

**The Empire District Electric Company
Cogeneration Rate Calculation
January 2017**

	Summer	Winter	Source
1. Avoided Energy Cost	0.02825	0.02506	Prosym Model
2. Transmission Loss Factor	1.02184	1.02184	Loss Study 2014
3. Cogeneration Purchase Rate	0.0289	0.0256	Calculated: Line 1 * Line 2
4. Summer / Winter Differential	12.73%		

Costs are averaged for 2015-2016 cost years.

The Summer period is the four months of June through September.

The Winter period is the remaining eight months.

	2017		2018	
	Avg Marg \$	Hours	Avg Marg \$	Hours
SUMMER				
Average Marginal Costs On-Peak	31.72	1,131	34.84	1,118
Average Marginal Costs Off-Peak	24.42	1,797	25.81	1,810
		2,928		2,928

WINTER				
Average Marginal Costs On-Peak	26.49	2,768	27.61	2,800
Average Marginal Costs Off-Peak	22.60	3,064	23.88	3,032
		5,832		5,832

AVOIDED ENERGY COST

(Marginal cost *on-peak/off-peak hours) / total hours

SUMMER	2017	2018	
On-Peak	12.25	13.30	
Off-Peak	14.99	15.95	
	<u>27.24</u>	<u>29.26</u>	\$28.25 2017-18 Average

WINTER	2017	2018	
On-Peak	12.57	13.26	
Off-Peak	11.87	12.41	
	<u>24.45</u>	<u>25.67</u>	\$25.06 2017-18 Average

SUMMARY

Winter: January-May and October-December

On-Peak Hours: Weekdays 6 AM thru 9 PM

Off-Peak Hours: All other hours including weekends

Summer: June, July, August, September

On-Peak Hours: Weekdays 10 AM thru 10 PM

Off-Peak Hours: All other hours including weekends

Average Marginal Costs \$/Mwh

Year	Annual Avg Marg Cost	Summer On-Peak Avg Marg Cost	Summer Off-Peak Avg Marg Cost	Winter On-Peak Avg Marg Cost	Winter Off-Peak Avg Marg Cost
2017	25.38	31.72	24.42	26.49	22.60
2018	26.87	34.84	25.81	27.61	23.88
2019	28.17	36.49	27.35	28.91	24.90
2020	28.93	38.31	27.80	29.84	25.28
2021	29.78	39.52	28.30	31.04	25.88

The Empire District Electric Company
Load and Capability Forecast
Based on Load Forecast 2017-2021

Winter

Year	2017	2018	2019	2020	2021
Projected :					
Gross Peak	1,142	1,160	1,170	1,177	1,183
Less Interruptibles	(7.6)	(7.6)	(7.6)	(7.6)	(7.6)
Net Peak	1,134	1,152	1,162	1,170	1,176
Asbury	198	198	198	198	198
Iatan	85	85	85	85	85
Iatan 2	106	106	106	106	106
Plum Point (own)	50	50	50	50	50
Riverton 10	18	18	18	18	18
Riverton 11	18	18	18	18	18
Riverton 12 C. C.	285	285	285	285	285
Energy Center 1	92	92	92	92	92
Energy Center 2	92	92	92	92	92
Energy Center 3	60	60	60	60	60
Energy Center 4	60	60	60	60	60
State Line 1	105	105	105	105	105
State Line C.C.	331	331	331	331	331
Ozark Beach	16	16	16	16	16
Plum Point PPA	50	50	50	50	50
150 MW Elk River Wind Farm PPA	17	17	17	17	17
105 MW Meridian Way Windfarm PPA	19	19	19	19	19
Total Capacity	1,602	1,602	1,602	1,602	1,602
Capacity Resp. (12%)	1,289	1,310	1,321	1,329	1,336
Capacity Balance	313	292	281	273	266
Capacity Margin	29.19%	28.06%	27.46%	26.98%	26.62%

Summer

Year	2017	2018	2019	2020	2021
Projected :					
Gross Peak	1,124	1,128	1,131	1,134	1,136
Less Interruptibles	(8.4)	(8.4)	(8.4)	(8.4)	(8.4)
Net Peak	1,115	1,119	1,123	1,125	1,127
Asbury	198	198	198	198	198
Iatan	85	85	85	85	85
Iatan 2	106	106	106	106	106
Plum Point (own)	50	50	50	50	50
Riverton 10	13	13	13	13	13
Riverton 11	15	15	15	15	15
Riverton 12 C. C.	250	250	250	250	250
Energy Center 1	83	83	83	83	83
Energy Center 2	80	80	80	80	80
Energy Center 3	47	47	47	47	47
Energy Center 4	47	47	47	47	47
State Line 1	96	96	96	96	96
State Line C.C.	295	295	295	295	295
Ozark Beach	16	16	16	16	16
Plum Point PPA	50	50	50	50	50
150 MW Elk River Wind Farm PPA	17	17	17	17	17
105 MW Meridian Way Windfarm PPA	19	19	19	19	19
Total Capacity	1,467	1,467	1,467	1,467	1,467
Capacity Resp. (12%)	1,267	1,272	1,276	1,279	1,281
Capacity Balance	200	195	191	188	186
Capacity Margin	23.99%	23.70%	23.47%	23.28%	23.15%

12% Capacity Responsibility
Current Capacity Ratings

Empire District Electric Company 2014 Analysis of System Losses

TABLE 1
Loss Factors at Sales Level, Calendar Year 2014

<u>Voltage Level of Service</u>	<u>Total EDE</u>	<u>Missouri</u>	<u>Arkansas</u>	<u>Kansas</u>	<u>Oklahoma</u>
<u>Demand (kW)</u>					
Transmission	1.03071	1.03071	1.03071	1.03071	1.03071
Substation	1.03731	1.03777	1.03741	1.03741	1.03741
Primary	1.06244	1.06276	1.06362	1.06362	1.06362
Secondary	1.08450	1.08476	1.08604	1.08624	1.08646
Losses (MW) to Net System Input ¹	7.23%	7.25%	7.25%	7.41%	7.33%
<u>Energy (kWh)</u>					
Transmission	1.02184	1.02184	1.02184	1.02184	1.02184
Substation	1.03043	1.03122	1.03081	1.03081	1.03081
Primary	1.04857	1.04870	1.04899	1.04899	1.04899
Secondary	1.07516	1.07426	1.07632	1.07496	1.07610
Losses (MWH) to Net System Input ¹	6.21%	6.17%	5.92%	6.33%	6.06%

TABLE 2
Historical System MWH Losses²

<u>Year</u>	<u>Firm Sales MWH</u>	<u>Total Losses</u>	<u>% Annual</u>	<u>% 5-Yr. Avg. Rolling</u>
1998	4,162,607	303,175	7.28	
1999	4,163,824	304,747	7.32	
2000	4,424,768	366,028	8.27	
2001	4,494,199	304,067	6.77	
2002	4,566,262	334,287	7.32	7.39
2003	4,594,856	347,676	7.57	7.45
2004	4,628,759	338,035	7.30	7.45
2005	4,923,486	361,858	7.35	7.26
2006	5,049,599	273,483	5.42	6.99
2007	5,118,460	356,396	6.96	6.92
2008	5,124,277	353,204	6.89	6.78
2009	4,901,435	349,647	7.13	6.75
2010	5,202,277	363,250	6.98	6.68
2011	5,082,772	351,949	6.92	6.98
2012	4,922,036	311,275	6.32	6.85
2013	4,973,276	341,362	6.86	6.85
2014	5,037,140	333,810	6.63	6.74

¹ Net System Input equals firm (MW and MWH) sales plus losses, Company use less non-requirement sales. See Appendices A and B, Exhibit 1, for their calculations.

² Percent losses shown are based on Net System Output (metered sales basis).



Time of Day Marginal Cost
Data From the 2017-2021 Fuel and Purchase Power Budget
Average Marginal Cost \$/MWh

2017			
Period	Total hours	% of hours	Average Marg Cost
Summer On-Peak	1,131	12.9%	31.72
Summer Off-Peak	1,797	20.5%	24.42
Total Summer	2,928	33.4%	27.24
Winter On-Peak	2,768	31.6%	26.49
Winter Off-Peak	3,064	35.0%	22.60
Total Winter	5,832	66.6%	24.45
Total	8,760	100.0%	25.38

2018			
Period	Total hours	% of hours	Average Marg Cost
Summer On-Peak	1,118	12.8%	34.84
Summer Off-Peak	1,810	20.7%	25.81
Total Summer	2,928	33.4%	29.26
Winter On-Peak	2,800	32.0%	27.61
Winter Off-Peak	3,032	34.6%	23.88
Total Winter	5,832	66.6%	25.67
Total	8,760	100.0%	26.87

2019			
Period	Total hours	% of hours	Average Marg Cost
Summer On-Peak	1,118	12.8%	36.49
Summer Off-Peak	1,810	20.7%	27.35
Total Summer	2,928	33.4%	30.84
Winter On-Peak	2,800	32.0%	28.91
Winter Off-Peak	3,032	34.6%	24.90
Total Winter	5,832	66.6%	26.83
Total	8,760	100.0%	28.17

2020			
Period	Total hours	% of hours	Average Marg Cost
Summer On-Peak	1,144	13.1%	38.31
Summer Off-Peak	1,784	20.4%	27.80
Total Summer	2,928	33.3%	31.91
Winter On-Peak	2,784	31.8%	29.84
Winter Off-Peak	3,072	35.1%	25.28
Total Winter	5,856	66.7%	27.45
Total	8,784	100.0%	28.93

2021			
Period	Total hours	% of hours	Average Marg Cost
Summer On-Peak	1,144	13.1%	39.52
Summer Off-Peak	1,784	20.4%	28.30
Total Summer	2,928	33.4%	32.68
Winter On-Peak	2,768	31.6%	31.04
Winter Off-Peak	3,064	35.0%	25.88
Total Winter	5,832	66.6%	28.33
Total	8,760	100.0%	29.78