp will be passed through to the Transmission Customer in addition to PacifiCorp Real Power Losses identified in this section.

Settlement of Transmission Losses: Unless Transmission Service is subject to Attachment S of the Tariff, a Transmission Customer taking Network Integration Transmission Service, Firm or Non-Firm Point-to-Point Transmission Service shall be responsible for Real Power Losses as provided for in Section 15.7 of the Tariff, this Schedule 10 and the Transmission Provider's business practices posted on OASIS. A Transmission Customer shall have the option to settle Real Power Losses pursuant to section (a) (Financial Settlement) or section (b) (Physical Delivery) subject to the Transmission Provider's business practices posted on OASIS.

(a) **Financial Settlement.**

(i) **Charges for Transmission Losses.** For each hour where the Transmission Provider provides loss service, the Transmission Customer shall compensate the Transmission Provider at a rate equal to the average hourly LAP price for the PACE and PACW BAAs, as established by the MO under Section 29.11(b)(3)(C) of the MO Tariff, multiplied by the energy for such hour based on a Transmission Customer's metered load actual amounts (for a Transmission Customer taking Network Integration Transmission Service) or actual amounts of power scheduled to be delivered at Point(s) of Delivery (for a Transmission Customer taking Point-to-Point Transmission Service).

A spreadsheet showing the average LAP prices for each hour of the previous month shall be accessible through the Transmission Provider's OASIS.

(b) **Physical Delivery**. Transmission Customers opting for physical delivery shall schedule losses to the Transmission Provider concurrently with transmission schedules. The Transmission Provider shall deliver to the Point(s) of Delivery the amount of power received from a Transmission Customer at Point(s) of Receipt, reduced for losses from the Point(s) of Receipt to the Point(s) of Delivery. The amount delivered to the Point(s) of Delivery shall be determined to be the amount of power received from a Transmission Customer at the Point(s) of Receipt divided by (1 + Real Power Losses rate) and the amount of losses shall be determined to be the amount of power received from a Transmission Customer at Point(s) of Receipt multiplied by (1 - 1/ (1 + Real Power Losses rate). Any hourly differences between the amounts of power scheduled to be delivered at Point(s) of Delivery (plus applicable Real Power Losses) and the actual amounts of energy received at Point(s) of Receipt shall be accounted for as Energy Imbalance subject to charges pursuant to Schedule 4.

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Enclosure 3

Line Loss Study (Exhibit No. PAC-0001)

Rocky Mountain Power | Pacific Power

PACIFICORP

2018 Electric System Loss Study

April 2020

PacifiCorp
2018 Electric System Loss Study

Executive Summary

The PacifiCorp's 2018 Electric System Loss Study ("Study") presents power loss information on PacifiCorp's power systems. This Study only considers technical losses, or losses affiliated with transmitting electricity over Company equipment and does not consider non-technical losses, such as losses attributable to erroneous metering or theft.

The Study developed estimated losses for each level of the system including; transmission, distribution substations, the primary system, service transformers, the secondary system, services and the retail meter. The Study developed separate demand (kW) and energy (kWh) loss factors for each level of service in the power system.

Since it is impractical to perform detailed line loss calculations for each level of the system for every hour of the year, PacifiCorp selected four hours that broadly represent different conditions on its electric system and conducted power flow analyses at these four hours. The four base cases used in the study were as follows:

Table 1: Power Flow Base Cases

PacifiCorp Load	Percent of Peak	Base Case
10,551 MW	100.0%	July 16, 2018 @ 17:00 PPT (Summer Peak)
8,436 MW	80.0%	February 23, 2018 @ 08:00 PPT (Winter Peak)
6,638 MW	62.9%	October 8, 2018 @ 10:00 PPT (Median)
4,757 MW	45.1%	May 4, 2018, @ 03:00 PPT (Minimum)

To extrapolate the losses from the four base cases to hourly (demand) and annual (energy) losses, two separate second-degree polynomial loss functions for each level of the system were developed – one for winter and one for summer. The total hourly losses for each state and loss category are calculated across the entire year and then, once summed, are divided by the appropriate total load to determine the annual loss percentage for each category. Demand losses are calculated based on the sum of the losses at time of the twelve-monthly coincident peaks divided by the sum of load at those same times. The demand loss factors and energy loss factors are shown in Tables 2 and 3.

Table 2: 2018 Demand and Energy Loss Summary

Voltage Class	Demand Loss Factor	Energy Loss Factor
Transmission	3.816%	3.503%
Primary	6.463%	6.032%
Secondary	7.901%	7.644%

Table 3: Distribution System Losses

Functional Category	Demand Loss Factor	Energy Loss Factor
Dist. Substation Transformers	0.608%	0.654%
Primary Lines	2.039%	1.876%
Service Transformers	1.135%	1.400%
Secondary Lines	0.232%	0.141%
Meters	0.071%	0.071%
Total	**4.084%**	**4.141%**

PacifiCorp
2018 Electric System Loss Study

INTRODUCTION

PacifiCorp's 2018 Electric System Loss Study ("Study") presents power loss information on PacifiCorp's power systems. This Study only considers technical losses, or losses affiliated with transmitting electricity over PacifiCorp ("Company") equipment and does not consider non-technical losses, such as losses attributable to erroneous metering or theft. Information included in the Study includes an overview of the systems analyzed along with a discussion of the methodology employed. The Appendices provide additional supporting data.

METHODOLOGY

PacifiCorp performed a system loss study on its electric system to determine the amount of demand and energy losses occurring by voltage class level. The Study developed estimated losses for each level of the system including; transmission, distribution substations, the primary system, service transformers, the secondary system, services and the retail meter. The Study developed separate demand (kW) and energy (kWh) loss factors for each level of service in the power system.

Since it is impractical to perform detailed line loss calculations for each level of the system for every hour of the year, PacifiCorp selected four hours that broadly represent different conditions on its electric system and conducted power flow analyses at these four hours. The four base cases used in the study were as follows:

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6,638 MW	62.9%	October 8, 2018 @ 10;00 PPT (Median)
4,757 MW	45.1%	May 4, 2018, @ 03:00 PPT (Minimum)

Subsequent sections provide additional detail regarding the technical analysis necessary to determine the losses for each level of the system for the base case.

<u>High Voltage System</u>

Transmission: To calculate losses on the transmission system, PacifiCorp developed detailed power flow models for the base cases for both the PacifiCorp West (PACW) and PacifiCorp East (PACE) balancing authority areas. PacifiCorp utilized the Siemens PTI

PSS/E power flow software program for power flow studies. Transmission planning relied on Western Electric Coordinating Council (WECC) approved base cases to conduct the system Study, which represents the Bulk Electric System (BES). Detailed system models for the PacifiCorp local area non-BES systems were added to the starting base cases. System loads within each of the PacifiCorp balancing authority areas were scaled to represent the four 2018 snapshot load profiles and generation dispatch was adjusted within each of the four cases to approximate the dispatch observed in those four historic hours. Supporting data and calculations are found in Appendix A.

Distribution System

Distribution Substations: The substation detailed network data was added to the starting WECC approved base cases in both of the PacifiCorp balancing authority areas. The cases were then tuned and solved. After addition of the detailed network data in the four different base cases, transmission and substation losses were extracted from the base cases. Additionally, substation losses were grouped by state jurisdiction. Supporting data and calculations are found in Appendix A.

Primary System: A high level loss ranking of primary distribution system networks was performed in order to develop a sample of primary networks by using their electrical characteristics. Specifically, in order to estimate relative range of losses across many circuits in each state, the customer energy usage (summer peak kWh/day), E, and locational positive sequence resistance (primary R_1) for each customer location were used. From the sample set for each state, several networks near the average E^2R_1 were evaluated to determine whether the distribution model was reasonably accurate, and whether detailed load information (typically SCADA at the breaker) was available. Then three to five of these networks were studied in the CYME power flow application, under base case loading conditions.

The kW and kVAR loss results from each state's sample of power flows were reduced to an average value for each base case, and that average value was then multiplied by the total number of distribution networks within the state to estimate the state's total primary system losses. Supporting data and calculations are found in Appendix B.

Secondary System - Service Transformers, Secondary and Service Conductors: An extract from the Company's GIS database was used to evaluate and classify line transformers and to develop impedance models for the associated secondary and service conductors. A summary of parameters extracted from the Company's GIS database is provided in Table C.1.

Manufacturer test records for line transformers procured between CY2012 and CY2015 were used to determine no-load and load loss values for typical transformer sizes based on class, voltage and kVA rating. Current Company standards for the sizing of secondary and service conductors were used to develop an impedance model and an associated load loss value for the secondary of each line transformer. Hourly load profile data for the delivery of residential and non-residential load at secondary voltage was used distribute load and calculate losses for each base case.

Retail Meter: PacifiCorp contacted meter manufacturers to determine the losses for those meter models used extensively by PacifiCorp throughout its service territory. PacifiCorp then determined the currently installed population of each meter model and multiplied the population by the losses, as obtained from the manufacturer. This system-wide total was then allocated to each individual state based on the number of customers located in each state. Supporting data and calculations are found in Appendix D.

APPLICATION OF BASE CASE RESULTS TO HOURLY LOSSES

To extrapolate the losses from the four base cases to hourly (demand) and annual (energy) losses, two loss functions for each level of the system were developed; one for winter and one for summer. Generally, the winter line loss function relies on 2018 loads and losses for three points - winter peak, median and minimum power flow results. The summer line loss function relies on 2018 loads and losses for three points - summer peak, median, and minimum power flow results. In some cases, the loss functions rely on two points – peak and minimum power flow results.

Once the loss functions were determined, those loss functions were applied to 2018 actual hourly loads to derive hourly losses. Transmission system losses were derived from PacifiCorp West and PacifiCorp East balancing area hourly loads. Primary losses rely on hourly primary and secondary energy volumes by state as determined by load research studies. Transformer losses and secondary losses rely on hourly secondary energy volumes by state as determined by load research studies. Supporting data and calculations are found in the Appendix E.

Appendix A

Table A.1: PacifiCorp Power Flow Results

Location	Condition	Total Load (MW)	Total Losses (MW)	Total Losses (%)	Transmission Losses (MW)	Distribution Losses (MW)
PACW	Summer Peak	3,659.7	107.6	2.94%	84.9	22.8
	Winter Peak	3,645.3	99.3	2.72%	76.8	22.4
	Median	2,339.5	68.9	2.95%	54.5	14.4
	Minimum	1,533.6	56.1	3.66%	46.7	9.4
PACE	Summer Peak	9,063.0	377.3	4.16%	352.9	24.4
	Winter Peak	6,661.4	237.2	3.56%	220.1	17.2
	Median	6,125.3	185.4	3.03%	169.7	15.7
	Minimum	5,016.8	141.8	2.83%	129.1	12.7

Table A.2: Base Case Distribution Substation Power Flow Results

Location	Condition	Total Load (MW)	Substation Losses (MW)	Substation Losses (%)
Oregon	Summer Peak	2,718.2	18.3	0.67%
	Winter Peak	2,685.2	18.0	0.67%
	Median	1,743.3	11.5	0.66%
	Minimum	1,148.3	7.5	0.65%
Washington	Summer Peak	757.3	3.4	0.45%
	Winter Peak	779.9	3.4	0.44%
	Median	478.3	2.2	0.46%
	Minimum	307.9	1.4	0.47%
California	Summer Peak	184.2	1.0	0.56%
	Winter Peak	180.2	1.0	0.55%
	Median	117.9	0.7	0.57%
	Minimum	77.4	0.5	0.60%
Idaho	Summer Peak	857.6	2.2	0.25%
	Winter Peak	570.1	1.4	0.25%
	Median	527.9	1.3	0.25%
	Minimum	388.4	1.0	0.25%
Utah	Summer Peak	6,561.6	20.0	0.31%
	Winter Peak	4,455.3	13.6	0.31%
	Median	4,047.5	12.4	0.31%
	Minimum	3,235.9	9.9	0.31%
Wyoming	Summer Peak	1,643.8	2.2	0.13%
	Winter Peak	1,636.0	2.2	0.13%
	Median	1,550.0	2.1	0.13%
	Minimum	1,392.4	1.8	0.13%

Appendix B

Table B.1: Primary Distribution Screened Network Detail

State	Total Networks	Sampled E2R1 Networks (% of Total)	E2R1 Average of Sample Set	Detailed Load Flow Networks
Oregon	499	221 (44%)	513,645,903	3
Washington	127	112 (88%)	360,837,843	3
California	76	56 (74%)	238,490,591	3
Idaho	168	131 (78%)	493,279,060	3
Utah	949	639 (67%)	312,501,766	5
Wyoming	220	178 (81%)	2,779,440,675	4

Table B.2: Base Case Primary Loss Results

State	Condition	Average Network kW Loss	Average Network kVAR Loss	kW Loss	kVAR Loss	kVA Loss
Oregon	Summer Peak	53.3	87.9	26,612	43,873	51,313
	Winter Peak	140.9	247.2	70,309	123,352	141,982
	Median	43.7	96.0	21,790	47,881	52,606
	Minimum	15.4	39.6	7,675	19,763	21,201
Washington	Summer Peak	133.2	182.9	16,914	23,224	28,731
	Winter Peak	71.1	144.9	9,033	18,404	20,502
	Median	58.6	102.2	7,446	12,979	14,963
	Minimum	47.4	85.2	6,018	10,821	12,382
California	Summer Peak	197.3	230.8	14,997	17,538	23,076
	Winter Peak	36.9	47.9	2,806	3,637	4,594
	Median	38.8	35.9	2,949	2,729	4,018
	Minimum	31.1	25.7	2,362	1,951	3,064
Idaho	Summer Peak	112.5	125.7	18,897	21,125	28,344
	Winter Peak	51.3	103.6	8,616	17,401	19,417
	Median	8.6	9.2	1,446	1,545	4,472
	Minimum	8	8.2	1,336	1,385	4,066
Utah	Summer Peak	44.9	77.8	42,646	73,861	85,288
	Winter Peak	19.8	37.5	18,749	35,599	40,235
	Median	17.4	32	16,516	30,364	34,565
	Minimum	15.6	27.8	14,760	26,428	30,271
Wyoming	Summer Peak	60.0	179.8	11,939	35,790	37,729
	Winter Peak	74.5	223.1	14,830	44,398	46,809
	Median	64.0	192.4	12,739	38,282	40,346
	Minimum	42.2	131.2	8,407	26,101	27,421

Appendix C

Table C.1: Line Transformer GIS Database Extract

Line Transformer (Parameter)	Parameters Value (ex.)
State	UT, WY, ID, OR, WA, CA
Facility Point Number	Ex: 11302001.0069804
Class	Overhead, Padmount,….
Phase(s) Energized	1,2,3
KVA	25,50,...,2500
Primary Voltage (kV)	7.2,12.47,...14.4,19.9
Secondary Voltage	120/240, 120/208, 277/480,…
No. of Connected Customers	1,2,…10,..
Connected Customer Rate Sch.	Residential, Non-Residential

Table C.2: Secondary Voltage Loads (MW)

State	MWH	Load Factor	Loss Factor	Peak Load	July 16, 2018 at HE 17:00 PPT	February 23, 2018 at HE 8:00 PPT	May 14, 2018 at HE 3:00 PPT	October 8, 2018 at HE 10:00 PPT
Oregon	10,689,532	54%	31%	2,241	2,226	2,118	642	1,176
Washington	3,552,152	53%	30%	762	680	633	249	376
California	712,636	54%	31%	149	148	141	43	78
Idaho	1,812,581	37%	16%	566	497	219	114	157
Utah	15,757,012	45%	22%	4,027	3,799	1,925	1,005	1,670
Wyoming	2,612,514	63%	41%	476	363	412	182	352

Table C.3: Non-Residential Secondary Voltage Loads (MW)

State	MWH	Load Factor	Loss Factor	Peak Load	July 16, 2018 at HE 17:00 PPT	February 23, 2018 at HE 8:00 PPT	May 14, 2018 at HE 3:00 PPT	October 8, 2018 at HE 10:00 PPT
Oregon	5,152,201	---	---	---	970	823	370	682
Washington	1,991,866	---	---	---	369	249	154	247
California	355,802	---	---	---	67	58	25	47
Idaho	1,112,073	---	---	---	376	97	67	94
Utah	8,644,710	---	---	---	1,729	1,085	623	1,108
Wyoming	1,613,116	---	---	---	215	238	127	219

Table C.4: Residential Secondary Voltage Loads (MW)

State	MWH	Load Factor	Loss Factor	Peak Load	July 16, 2018 at HE 17:00 PPT	February 23, 2018 at HE 8:00 PPT	May 14, 2018 at HE 3:00 PPT	October 8, 2018 at HE 10:00 PPT
Oregon	5,537,332	47%	25%	1,340	1,256	1,295	271	494
Washington	1,560,286	44%	22%	402	312	384	95	129
California	356,834	47%	25%	86	81	83	17	32
Idaho	700,508	48%	25%	165	121	123	46	63
Utah	7,112,302	34%	14%	2,370	2,070	840	382	562
Wyoming	999,398	47%	24%	243	148	175	54	133

Table C.5: Base Case Service Transformer, Secondary and Service Loss Parameters

Class/State	Sum of Transformer Capacity MVA	Sum of Transformer NLL	Sum of Transformer LL at Full Load	Sum of Secondary Losses LL at Full Load	Sum of Service Losses at Full Load
Non-Residential	**14,706.6**	**24.9**	**135.3**	**-**	**70.1**
Oregon	4,135.7	7.2	39.0	-	21.5
Washington	1,455.7	2.4	13.4	-	7.1
California	424.1	0.8	4.3	-	2.6
Idaho	1,110.0	2.0	10.7	-	5.6
Utah	6,329.8	10.3	55.9	-	26.7
Wyoming	1,251.4	2.2	12.0	-	6.5
Residential	**11,984.5**	**23.9**	**130.0**	**64.9**	**70.7**
Oregon	4,233.8	8.5	46.9	19.6	21.9
Washington	929.4	1.9	10.4	4.2	4.6
California	359.1	0.8	4.3	1.3	1.6
Idaho	716.3	1.5	8.3	2.3	2.9
Utah	5,019.7	9.8	51.9	32.9	34.7
Wyoming	726.2	1.5	8.3	4.6	5.0
Total	**26,691.1**	**48.7**	**265.3**	**64.9**	**140.8**

Table C.6: Base Case Service Transformer, Secondary and Service Loss Results

State	Condition	Transformer Input (MVA)	Transformer NLL (MW)	Transformer LL (MW)	Secondary LL (MW)	Service LL (MW)	Retail Load (MVA)
Oregon	Summer Peak	2,371.5	15.7	7.1	2.0	3.5	2,343.3
	Winter Peak	2,256.9	15.7	6.7	2.1	3.3	2,229.1
	Median	1,256.8	15.7	1.9	0.3	1.0	1,237.8
	Minimum	692.2	15.7	0.6	0.1	0.3	675.5
Washington	Summer Peak	724.4	4.3	2.3	0.5	1.1	716.1
	Winter Peak	675.2	4.3	2.5	0.8	1.1	666.4
	Median	400.9	4.3	0.7	0.1	0.3	395.5
	Minimum	267.1	4.3	0.3	0.1	0.1	262.3
California	Summer Peak	158.4	1.5	0.4	0.1	0.2	156.2
	Winter Peak	150.7	1.5	0.4	0.1	0.2	148.6
	Median	84.2	1.5	0.1	0.0	0.1	82.5
	Minimum	46.6	1.5	0.0	0.0	0.0	45.0
Idaho	Summer Peak	528.9	3.4	1.7	0.1	0.8	522.9
	Winter Peak	235.0	3.4	0.4	0.1	0.1	230.9
	Median	169.0	3.4	0.2	0.0	0.1	165.3
	Minimum	123.3	3.4	0.1	0.0	0.0	119.7
Utah	Summer Peak	4,049.3	20.1	14.8	6.4	9.0	3,999.1
	Winter Peak	2,052.4	20.1	3.5	1.1	2.0	2,025.8
	Median	1,782.1	20.1	2.7	0.5	1.4	1,757.5
	Minimum	1,079.8	20.1	1.0	0.2	0.5	1,058.0
Wyoming	Summer Peak	387.2	3.7	0.8	0.2	0.5	382.1
	Winter Peak	439.4	3.7	1.0	0.3	0.6	433.8
	Median	375.7	3.7	0.7	0.2	0.4	370.7
	Minimum	195.1	3.7	0.2	0.0	0.1	191.1

Appendix D

Table D.1: Meter Populations and Results

Model	Voltage	Losses (W)	Population	Total Losses (Wh) / Day	Final Losses (MWh) / Day
CENTRON Single Phase	120-240	1.08	1,242,427	32,205,241	32.2
CENTRON Polyphase	120-480	1.35	40,253	1,308,110	1.3
KV2C	120-480	1.15	33,717	930,589	0.9
KV2C	120-480	1.17	5,691	159,803	0.2
KV2C	120-480	2.029	47,342	2,305,366	2.3
I-210+c	240	2.184	605,839	31,755,657	31.8
Total			1,975,269	68,664,767	68.7

Table D2: Meter Loss Results

Location	Customers	Annual Losses (MWh)	Losses (aMW)	Loss Percentage
Oregon	609,685	7,736	0.9	0.07%
Washington	135,900	1,724	0.2	0.05%
California	46,614	591	0.1	0.07%
Idaho	82,994	1,053	0.1	0.06%
Utah	954,304	12,108	1.4	0.08%
Wyoming	145,771	1,850	0.2	0.07%
Total	1,975,269	25,063	2.9	0.07%

Appendix E

Table E.1: Loss Functions

Location	Level	Summer			Winter		
		X^2	X	b	X^2	X	b
PACE	Transmission	0.000008	-0.019110	107.107548	0.000044	-0.300927	647.306243
PACW	Transmission	0.000008	-0.018491	57.680383	0.000004	-0.003855	45.284597
Oregon	Substation	0.000000	0.007587	1.595910	0.000000	0.006810	1.993896
	Primary	0.000000	0.010143	-4.718163	0.000000	0.067400	-50.951459
	Transformer	0.000002	-0.000226	15.789439	0.000002	-0.000626	15.955383
	Secondary	0.000001	-0.000882	0.378246	0.000002	-0.001489	0.629952
Washington	Substation	-0.000001	0.005572	0.010332	0.000000	0.004609	0.172129
	Primary	0.000000	0.025808	-0.115800	0.000000	0.008961	4.493930
	Transformer	0.000006	-0.000636	4.425511	0.000011	-0.003694	4.883538
	Secondary	0.000005	-0.001423	0.233859	0.000011	-0.004965	0.764504
California	Substation	-0.000006	0.005848	0.183742	-0.000006	0.005860	0.183360
	Primary	0.001580	-0.205668	7.656600	0.000000	0.007936	0.914328
	Transformer	0.000015	-0.000292	1.557873	0.000017	-0.000617	1.568066
	Secondary	0.000010	-0.000301	0.011197	0.000012	-0.000549	0.018947
Idaho	Substation	-0.000016	0.013210	-0.390300	-0.000067	0.027641	-1.394837
	Primary	0.000140	-0.033208	2.259246	0.000000	0.136937	-16.384230
	Transformer	0.000007	-0.000106	3.449119	0.000015	-0.002289	3.593100
	Secondary	0.000004	0.000058	-0.002362	0.000010	-0.001678	0.112087
Utah	Substation	0.000000	0.003707	5.724340	0.000001	0.000414	8.016543
	Primary	0.000000	0.008336	-2.449088	0.000000	0.004853	1.485170
	Transformer	0.000001	-0.000381	20.298747	0.000001	0.000612	19.675635
	Secondary	0.000002	-0.002680	1.783622	0.000003	-0.006366	4.096024
Wyoming	Substation	0.000007	-0.006947	3.547739	0.000004	-0.003844	2.688215
	Primary	0.000000	0.036757	4.593334	0.000000	0.069058	-10.735826
	Transformer	0.000013	-0.003653	4.115887	0.000008	-0.001123	3.812854
	Secondary	0.000025	-0.010726	1.259744	0.000010	-0.002870	0.318776

Enclosure 4

Testimony of Jake S. Barker (Exhibit No. PAC-0002)

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PacifiCorp	**)))**	**Docket No. ER22-___-000**

DIRECT TESTIMONY

OF

JAKE S. BARKER

ON BEHALF OF

PACIFICORP

Exhibit No. PAC-0002

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PacifiCorp	)))	**Docket No. ER22-___-000**

DIRECT TESTIMONY OF
JAKE S. BARKER

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jake S. Barker. My business address is 1407 W North Temple, Salt Lake City, Utah 84116.

Q. WHO IS YOUR CURRENT EMPLOYER, AND WHAT POSITION DO YOU HOLD?

A. My employer is PacifiCorp. I am the director of field engineering and area transmission planning.

Q. WHAT ARE YOUR RESPONSIBILITIES?

A. I am responsible for distribution engineering, power quality and customer generation engineering for PacifiCorp, and sub-transmission planning for Rocky Mountain Power.

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND.

A. I hold a bachelor of science degree in electrical engineering from Utah State University and a master's degree in business administration from the University of Utah. I have worked at PacifiCorp for 19 years in various engineering roles including distribution engineering, transmission planning, smart grid and power quality.

Q. HAVE YOU TESTIFIED BEFORE THIS OR ANY OTHER REGULATORY COMMISSION?

A. Yes.

II. PURPOSE AND EXHIBITS

Q. PLEASE EXPLAIN THE PURPOSE OF YOUR TESTIMONY.

A. I am explaining the basis for PacifiCorp's filing to update the distribution system loss factor reflected in Schedule 10 of its Open Access Transmission Tariff.

Q. ARE YOU SPONSORING ANY EXHIBITS IN CONNECTION WITH YOUR TESTIMONY?

A. Yes. I am sponsoring the loss factor study that was submitted to the Wyoming, Utah, Oregon, and Idaho commissions.

III. LOSS FACTOR STUDY

Q. HOW WAS THE LOSS FACTOR STUDY CONDUCTED?

A. PacifiCorp performed a system loss study on its electric system to determine the amount of demand and energy losses occurring by voltage class level. The study developed estimated losses for each level of the system including: transmission, distribution substations, the primary distribution system, the secondary distribution system (including service transformers and secondary and service conductors) and the retail meter.

Using a 2018 study year, which was the most recent year for which the data was available, PacifiCorp selected four hours that broadly represent different conditions on its electric system and conducted power flow analyses at these four hours. Losses were then extrapolated to hourly (demand) and annual (energy) losses.

Models of the transmission system and distribution substations were utilized to conduct the analysis for their respective contributions to losses. The primary distribution system was analyzed using a sampling of primary circuits, and then applying the average values obtained from the sample set from each state to all circuits within the state to estimate the state's total primary system losses. An extract from the Company's GIS database was used to evaluate line transformers and to develop impedance models for the associated secondary and service conductors. Meter losses were determined by meter type loss specifications then multiplied across each meter type population in the system.

Q. WHAT IS THE CONCLUSION OF THE LOSS FACTOR STUDY?

A. The total hourly losses for each of PacifiCorp's state jurisdictions and loss category are calculated across the entire year and then, once summed, are divided by the appropriate total load to determine the annual loss percentage for each category. The results for each functional category, which are summed to an aggregated distribution loss factor of 4.14%, are shown in the table below.[1]

Functional Category	Energy Loss Factor
Distribution Substation Transformers	0.65%
Primary Lines	1.88%
Service Transformers	1.40%
Secondary Lines	0.14%
Meters	0.07%
Aggregated Distribution loss (for all states)	**4.14%**

Q. HAS THE DISTRIBUTION LOSS FACTOR IDENTIFIED IN THE STUDY BEEN USED IN STATE RATES?

A. Yes, rates have been set in Utah, Wyoming and Oregon in reliance upon the loss study.

[1] This table is an abbreviated version of Table 3 on page two of the Losses Study.

Q. HAVE THERE BEEN ANY CHANGES TO THE PACIFICORP DISTRIBUTION SYSTEM SINCE THE STUDY THAT WOULD BE EXPECTED TO IMPACT THE STUDY RESULTS?

A. No. The Company has continued to experience slow to moderate load growth within its service territory. Load growth has been met with typical and corresponding line extension projects and metering, effectively dismissing any material impact to study loss factor calculations. In addition, the Company has not changed any construction or design practice that would materially affect loss study results.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PacifiCorp	)))	**Docket No. ER22-___-000**

County of SALT LAKE
State of UTAH

Jake Barker, being duly sworn, deposes and states: that the Direct Testimony of Jake Barker was prepared by me or under my direct supervision, and that the statements contained therein and the Exhibits attached thereto are true and correct to the best of my knowledge, information and belief.

Jake Barker

Subscribed and sworn before me this 5th_____
day of October, 2021

Sally Hill

Notary Public - State of Utah
SALLY HILL
Comm. #715133
My Commission Expires
November 9, 2024

Notary Public

My Commission expires: 11-9-2024