

Demand Charges in Electric Bills

Your Key to Scheduling Savings

May 2007

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Executive Summary

There are many commercial and industrial electric customers today who still believe that most of the electric bill is related to kilowatt-hour (kwh) consumption. The more savvy electric customers realize that under many utility rate schedules a single 15-minute or 30-minute time span can dictate 50% to 70% of the electric bill for up to two years! This is due to the fact that many electric utilities have shifted the largest portion of electric charges away from total monthly consumption charges to demand charges for short time spans over which peak demand is calculated. Today about 90% of the public electric utilities across the United States place greater emphases on peak demand than on consumption. The utilities justify this shift in billing charges by noting that the utility has to have sufficient capacity ready to provide for the customers' maximum load requirements.

The purpose of this report is to explore the various approaches to demand charges that electric utilities take. For the following reasons, it is prudent for commercial and industrial customers to understand how the utility captures this information and the charge for demand.

- The demand charge is most often the largest component of the electric bill. Because of this there is substantial money to be saved if a customer can schedule loads during the periods or times of year when demand charges are lower.
- If a company is considering opening a facility in a new location, the utility in that location may have a different approach to demand charges than the utility in the current location. You cannot assume that electric costs in one place will be the same in another.
- A company with multiple locations covered by different utilities needs to understand how each utility factors demand, power factor and consumption into their charges. If you have limited capital dollars to invest in electric cost reductions it is important to remember that what maximized cost reduction at one electric utility might not get the same results in another.

We have prepared a case study to illustrate the impact of various approaches to demand charges. You will see why it can be important to know how an electric utility calculates demand charges. We have also collected data from utilities across the United States regarding their approaches to demand charges.

Background on Electric Bills

How Utilities Bill

Electric utilities have different practices for charging for their services. Every utility has several different rate schedules for different classes of customers: residential, commercial, industrial, etc. These rate schedules are agreed upon by the utility and the state's public utility commission. The principal factors used in the calculation of the electric bill are typically:

- Actual electric consumption
- Power factor
- Demand

There may be other factors, such as seasonal rates, customer ownership of transformers, fuel adjustment charges, state and local taxes, etc. There is also usually a fixed monthly customer charge.

Electric Consumption

One component of the electric bill is a charge for the amount of electrical energy used by the customer over the billing period. Power companies consume fuel (coal, natural gas and nuclear fuel) to generate electricity. Consumption charges recover fuel and other costs that vary with the amount of energy consumed. However, for commercial and industrial customers, the utility often adds other charges beyond those for the electricity actually consumed.

Power Factor

Power factor is a measure of how effectively your equipment is converting electric current from the generation station to useful power output. Certain types of electrical equipment (transformers, motors, etc.) require power in excess of the kilowatts actually metered. The utility must generate additional power to cover this excess. As your power factor approaches the maximum of 100%, less current must pass through the wiring to operate the equipment.

If a customer's power factor is less than 100%, the utility must generate additional power to offset the difference. For example, if your equipment requires 100 kilowatts (kw) each hour and your power factor is 80%, the utility must supply 125 kw ($100 \text{ kw} / 80\% \text{ power factor}$). Thus, some utilities charge a premium for low power factor because they must install larger equipment down the line to satisfy the requirements of these consumers.

Demand Charges

The demand charges are often the largest portion of the bill for commercial and industrial customers. Most utilities consider the demand charges to be the basic billing factor in order to cover the investment in equipment that must be available to satisfy the customer's maximum load requirements. Demand charges are based upon the peak average electrical load over some utility-selected interval.

Outlined below are some of the different approaches to demand charges that utilities may take.

- The demand interval is important. Demand charges are usually based on the average load over some utility-selected interval. This interval is usually 15, 30 or 60 minutes.

- Demand charges may be measured in kilowatts (kw) or in apparent power measured in kilovolt amperes (kva). When kva is used, the user is charged for power factor waste.
- Some utilities have hybrid provisions for including power factor charges in the demand charges. For example, if the power factor falls below a specified level (e.g., 90%), then the demand charges are based on kva (kw / pf) rather than kw.
- Some utilities have ratchet clauses. The customer's highest electric consumption in some prior period of time is used as the basis for the peak demand charges. Another variation of the ratchet clause is that a certain percentage of the peak demand during the specified prior period is a minimum. In the case of a ratchet, an unusual high peak demand would not only impact the electric bill in the month it occurred, it would be used to determine the electric bill for possibly the next 23 months under some utilities!
- Demand charges may also vary with the time or year. For example, charges may be higher during the summer months than during the winter months.

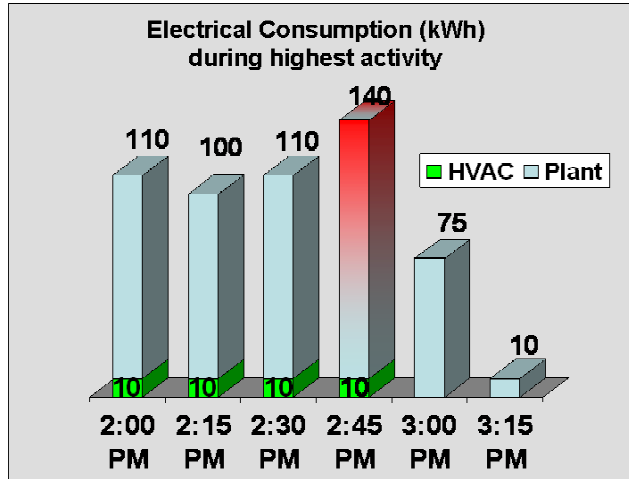
Utilities often consider demand charges to be the basic billing factor, with consumption and power factor charges added onto the demand charges. If it is possible for a customer to schedule loads during periods when demand charges are lower, then there is an opportunity to reduce the electric bill. To do this, a customer must understand the way the utility bills for demand charges. Thus, this report provides:

- A case study to illustrate the impact of the various approaches to demand charges
- Survey data on the various approaches taken by utilities across the United States

Case Study

Let's assume that you will be starting up some franchise businesses throughout the U.S. that will replicate your present company model. Electric costs are one of many important variables needed to select a site location.

Your present facility consumes 150,000 kilowatt hours (kwh) per month. Your utility uses a 60-minute demand window and bills demand on kilowatts (kw). The graph at right shows the electric consumption in 15-minute intervals during a 90-minute period that includes the peak demand interval. The consumption shown in green for air conditioning would only apply in the summer months. Based on this real time metering, we are able to determine the billed demand for an average monthly bill. The peak load occurs during the 60-minute period beginning at 2:00 PM.



- During the four summer months, the maximum load during a consecutive 60-minute period is 500 kw (110 + 10 + 100 + 10 + 110 + 10 + 140 + 10). Thus, your billed demand is 500 kw.
- For the remaining eight months of the year, the maximum load was 460 kw (excluding the consumption for air conditioning).

Let's assume that the power factor hovered close to 100% most of the time, but dropped as low as 85% during one or two 15-minute intervals during each month. Assume also that the utility for the original site has no power factor charges.

The annual electric costs at this original site, based on 1.8 million kwh per year, were \$214,800. This works out to an average cost per kwh of 11.93¢. (See Table 1 below.)

Table 1 (Original Site)	Summer Months	Winter Months	Annual Total	Percent
Number of months	4	8	12	
Customer charge	\$100	\$100	\$1,200	0.6%
Consumption charge	150,000 x 6¢ = \$9,000	150,000 x 5¢ = \$7,500	\$96,000	44.7%
Demand charge	500 x \$22 = \$11,000	460 x \$20 = \$9,200	<u>\$117,600</u>	54.7%
Total cost			\$214,800	

Demand Interval

If the utility used a 30-minute peak demand interval instead of a 60-minute window, how would the bill change?

With this smaller demand window, the utility would capture the highest kilowatt-hour consumption over a 30-minute period and double it. Based on the real time meter reading shown in the graph above, the peak load occurs during the 30-minute period beginning at 2:30 PM.

- The billed demand in the summer would be 540 kw (2 x 270).
- In the winter, the billed demand would be 500 kw (2 x 250).

With the change in the demand interval, the annual electric costs climb to \$224,920 (a 4.7% increase over the costs with a 60-minute demand window). This works out to an average cost per kwh of 12.50¢. (See Table 2 below.)

Table 2 (30-Minute Interval)	Summer Months	Winter Months	Annual Total	Percent
Number of months	4	8	12	
Customer charge	\$100	\$100	\$1,200	0.5%
Consumption charge	150,000 x 6¢ = \$9,000	150,000 x 5¢ = \$7,500	\$96,000	42.7%
Demand charge	540 x \$22 = \$11,880	500 x \$20 = \$10,000	<u>\$127,520</u>	56.7%
Total cost	\$20,980	\$17,600	\$224,920	

What if the utility used a 15-minute demand interval? How would the bill change?

With this smaller demand window, the utility would capture this highest kilowatt-hour consumption over a 15-minute period and quadruple it. Based on the real time meter reading shown in the graph above, the peak load occurs during the 15-minute period beginning at 2:45 PM.

- The billed demand in the summer months would be 600 kw (4 x 150).
- In the winter, the billed demand would be 560 kw (4 x 140).

The annual electric costs climb to \$239,600 (an 11.5% increase over the costs at the original site). This works out to an average cost per kwh of 13.31¢. (See Table 3.)

Table 3 (15-Minute Interval)	Summer Months	Winter Months	Annual Total	Percent
Number of months	4	8	12	
Customer charge	\$100	\$100	\$1,200	0.5%
Consumption charge	150,000 x 6¢ = \$9,000	150,000 x 5¢ = \$7,500	\$96,000	40.1%
Demand charge	600 x \$22 = \$13,200	560 x \$20 = \$11,200	<u>\$142,400</u>	59.4%
Total cost	\$22,300	\$18,800	\$239,600	

Ratchet Clause

What if, in addition to the 15-minute peak demand window, the utility has a ratchet clause on demand requiring the use of the highest peak demand in the last 12 months? How would the bill change?

The winter months' peak demand would have to be increased from 560 kw to the 600 kw recorded over the summer months. The annual electric costs climb to \$246,000 (a 14.5% increase over the costs at the original site). This works out to an average cost per kwh of 13.66¢. (See Table 4 below.)

Table 4 (15-Minute Interval with Ratchet Clause)	Summer Months	Winter Months	Annual Total	Percent
Number of months	4	8	12	
Customer charge	\$100	\$100	\$1,200	0.5%
Consumption charge	150,000 x 6¢ = \$9,000	150,000 x 5¢ = \$7,500	\$96,000	39.0%
Demand charge	600 x \$22 = \$13,200	600 x \$20 = \$12,000	<u>\$148,800</u>	60.5%
Total cost	\$22,300	\$19,600	\$246,000	

Power Factor

What if, in addition to the 15-minute peak demand window and ratchet clause, this particular utility measured demand on kva? How would the bill change?

To bill on kva, the utility would divide the billed demand in kw by the power factor that occurred during the highest demand period. In this case, the power factor was 85%. The billed demand would increase from 600 kw to 706 kva. The annual electric costs would climb to \$272,288 (a 26.8% increase over the costs at the original site). This works out to an average cost per kwh of 15.13¢. (See Table 5 below.)

Table 5 (15-Minute Interval, Ratchet Clause & KVA)	Summer Months	Winter Months	Annual Total	Percent
Number of months	4	8	12	
Customer charge	\$100	\$100	\$1,200	0.4%
Consumption charge	150,000 x 6¢ = \$9,000	150,000 x 5¢ = \$7,500	\$96,000	35.3%
Demand charge	706 x \$22 = \$15,532	706 x \$20 = \$14,120	<u>\$175,088</u>	64.3%
Total cost	\$24,632	\$21,750	\$272,288	

Conclusion

In these examples, we can see that subtle changes in how the demand charges are determined resulted in significant changes in the electric costs. When comparing electric rates from one utility to another, you must be keenly aware of the impact individual rate design structures can have on overall electric costs.

Survey Data

Each year, regional and national electric studies are released attempting to compare the competitiveness of electric rates in cities throughout the United States. A popular annual survey¹ compares rates across 105 U.S cities for residential, commercial and small industrial rate schedules. Residential rate apple-to-apple comparisons are typically straight forward and relatively accurate because the rates are based on actual consumption in kilowatt-hours (kwh). However, great care has to be taken with commercial and industrial comparisons from one utility to the next. Demand charges are frequently the largest component of the electric bill and yet the actual calculations for peak demand can drastically vary from one utility to the next.

We have researched how 187 different utilities in major cities across the United States bill for demand. The results for large commercial and industrial rates are summarized in the table below.

Basis for Demand Charges	Number of Utilities	% of Utilities
Demand window:		
• 15 minutes	119	64%
• 30 minutes	49	26%
• 60 minutes	19	10%
Basic billed demand:		
• Kilowatts (kw)	159	85%
• Apparent power (kva)	23	12%
• None	5	3%
Additional demand charge for power factor below a set level	134	72%
Ratchet clauses	102	55%
Time of year:		
• No seasonal variability	136	73%
• Seasonal rates	51	27%

¹ Lincoln Electric System, National Electric Rate Survey, Ranking of Typical Residential, Commercial and Industrial Electric Bills, January 1, 2006. www.csu.org/customer/rates/11923.pdf

National Utility Comparisons

The tables on the following pages show the demand provisions by utility for 187 utilities in major cities across the United States. Also shown, from the Lincoln Electric System Survey and other sources, are the estimated electric costs for a commercial customer consuming 150,000 kwh per month with peak demand of 150 kw (i.e., a 42% load factor). However, these costs do not reflect the relative value of the various approaches to demand charges. Thus, we have adjusted these costs, using the adjustment factors documented in the Assumptions section of this report, for the effect on costs of the various demand provisions.

State	City	Name of Utility / (M) = Municipal, (I) = Investor-Owned	Demand Window Minutes 1a	Special Demand Charges 1b	If Ratchet @yy% 1c	Ratchet Capture Period in Months 1d	Demand billed in KVA 2a	Power Factor Charges Below xx% 2b	Seasonal Rates: # of Summer Months	Cost for 500kW 150,000 kWh	Adjustment	Adjusted Cost for 500kW 150,000 kWh
1	Alabama	Birmingham (I,W)	15		90.0%	12	KWD	90.0%	0	\$13,226	13.00%	\$14,945
2	Alabama	Huntsville (M,A)	60		Not listed		KWD		0	\$11,467	-6.00%	\$10,779
3	Alabama	Mobile (I,W)	15		90.0%	12	KWD	90.0%	0	\$13,226	13.00%	\$14,945
4	Alaska	Anchorage (M,W)	15		80.0%	12	KWD		0	\$13,865	10.00%	\$15,252
5	Alaska	Anchorage (Rural)	15		Not listed		KWD	90.0%	0		6.00%	
6	Alaska	Fairbanks (I,W)	60		Not listed		KWD		0		-6.00%	
7	Arizona	Mesa (M,W)	15		Not listed		KWD	85.0%	0	\$10,125	5.50%	\$10,682
8	Arizona	Phoenix (I,W)	15		80.0%	6	KWD		0	\$16,123	8.00%	\$17,413
9	Arizona	Tucson (I,W)	15		50.0%	12	KWD		6	\$13,021	11.50%	\$14,518
10	Arkansas	Benton (I)	15		65.0%	11	KWD		0		8.50%	
11	Arkansas	Little Rock (I,W)	15		100.0%	12	KWD	90.0%	0	\$9,611	14.00%	\$10,957
12	California	Los Angeles (M,A)	15		Not listed		KWD		0	\$14,672	4.00%	\$15,259
13	California	Palto Alto (M)	15		Not listed		KWD	95.0%	0	\$17,287	6.50%	\$18,411
14	California	Sacramento (M)	60		Not listed		KWD	95.0%	4	\$17,287	-1.50%	\$17,028
15	California	San Bernardino (I)	15	5	50.0%	12	KWD		0	\$27,590	10.75%	\$30,556
16	California	San Diego (I,W)	15		50.0%	12	KWD		5	\$27,431	11.00%	\$30,448
17	California	San Francisco (I,W)	15		Not listed		KVA	85.0%	6	\$17,287	10.50%	\$19,102
18	Colorado	Colorado Springs (M,A)	15		75.0%	12	KWD	95.0%	6	\$9,598	14.50%	\$10,990
19	Colorado	Denver (I,A)	15		Not listed		KWD		4	\$12,670	6.00%	\$13,430
20	Colorado	Pueblo (I,A)	15		100.0%	12	KWD	95.0%	0	\$12,483	14.75%	\$14,324

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21	Connecticut	Bridgeport (I,W)	15		80.0%	12	KVA	100.0%	4	\$18,336	17.00%	\$21,453
22	Connecticut	New Haven (I,W)	15		80.0%	12	KVA	100.0%	4	\$18,336	17.00%	\$21,453
23	Connecticut	Waterbury (I,A)	30		Not listed		KWD	97.0%	0	\$19,133	1.50%	\$19,420
24	Delaware	Dover (M)	60		Not listed		KWD		0	\$10,707	-6.00%	\$10,065
25	Delaware	Wilmington (I,W)	60		Not listed		KWD		4	\$10,707	-4.00%	\$10,279
26	District of Columbia	Washington, DC (I,W)	30		Not listed		KWD		5	\$15,625	1.50%	\$15,859
27	Florida	Jacksonville (M,A)	15		Not listed		KWD	90.0%	0	\$12,498	6.00%	\$13,248
28	Florida	Key West (M)	15		90.0%	12	KWD	85.0%	0		12.50%	
29	Florida	Miami (I,A)	30		100.0%	24	KWD		0	\$15,707	8.00%	\$16,964
30	Florida	Sebring (I)	15		80.0%	12	KWD	85.0%	4		13.50%	
31	Florida	Tallahassee (M)	60		Not listed		KWD		0		-6.00%	
32	Florida	Tampa (I,A)	30		Not listed		KWD	85.0%	0	\$14,118	0.50%	\$14,189
33	Georgia	Atlanta (I,W)	30		95.0%	4	KWD	95.0%	0	\$11,747	6.00%	\$12,452
34	Georgia	Columbus (I,W)	30		95.0%	4	KWD	95.0%	0	\$11,747	6.00%	\$12,452
35	Georgia	Savannah (I,W)	30		70.0%	4	KWD		4	\$15,354	3.50%	\$15,891
36	Hawaii	Honolulu (I,A)	60		Not listed		¢/KWH		0	\$23,160	-4.00%	\$22,234
37	Hawaii	Lanai Island (I)	60		Not listed		¢/KWH		0	\$48,690	-4.00%	\$46,742
38	Hawaii	Maui Island (I)	60		Not listed		¢/KWH		0	\$36,375	-4.00%	\$34,920
39	Hawaii	Motolai Island (I)	60		Not listed		¢/KWH		0	\$45,165	-4.00%	\$43,358
40	Hawaii	Oahu (I)	60		Not listed		¢/KWH		0	\$37,440	-4.00%	\$35,942
41	Idaho	Boise (I,W)	15		Not listed		KWD	90.0%	0	\$6,793	6.00%	\$7,201
42	Idaho	Coeur d'Alene (I,W)	15		100.0%		KWD	90.0%	0	\$9,300	10.00%	\$10,230
43	Illinois	Chicago (I,W)	30		Not listed		KWD		0	\$11,859	-1.00%	\$11,740
44	Illinois	Decatur (I)	15		90.0%	4	KWD	90.0%	4		12.50%	
45	Illinois	Pawnee (I)	60		Not listed		KWD		4		-4.00%	

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46	Illinois	Peoria (I)	15		90.0%	4	KWD	90.0%	4		12.50%	
47	Illinois	Rockford (I,W)	30		Not listed		KWD		0	\$11,859	-1.00%	\$11,740
48	Illinois	Springfield (M,W)	15		Not listed		KWD		5	\$11,733	6.50%	\$12,496
49	Illinois	Unlisted (I)	15		Not listed		KWD	89.4%	4		7.75%	
50	Indiana	Evansville (I,W)	15		90.0%	12	KVA	100.0%	0	\$10,451	16.00%	\$12,123
51	Indiana	Gary (I,A)	30		50.0%		KWD	80.0%	0	\$14,298	0.50%	\$14,369
52	Indiana	Indianapolis (I,A)	15		60.0%	11	KWD	85.0%	0	\$10,344	10.00%	\$11,378
53	Iowa	Cedar Rapids (I,W)	15		75.0%	4	KWD	85.0%	0	\$9,380	8.00%	\$10,130
54	Iowa	Davenport (I,W)	15		100.0%	12	KWD	89.4%	0	\$9,372	13.50%	\$10,637
55	Iowa	Des Moines (I,W)	15		100.0%	12	KWD	89.4%	0	\$7,975	13.50%	\$9,052
56	Kansas	Baxter Springs (I)	15		65.0%	11	KWD		0		8.50%	
57	Kansas	Elkhart (I)	30		60.0%	11	KWD	88.4%	0		5.25%	
58	Kansas	Kansas City (M,W)	30		100.0%	12	KWD		0	\$10,250	7.00%	\$10,968
59	Kansas	Overland Park (I,W)	30		100.0%	11	KWD	85.0%	0	\$8,676	8.25%	\$9,392
60	Kansas	Unlisted (I)	15		100.0%	12	KWD	85.0%	0		13.50%	
61	Kansas	Wichita (I,W)	15		85.0%	4	KWD	90.0%	4	\$9,695	11.50%	\$10,810
62	Kentucky	Lexington (I,A)	15		60.0%	12	KWD	90.0%	0	\$7,719	10.75%	\$8,549
63	Kentucky	Louisville (I,W)	15		50.0%	12	KVA	80.0%	0	\$9,080	11.50%	\$10,124
64	Kentucky	Paducah (M)	60		Not listed		KWD		0	\$12,923	-6.00%	\$12,147
65	Kentucky	Walton (I)	15		85.0%	12	KWD	90.0%	0		12.00%	
66	Louisiana	Baton Rouge (I,W)	15		70.0%	12	KWD		0	\$17,534	9.00%	\$19,112
67	Louisiana	Bunkie (I)	15		100.0%	4	KWD	90.2%	4		13.50%	
68	Louisiana	Lafayette (I)	15		70.0%	11	KWD	89.0%	0		10.75%	
69	Louisiana	New Orleans (I,W)	15		Not listed		KWD	80.0%	0	\$12,892	5.00%	\$13,537
70	Louisiana	Shreveport (I,W)	15		70.0%	12	KWD	90.0%	0	\$7,706	11.00%	\$8,554
71	Louisiana	Unlisted (I)	15		Not listed		KWD	90.0%	0		6.99%	
72	Maine	Bangor (I,A)	15		75.0%	4	KWD		4		9.00%	
73	Maine	Skowhegan(I,A)	15		Not listed		KWD	90.0%	5		8.50%	
74	Maine	Portland (I,A)	15		Not listed		KWD		3	\$21,709	5.50%	\$22,903
75	Maryland	Baltimore (I,W)	30		Not listed		KWD		4	\$11,618	1.00%	\$11,734

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76	Maryland	Georgetown (I)	60		Not listed		KWD	90.0%	4		-2.00%	
77	Maryland	Knoxville (I)	30		Not listed		KWD	85.0%	4		2.75%	
78	Maryland	Unlisted (I)	30		Not listed		KWD	85.0%	0		0.50%	
79	Maryland	Washington D.C. (I)	30		Not listed		KWD	85.0%	4		2.50%	
80	Massachusetts	Boston (I,W)	15		Not listed		KWD	90.0%	0	\$35,684	6.00%	\$37,825
81	Massachusetts	Brockton (I)	15		90.0%	12	KVA	100.0%	0		16.00%	
82	Massachusetts	Cambridge (I,W)	15		60.0%	12	KVA	100.0%	0	\$34,193	13.75%	\$38,895
83	Massachusetts	Springfield (I,A)	30		Not listed		KWD	97.0%	0	\$30,924	1.50%	\$31,388
84	Michigan	Detroit (I,W)	15		65.0%	4	KWD		4	\$13,116	8.25%	\$14,198
85	Michigan	Grand Rapids (I,W)	15		100.0%	12	KWD	80.0%	0	\$9,819	13.00%	\$11,095
86	Michigan	Lansing (M,W)	15		Not listed		KWD		0	\$10,332	4.00%	\$10,745
87	Minnesota	Duluth (I,W)	15		100.0%		KWD	85.0%	0	\$9,187	9.50%	\$10,060
88	Minnesota	Minneapolis (I,W)	15		50.0%		KWD	90.0%	0	\$11,641	6.50%	\$12,398
89	Minnesota	Saint Paul (I,W)	15		50.0%		KWD	90.0%	0	\$11,641	6.50%	\$12,398
90	Minnesota	Unlisted (I)	15		Not listed		KWD	89.4%	4		8.00%	
91	Mississippi	Biloxi (I)	15		75.0%	6	KVA	100.0%	6		15.00%	
92	Mississippi	Jackson (I,W)	15		80.0%	12	KWD	85.0%	0	\$17,859	11.75%	\$19,957
93	Missouri	Bigelo (I)	15		80.0%	12	KWD	89.2%	0		11.50%	
94	Missouri	Joplin (I)	15		65.0%	11	KWD		4		10.50%	
95	Missouri	Kansas City (I,W)	30		100.0%	12	KWD	85.0%	0	\$8,342	8.50%	\$9,051
96	Missouri	Saint Louis (I,W)	15		90.0%	12	KWD	90.0%	0	\$6,796	13.00%	\$7,679
97	Missouri	Springfield (M,W)	30		90.0%	3	KWD	85.0%	0	\$8,105	4.50%	\$8,470
98	Montana	Billings (I,A)	15		Not listed		KWD	90.0%	0	\$12,111	6.00%	\$12,838
99	Montana	Bismarck (I,A)	15		100.0%	3	KWD	95.0%	3	\$12,005	13.99%	\$13,684
100	Nebraska	Battle Creek (I)	60		Not listed		KWD	90.0%	0	\$9,392	-4.00%	\$9,016
101	Nebraska	Lincoln (M,W)	30		100.0%	4	KWD	93.0%	0	\$9,530	6.50%	\$10,149
102	Nebraska	Omaha (M,W)	15		85.0%	4	KWD	85.0%	0	\$8,051	9.00%	\$8,776
103	Nevada	Las Vegas (I,A)	15		100.0%	12	KWD		0	\$16,611	12.00%	\$18,605
104	Nevada	Reno (I,A)	15		Not listed		KWD	90.0%	4	\$15,163	8.00%	\$16,376
105	New Hampshire	Manchester (I,A)	30		Not listed		KWD	80.0%	0	\$19,487	0.00%	\$19,487

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106	New Jersey	Atlantic City (I)	15		80.0%	4	KVA	100.0%	4		14.50%	
107	New Jersey	Jersey Central Power & Light (I)	15		Not listed		KWD		0		4.25%	
108	New Jersey	Public Service Electric & Gas Company (I)	30		Not listed		KWD		4	\$13,159	1.00%	\$13,291
109	New Jersey	Public Service Electric & Gas Company (I)	30		Not listed		KWD		4	\$13,159	1.00%	\$13,291
110	New Mexico	Public Service Company of New Mexico (I)	15		50.0%		KWD	90.0%	0	\$10,466	6.50%	\$11,146
111	New Mexico	Southwestern Public Service Company (I)	30		60.0%	11	KWD	88.4%	0	\$10,350	5.25%	\$10,893
112	New Mexico	El Paso Electric Company (I)	30		65.0%	6	KWD	90.0%	0	\$15,998	3.75%	\$16,598
113	New York	New York State Electric & Gas Corporation (I)	15		75.0%	12	KWD	85.0%	0		10.50%	
114	New York	Niagara Mohawk Power Corporation (I)	15		50.0%	12	KWD	75.0%	0	\$25,066	9.50%	\$27,447
115	New York	Long Island Public Authority (I)	15		85.0%	4	KWD		0	\$26,406	7.50%	\$28,386
116	New York	Consolidated Edison Company of New York (I)	60		Not listed		KWD		4	\$33,539	-4.00%	\$32,197
117	New York	Rochester Gas & Electric (M)	30		100.0%	12	KWD	90.2%	4		11.00%	
118	New York	Pennsylvania Electric Company (I)	15		50.0%		KVA	100.0%	0		9.75%	
119	North Carolina	Duke Electric (I)	30		50.0%		KWD	85.0%	0	\$9,522	1.00%	\$9,617
120	North Carolina	Duke Electric (I)	30		50.0%		KWD	85.0%	0	\$9,522	1.00%	\$9,617
121	North Carolina	Progress Energy Carolinas (I)	15		80.0%	4	KWD	85.0%	4	\$10,650	11.00%	\$11,822
122	North Carolina	Duke Electric (I)	30		50.0%		KWD	85.0%	0	\$9,522	1.00%	\$9,617
123	North Dakota	Northern States Power Company (I)	15		50.0%		KWD	90.0%	0	\$10,894	6.50%	\$11,602
124	North Dakota	Otter Trail Power (North Dakota)	15		Not listed		KWD	92.8%	0	\$10,631	6.00%	\$11,269
125	North Dakota	Montana-Dakota Utilities Company	15		100.0%	3	KWD	95.0%	3	\$10,882	13.99%	\$12,404
126	Ohio	Ohio Edison (I)	30		30.0%		KVA	100.0%	0	\$15,519	4.25%	\$16,179
127	Ohio	Ohio Power Rate Area (I)	30		65.0%		KWD	88.5%	0	\$9,703	1.25%	\$9,824
128	Ohio	Cincinnati Gas & Electric Company (I)	15		85.0%	4	KWD	90.0%	0	\$14,990	9.50%	\$16,414
129	Ohio	Cleveland Electric Illuminating Company (I)	30		30.0%		KWD		0	\$16,418	-0.50%	\$16,336
130	Ohio	Cleveland Public Power (M)	30		40.0%		KWD		0	\$14,610	-0.65%	\$14,515
131	Ohio	Columbus Southern Power Rate Area (I)	30		65.0%		KWD	88.5%	0	\$12,561	1.25%	\$12,718
132	Ohio	Dayton Power & Light (I)	30		75.0%	6	KWD	90.0%	0	\$12,306	4.00%	\$12,798
133	Ohio	Toledo Edison (I)	15		30.0%		KWD		0	\$17,985	4.25%	\$18,749

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134	Oklahoma	Delmark (I)	15		65.0%	11	KWD		0		8.50%	
135	Oklahoma	Oklahoma City (I,W)	15		25.0%		KWD	80.0%	0	\$11,386	5.25%	\$11,984
136	Oklahoma	Tulsa (I,W)	60		90.0%	11	KWD	85.0%	0	\$12,144	2.25%	\$12,417
137	Oklahoma	Unlisted (I)	30		60.0%	11	KWD	88.4%	0		5.25%	
138	Oregon	Albany (I)	15		Not listed		KWD		6	\$8,715	7.00%	\$9,325
139	Oregon	Eugene (M,W)	15		Not listed		KWD		0	\$8,720	4.25%	\$9,091
140	Oregon	Portland (I,A)	30		Not listed		KWD		0	\$10,464	-0.50%	\$10,412
141	Pennsylvania	Allentown (I)	15		Not listed		KWD		0		4.00%	
142	Pennsylvania	Erie (I,W)	15		Not listed		KVA	100.0%	0	\$15,570	9.00%	\$16,971
143	Pennsylvania	Johnstown (I)	15		50.0%	11	KVA	100.0%	0	\$15,570	13.25%	\$17,633
144	Pennsylvania	Milford (I)	15		50.0%	11	KWD	90.0%	6		13.25%	
145	Pennsylvania	New Castle (I)	15		Not listed		KVA	100.0%	0	\$15,570	9.00%	\$16,971
146	Pennsylvania	Philadelphia (I,W)	60		80.0%	4	KVA	100.0%	4	\$18,516	4.50%	\$19,349
147	Pennsylvania	Pittsburgh (I,A)	15		70.0%	6	KWD	85.0%	6	\$12,068	11.50%	\$13,456
148	Pennsylvania	Reading (I)	15		50.0%	11	KVA	100.0%	0		13.25%	
149	Pennsylvania	Unlisted (I)	15	5	Not listed		KWD	94.4%	0		8.00%	
150	Rhode Island	Pawtucket (I,A)	15		80.0%	12	KWD	90.0%	0	\$20,411	12.00%	\$22,860
151	South Carolina	Columbia (I,W)	15		80.0%	4	KWD	80.0%	4	\$13,307	10.50%	\$14,704
152	South Carolina	Portions of (I)	30		80.0%		KWD		0		1.00%	
153	South Dakota	Not listed (I)	15		Not listed		KWD	90.2%	0	\$9,987	6.00%	\$10,587
154	South Dakota	Rapid City (I)	15		80.0%	11	KVA	100.0%	0	\$10,028	14.75%	\$11,507
155	South Dakota	Sioux Falls (I,W)	15		50.0%		KWD	90.0%	0	\$11,605	6.50%	\$12,359
156	Tennessee	Knoxville (M,A)	30		100.0%	12	KWD	100.0%	0	\$11,503	10.00%	\$12,653
157	Tennessee	Memphis (M,A)	30		100.0%	12	KWD	95.0%	0	\$11,508	10.49%	\$12,715
158	Tennessee	Nashville (M,A)	30		30.0%		KWD	85.0%	0	\$12,097	0.75%	\$12,188
159	Texas	Austin (M,W)	15		Not listed		KWD	85.0%	6	\$14,476	8.50%	\$15,706
160	Texas	Dallas (I,W)	15		80.0%	6	KVA	100.0%	6	\$19,947	16.00%	\$23,139
161	Texas	El Paso (I,W)	30		75.0%	6	KWD	90.0%	0	\$18,169	4.00%	\$18,896
162	Texas	Galveston (I)	15		60.0%	12	KWD	85.0%	0		10.25%	
163	Texas	Houston (I)	15		100.0%	11	KVA	100.0%	0		16.75%	
164	Texas	San Antonio (M)	15		80.0%	4	KWD	80.0%	4		10.50%	
165	Texas	Amarillo (I)	30		60.0%	11	KWD	88.4%	0		5.25%	

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166	Utah	Salt Lake City (I,W)	15		Not listed		KWD	90.0%	0	\$11,568	6.00%	\$12,262
167	Vermont	Burlington (M,W)	15		60.0%	12	KWD	90.0%	0	\$18,638	10.75%	\$20,642
168	Vermont	Montpelier (M)	15		50.0%	11	KWD	100.0%	0		11.25%	
169	Vermont	Rutland (M,W)	15		100.0%	12	KWD	100.0%	0		15.00%	
170	Virginia	Gainesboro (I)	30		75.0%	11	KWD	97.0%	0		6.50%	
171	Virginia	Norfolk (I,W)	30		75.0%	4	KWD	85.0%	4	\$9,860	5.00%	\$10,353
172	Virginia	Richmond (I,W)	30		75.0%	4	KWD	85.0%	4	\$9,860	5.00%	\$10,353
173	Virginia	Roanoke (I,A)	30		50.0%		KWD	88.5%	0	\$8,017	1.00%	\$8,097
174	Washington	Bellevue(I)	15		100.0%	6	KWD	100.0%	6	\$11,461	16.00%	\$13,294
175	Washington	Seattle (M,W)	60		50.0%		KWD	97.0%	0	\$9,020	-3.00%	\$8,749
176	Washington	Spokane (I,A)	15		Not listed		KWD	100.0%	0	\$10,404	7.00%	\$11,132
177	Washington	Tacoma (M,A)	30		Not listed		KVA	100.0%	0	\$7,820	4.00%	\$8,133
178	West Virginia	Johnsontown (I)	15	1	100.0%	12	KVA	100.0%	0		21.00%	
179	West Virginia	Northern Parts (I)	15	5	70.0%	12	KVA	100.0%	0		16.00%	
180	West Virginia	Wheeling (I,A)	15		60.0%	12	KWD	89.4%	0	\$7,723	10.25%	\$8,515
181	Wisconsin	Green Bay (I)	15		50.0%	11	KWD	80.0%	0		9.25%	
182	Wisconsin	Madison (I,W)	15		100.0%	11	KWD		0	\$13,818	11.75%	\$15,442
183	Wisconsin	Milwaukee (I)	15		100.0%	12	KWD	85.0%	0		13.50%	
184	Wisconsin	Milwaukee (I,W)	15		Not listed		KWD		0	\$13,365	4.50%	\$13,966
185	Wisconsin	Unlisted (I)	15		100.0%	11	KWD		4		13.75%	
186	Wyoming	Cheyenne (I,A)	15		Not listed		KWD	90.0%	0	\$14,543	6.00%	\$15,416
187	Wyoming	Newcastle	15		80.0%	11	KVA	100.0%	0	\$10,662	14.75%	\$12,235

Assumptions

In the tables comparing demand provisions by utility, we adjusted the estimated electric costs for a sample commercial customer in order to reflect the effect on costs of various approaches to demand charges. The assumed increase percentages for the various features are added together to get the appropriate adjustment for a particular utility. Our assumptions for these adjustments are documented below.

Demand Interval

The lower the load factor, the more a short demand interval would impact electric costs. Based upon our experience, we assumed, for example, that a business with a load factor between 40% and 50% will have an electric bill increased 5% for a utility with a 15-minute demand window from what it would have been with a 30-minute window. If the utility has a 60-minute window, the electric bill is lowered 5%. A demand window of 30 minutes is assumed to be typical. Our assumed increases or decreases for the impact of demand interval are shown below.

Load factor	15 minutes	30 minutes	60 minutes
20%	7.00%	0.00%	-7.00%
30%	6.00%	0.00%	-6.00%
40%	5.00%	0.00%	-5.00%
50%	4.00%	0.00%	-4.00%
60%	3.00%	0.00%	-3.00%
70%	2.00%	0.00%	-2.00%
80%	1.00%	0.00%	-1.00%
90%	0.25%	0.00%	-0.25%
100%	0.00%	0.00%	0.00%

Some utilities include peak demand clauses to activate a 5-minute or 1-minute demand window in certain circumstances. Our assumed increases for such clauses are:

- 4.00% for a 1-minute interval
 - 2.00% for a 5-minute interval
-

Ratchet Clause

The longer the “capture” period for a ratchet clause, the higher the electric costs are likely to be. If a utility’s ratchet clause only recognizes a percentage of the highest demand in the prior period, the effect is minimized. Our adjustment assumptions for ratchet clauses are shown below.

Capture Period in Months	Adjustment	Ratchet Level %	Adjustment
0	0.00%	None	0.00%
3	1.00%	10%	0.25%
4	1.50%	50%	0.50%
6	2.00%	60%	0.75%
11	3.75%	70%	1.00%
12	4.00%	80%	20..%
24	5.00%	90%	3.00%
36	6.00%	100%	4.00%

Power Factor

If a utility reflects power factor by billing demand in kva, we adjust the bill upwards 1%. If the utility tracks demand in kilowatts (kwd), we lower the bill 1%. The neutral position is no demand charges.

Some utilities initially bill in kwd but switch to kva if power factor drops below a specified level. Some utilities reflect power factor with a charge for reactive power measured in reactive kilovolt amperes (rkva). Our adjustment assumptions for power factor charges are shown below.

Switch to Kva if power factor less than %	adjustment	Charge per RKVA	adjustment
None	0.00%	\$0.00	0.00%
75%	0.50%	\$0.10	0.10%
80%	1.00%	\$0.25	0.25%
85%	1.50%	\$0.50	0.50%
90%	2.00%	\$0.99	0.99%
95%	2.50%	\$1.49	1.49%
98%	3.00%	\$2.00	2.00%

Seasonal Rates

Often utilities have both summer and winter rates as opposed to one year-round rate. With national surveys it is difficult to provide accurate weighted averages. For this reason, we adjust the bill upwards 1% to 3% depending upon the number of more expensive months provided by the rate schedule, as shown below.

Number of summer months	Adjustment
0	0.00%
3	1.00%
4	2.00%
5	2.50%
6	3.00%

Glossary of Terms

Apparent Power: The kilovolt amperes of electricity that the utility supplies. It is the sum of the real power and the reactive power.

Billed Demand: The demand level which a utility uses to calculate the demand charges on the current month's bill. If the rate schedule includes a ratchet clause, the billed demand may or may not be the actual peak demand for the current billing period.

Commercial: Service-providing facilities, such as governments, religious organizations and retail businesses.

Consumption Charge: The charge which utilities apply for the actual electricity used, measured in kilowatt-hours.

Customer Charge: The monthly service fee that all customers are charged whether or not any electricity is used.

Demand Charge: The charge which utilities apply to take into account the time-varying nature of customer loads. These fees allow the utility to recover its investment in the equipment which must be available to satisfy the customer's maximum load requirements.

Demand Interval: The utility-specified interval over which the peak demand is determined for purposes of calculating demand charges. Typical demand intervals are 15, 30 or 60 minutes.

Industrial: Facilities used for producing, processing or assembling goods. For example, activities would include manufacturing, agriculture, mining, and construction.

Kilowatt-hour: A kilowatt-hour is a measure of electricity equal to 1,000 watts in one hour.

Load Factor: A measure of scheduling efficiency equal to the ratio of kilowatt-hours used per hour in the billing period to the peak demand. As you spread your electric usage more evenly across the month, the load factor approaches 100%. Demand charges are inversely related to load factor.

Peak Demand: The highest average load over a utility specified time interval during the billing period.

Power Factor: The ratio of real power to apparent power. Power factor is a measure of how effectively your equipment is converting electric current from the generation station to useful power output. As your power factor approaches 100%, less current must pass through the wiring to operate the equipment.

Ratchet Clause: A clause in the rate schedule which states that the billed demand may be based on the current month's peak demand or on historical peak demand, depending upon the relative size.

Rate Schedule: A series of calculations to determine the monthly electric bill. Utilities have different rate schedules for different customer types. For example, there are rate schedules that are only available to residential customers. Other rate schedules might have requirements related to the amount of electricity used, or the type of operation.

Reactive Power: The component of apparent power which does no real work in a system. It is measured in reactive kilovolt-amperes (rkva). As reactive power increases, the power factor decreases.

Real Power: The component of apparent power that represents the real work. It is measured in kilowatts and equals the apparent power times the power factor.

Residential: Living quarters for private households.

About Brakey Consulting

Brakey Consulting, Inc. is an Ohio-based company providing energy consulting services to about 40 industrial and commercial businesses with facilities in over 100 locations in the greater Cleveland, Akron, Toledo and Youngstown areas. Brakey Consulting fills a void for companies who do not have an energy manager on staff. Our services include:

- Helping companies identify electric cost saving opportunities, such as improving power factor or scheduling efficiency, or switching rate schedules
- Using gas marketers to implement hedging strategies for the purchase of natural gas
- Sponsoring an association, known as MICA, for whom Brakey Consulting proactively keeps up to date on energy suppliers and energy prices
- Representing MICA members at meetings of the Industrial Energy Users – Ohio (IEU), an energy lobbying group based in Columbus, Ohio
- Working closely with our sister company, EnergyManager.com, to provide on-line electric bill audits and analysis

Michael Brakey, President and founder of Brakey Consulting, has energy-related experience in the manufacturing setting. Immediately before starting Brakey Consulting in 1999, Mike held various posts over a 22-year career at Johnson Rubber Company in Middlefield, Ohio. His accomplishments there included the implementation of manufacturing strategies that led to energy cost reductions in excess of \$20 million. Mike has a B.S. in engineering physics from the University of Maine and an E.M.B.A. from Baldwin-Wallace College.

Lucinda Brakey, Vice President, joined the firm in January 2005. Prior to that, Cindy had a 20-year career as a consulting actuary for Towers Perrin in Cleveland, Ohio. Cindy also serves as vice president of EnergyManager.com. She has a B.A. in mathematics from the University of Maine and an M.A. in actuarial mathematics from the University of Michigan.

Matthew Brakey, Vice President, joined the firm in June 2004. Matt is also president of EnergyManger.com. He has a B.A. in political science from Miami University.