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Title

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ABSTRACT

Ensuring reliability has and will continue to be a priority for electricity industry restructuring. Assessing the balance between public and private actions to ensure reliability should be guided in part by an understanding of the value of reliability to the nations' residential, commercial and industrial customers. Yet, there is no comprehensive body of information on this topic. This paper begins to address this information gap by analyzing studies conducted by electric utilities over the past 15 years to assess the value of electric service to their customers. Outage cost measurements prepared by 7 electric utilities through 20 studies are assembled and standardized into a national database of customer interruption costs. The database is used to describe trends in interruption costs, and regional (geographic) differences, differences in interruption costs by customer type. It can also be used to estimate customer damage functions.. Results from the study are intended to contribute to an improved understanding of the importance of electricity reliability to the nation.

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[1] Ms. Kaarsberg is currently staff to the Energy Subcommittee of the Committee on Science, U.S. House of Representatives.

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INTRODUCTION

Ensuring reliability has and will continue to be a priority for electricity industry restructuring. Given that efforts to restructure wholesale and retail markets to date have not been very successful, carefully designed public policies that reestablish electric system security and reliability and encourage cost-effective reductions in demand and consumption are clearly needed. We submit that a critical consideration – often missing from current discussions – should be the economic consequences of electric service unreliability.

That is, assessing the balance between public and private actions to ensure reliability should be guided in part by an understanding of the value of reliability to the nations' residential, commercial and industrial customers. Common sense and a considerable amount of empirical evidence indicate that electric utility customers incur substantial economic costs as a result of electric service reliability problems. It is appropriate to consider these costs are in assessing future restructuring policies, including the design and operation of wholesale electricity markets, the creation of incentives, tariffs, or programs to encourage investment in electricity generation, transmission, and distribution, including demand response.

Yet, there is no comprehensive body of information on this topic. A recent review of the available literature on the cost of reliability and power quality concluded (Eto, et al 2001):

- There are few estimates of the aggregate cost of unreliable power to the U.S. economy; and the estimates that are available are undocumented or based on questionable assumptions;

- Costs of large-scale outage events (e.g., State or region wide power outages) are not well documented and mostly based on natural disasters for which it difficult to separate costs of electric interruptions from damages caused by other disaster features (e.g., property damage from wind or water);

- Studies of hypothetical outages obtained from outage cost surveys could be used to prepare aggregate estimates of outage costs. However, there are important differences in the survey and statistical methodologies used in the studies that have been conducted that must be addressed in a meta-analysis.

- Very little information is available in the public domain regarding the costs of power quality problems – an increasingly important aspect of service reliability.

This paper begins to address this information gap by analyzing studies conducted by electric utilities over the past 15 years to assess the value of electric service to their customers. Most of the studies employed a common survey methodology including sample designs, measurement protocols, survey instruments and operating procedures. This methodology is described in detail in EPRI's *Outage Cost Estimation Guidebook* (Sullivan and Keane 1995). Utilities that used a variant of the approach outlined in the Guidebook include the following:

- Southern Company (1987, 1999)
- Niagra Mohawk (1985)
- Duke Energy Company (1992, 1997)
- Bonneville Power Administration (1987)
- Salt River Project (2000)
- Pacific Gas and Electric Company (1986, 1987, 1989, 1993, 1996)
- Puget Sound Energy (1999)
- Cinergy (1998)
- Southern California Edison Company (1987 and 2000)
- An unnamed Florida utility (1987).

The areas that can be represented by the above utilities include virtually all the Southeast, most of the Western U.S. (including almost all of California, rural Washington and Oregon and the largest metropolitan areas in Arizona and Washington), the Midwest south and east of Chicago and the Northeast (principally rural areas). The time frame covered by the studies ranges from as early as 1985 to as late as 2000. In several major studies (e.g., Southern California Edison, Pacific Gas and Electric and Duke Energy) the same customer classes were surveyed using virtually identical survey instruments at different points in time – sometimes separated by as much as 10 years. There are also studies in which interruption costs of similar customer populations (e.g., residential customers) were observed roughly at the same time using nearly identical measurement protocols for utilities located in different places (e.g., Southern California Edison 2000 v. Salt River Project 2000 v. Puget Sound Energy 1999). In almost all of these cases, detailed demographic and firma-graphic information was collected from study respondents and incorporated into an eventual digital database of results. Many of these studies were documented in a variety of publications: an extensive reference list of outage cost studies, with abstracts, can be found in Eto, et al., 2001.

In addition, several of the above studies specifically focused on measuring the economic costs of power quality disturbances for large commercial and industrial concerns (i.e., Duke Energy, Southern Company, Cinergy and Salt River Project). The studies carried out for Cinergy and Salt River Project collected both direct cost estimates of power quality disturbances and cost estimates using hedonic methods (e.g., Willingness-To-Pay experiments).

The number of studies, span of time and wide geographical scope of the prior research make it an extremely valuable source of information on customer interruption costs arising from all kinds of reliability problems. By making simple and reasonable assumptions (about the generalizability of existing survey findings to adjacent geographical areas), the results from these studies can be extended to the nation and major national grid regions.

In this paper, outage cost measurements prepared by 7 electric utilities through 21 studies are assembled and standardized into a national database of customer interruption costs. The database is used to describe trends in interruption costs, and regional (geographic) differences, differences in interruption costs by customer type. We also provide a short preview of the customer damage functions that are discussed separately in the complete technical report from this project (Lawton, Eto, Katz, Sullivan 2003).

METHOD

The principle task in preparing the information used in this study was the creation of databases for each of three distinct customer groups: residential, small-medium commercial and industrial, and large commercial and industrial. The process involved:

1. Contacting the utilities that had conducted customer interruption cost (or Value of Service) studies;
2. Negotiating agreement(s) to participate in the study, including agreements not to disclose customer-specific information or present information that could be attributed to an individual firm;
3. Obtaining the data sets, codebooks, and original survey questionnaires;
4. Standardizing each data set in terms of variable selection and construct;
5. Merging the datasets;
6. Normalizing prices to a common base, using the 2002 consumer price index; and
7. Reviewing the data to exclude outliers and other data anomalies.

Altogether, 20 data sets were acquired, standardized, and merged. In Tables 1-3, we present the basic structure of the data set. All variables were standardized to reflect the most common metric (e.g., hours into minutes, or summing up all of the costs and subtracting savings to account for the variations in those calculations).

TABLE 1: DATA VARIABLES RESIDENTIAL

Scenario Specific to Outage Cost Calculations	**Respondent Specific Demographic and Other Descriptor Variables**
Season	Year of survey
Hour of day	Geographic Region
Day of week	Housing type and ownership
Duration	Heat/cooling indices
Warning given	Sick bed or Medical and Medical equipment
Willingness to Pay	Home business
Willingness to receive credit	HH income
Average kW usage	Number of outages in previous 12 months
	Back up generator
	Acceptable Service measures
	Grid area

TABLE 2: DATA VARIABLES – SMALL/MEDIUM C&I

Scenario Specific to Outage Cost Calculations	**Respondent Specific Demographic and Other Descriptor Variables**
Season	Year of survey
Hour of day	Geographic Region
Day of week	SIC
Duration	Heat/cooling indices
Warning given	Number of employees
Outage cost per event	Grid area
Outage cost per kWh	Acceptable service measures
Peak kW demand	Number of outages in previous 12 months
Annual usage	Back up generator

TABLE 3: DATA VARIABLES – LARGE C&I

Scenario Specific to Outage Cost Calculations	**Respondent Specific Demographic and Other Descriptor Variables**
Season	Year of survey
Hour of day	Geographic Region
Day of week	SIC
Duration	Heat/cooling indices
Warning given	Number of employees
Outage cost per event	Grid area
Outage cost per kWh	Acceptable service measures
Peak kW demand	Number of outages in previous 12 months
Annual usage	Back up generator

RESULTS

This section presents summary statistics on the entire data set, starting with findings from the pooled data from the commercial and industrial surveys, followed by pooled data from the residential willingness to pay studies. We also provide a short preview of the customer damage functions that are discussed separately in the complete technical report from this project (Lawton, Eto, Katz, Sullivan 2003).

TABLE 4A: LARGE COMMERCIAL AND INDUSTRIAL OUTAGE COSTS BY REGION – 1 HOUR DURATION

Total Cost/Event					Cost Per Annual kWh			Cost Per Peak kW		
Region	N	Min	Average	Max	Min	Average	Max	Min	Average	Max
All regions	2728	-	59,983.37	5,066,024.76	0.0000	0.0037	0.0201	0.000	15.522	113.843
Northwest	834	-	28,609.22	3,822,931.79	0.0000	0.0066	0.0647	0.000	17.924	138.537
Southwest	190	1.04	51,908.86	1,045,122.26	0.0000	0.0039	0.0043	0.003	21.920	28.724
Southeast	1352	-	86,477.13	5,066,024.76	0.0000	0.0033	0.0201	0.000	14.835	113.843
West	120	-	52,734.75	2,085,161.96	0.0000	0.0073	0.0185	0.000	32.715	93.421
Midwest	232	1.00	28,735.36	1,010,000.00	0.0000	0.0025	0.0049	0.007	11.499	27.911

TABLE 4B: SMALL-MEDIUM COMMERCIAL AND INDUSTRIAL OUTAGE COSTS BY REGION – 1 HOUR DURATION

	Total Cost/Event				Cost Per Annual kWh			Cost Per Peak kW		
Region	N	Min	Average	Max	Min	Average	Max	Min	Average	Max
All regions	10849	0.000	1,859.465	105,224.660	0.0000	0.0155	0.1124	0.000	40.025	169.444
Northwest	3596	0.000	1,686.199	101,161.103	0.0000	0.0111	0.1095	0.000	18.411	162.900
Southwest	3064	0.000	2,175.757	105,224.660	0.0000	0.0283	0.1135	0.000	66.391	207.135
Southeast	3363	0.000	1,484.462	103,139.014	0.0000	0.0133	0.1102	0.000	25.792	199.882
West	411	0.000	4,581.176	85,992.686	0.0000	0.0448	0.0947	0.000	101.787	155.502
Midwest	415	1.000	1,369.007	75,000.000	0.0001	0.0072	0.0825	0.014	4.259	129.758

TABLE 5A: LARGE COMMERCIAL AND INDUSTRIAL OUTAGE COSTS BY DURATION AND YEARS

		Total Cost/Event				Cost Per Annual kWh			Cost Per Peak kW		
	Duration	N	Min	Average	Max	Min	Average	Max	Min	Average	Max
All years	All durations	7865	0.000	70,633.567	5,195,516.812	0.0000	0.0041	0.0206	0.000	19.761	116.753
	< 2 min	1259	0.000	18,840.883	1,175,672.646	0.0000	0.0009	0.0047	0.000	4.619	30.845
	2-20 min	437	0.000	32,093.205	4,775,036.285	0.0000	0.0035	0.0232	0.000	15.456	131.954
	1 hour	3375	0.000	61,949.277	5,066,024.759	0.0000	0.0033	0.0201	0.000	14.982	113.843
	4 hours	2097	0.000	119,715.433	5,195,516.812	0.0000	0.0067	0.0206	0.000	35.206	116.753
	8 hours	568	0.000	88,223.602	4,231,974.922	0.0000	0.0100	0.0206	0.000	44.714	116.947
	More than 8 hrs	129	0.000	58,562.166	1,036,717.063	0.0000	0.0187	0.0891	0.000	0.000	-
Before 1990	All durations	843	0.000	49,190.640	4,775,036.285	0.0000	0.0088	0.0809	0.000	30.818	173.040
	< 2 min					0.0000	0.0000	0.0000	0.000	0.000	-
	2-20 min	212	0.000	46,790.248	4,775,036.285	0.0000	0.0083	0.0809	0.000	29.314	173.040
	1 hour	421	0.000	39,980.756	3,822,931.785	0.0000	0.0071	0.0647	0.000	25.048	138.537
	4 hours					0.0000	0.0000	0.0000	0.000	0.000	-
	8 hours	210	0.000	70,077.518	4,046,444.122	0.0000	0.0125	0.0685	0.000	43.904	146.637
	More than 8 hrs					0.0000	0.0000	0.0000	0.000	0.000	-
1990-1995	All durations	2386	0.000	116,358.802	5,195,516.812	0.0000	0.0034	0.0206	0.000	19.762	116.753
	< 2 min	408	0.000	27,896.015	1,121,793.275	0.0000	0.0009	0.0045	0.000	4.827	29.432
	2-20 min					0.0000	0.0000	0.0000	0.000	0.000	-
	1 hour	1320	0.000	101,952.281	5,066,024.759	0.0000	0.0029	0.0201	0.000	17.251	113.843
	4 hours	658	0.000	200,111.728	5,195,516.812	0.0000	0.0058	0.0206	0.000	33.860	116.753
	8 hours					0.0000	0.0000	0.0000	0.000	0.000	-
	More than 8 hrs					0.0000	0.0000	0.0000	0.000	0.000	-
1996-2000	All durations	3501	0.000	54,983.301	4,702,914.798	0.0000	0.0050	0.0193	0.000	27.613	124.958
	< 2 min	651	0.000	14,977.416	1,175,672.646	0.0000	0.0008	0.0048	0.000	6.325	32.312
	2-20 min					0.0000	0.0000	0.0000	0.000	0.000	-
	1 hour	1402	0.000	36,378.958	3,363,228.700	0.0000	0.0039	0.0138	0.000	15.399	89.362
	4 hours	1202	0.000	89,214.847	4,702,914.798	0.0000	0.0086	0.0193	0.000	51.692	129.254
	8 hours	117	0.000	144,890.380	4,231,974.922	0.0000	0.0199	0.0376	0.000	89.885	189.605
	More than 8 hrs	129	0.000	58,562.166	1,036,717.063	0.0000	0.0187	0.0891	0.000	0.000	-
2001-2002	All durations	1135	1.000	38,710.708	1,710,000.000	0.0000	0.0033	0.0083	0.007	15.491	47.255
	< 2 min	200	1.000	12,944.000	500,000.000	0.0000	0.0011	0.0024	0.007	5.180	13.817
	2-20 min	225	1.000	18,245.324	576,000.000	0.0000	0.0016	0.0028	0.007	7.301	15.917
	1 hour	232	1.000	28,735.358	1,010,000.000	0.0000	0.0025	0.0049	0.007	11.499	27.911
	4 hours	237	1.000	51,196.203	970,000.000	0.0000	0.0044	0.0047	0.007	20.487	26.805
	8 hours	241	1.000	76,525.116	1,710,000.000	0.0000	0.0065	0.0083	0.007	30.623	47.255
	More than 8 hrs					0.0000	0.0000	0.0000	0.000	0.000	-

TABLE 5B: SMALL-MEDIUM COMMERCIAL AND INDUSTRIAL OUTAGE COSTS BY DURATION AND YEARS

			Total Cost/Event			Cost Per Annual kWh			Cost Per Peak kW		
	Duration	N	Min	Average	Max	Min	Average	Max	Min	Average	Max
All years	All durations	23800	0.000	2,734.865	105,224.660	0.0000	0.0218	0.1124	0.000	54.989	169.444
	< 2 min	3209	0.000	893.241	105,224.660	0.0000	0.0074	0.1124	0.000	21.354	182.050
	2-20 min	766	0.000	899.871	75,000.000	0.0000	0.0046	0.0812	0.000	8.553	120.773
	1 hour	11829	0.000	1,901.498	105,224.660	0.0000	0.0159	0.1124	0.000	40.623	169.444
	4 hours	5836	0.000	4,220.441	104,549.634	0.0000	0.0368	0.1117	0.000	91.631	180.882
	8 hours	1319	0.000	7,361.290	104,493.208	0.0000	0.0431	0.1131	0.000	100.105	168.266
	More than 8 hrs	841	0.000	5,590.039	86,393.089	0.0000	0.0408	0.0936	0.000	0.000	-
Before 1990	All durations	1650	0.000	3,190.202	101,161.103	0.0000	0.0154	0.1095	0.000	34.832	162.900
	< 2 min					0.0000	0.0000	0.0000	0.000	0.000	-
	2-20 min	413	0.000	831.116	50,798.258	0.0000	0.0040	0.0550	0.000	9.075	81.801
	1 hour	827	0.000	3,124.343	101,161.103	0.0000	0.0151	0.1095	0.000	34.113	162.900
	4 hours					0.0000	0.0000	0.0000	0.000	0.000	-
	8 hours	410	0.000	5,699.391	101,161.103	0.0000	0.0276	0.1095	0.000	62.229	162.900
	More than 8 hrs					0.0000	0.0000	0.0000	0.000	0.000	-
1990-1995	All durations	1349	0.000	4,472.232	100,373.599	0.0000	0.0321	0.1083	0.000	79.121	194.522
	< 2 min	10	0.000	18,749.689	93,623.910	0.0000	0.0607	0.1431	0.000	127.203	216.722
	2-20 min					0.0000	0.0000	0.0000	0.000	0.000	-
	1 hour	898	0.000	3,282.512	100,373.599	0.0000	0.0238	0.1083	0.000	58.774	194.522
	4 hours	441	0.000	6,571.086	97,833.554	0.0000	0.0476	0.1055	0.000	117.657	189.600
	8 hours					0.0000	0.0000	0.0000	0.000	0.000	-
	More than 8 hrs					0.0000	0.0000	0.0000	0.000	0.000	-
1996-2000	All durations	18787	0.000	2,590.428	105,224.660	0.0000	0.0242	0.1124	0.000	67.111	182.682
	< 2 min	2944	0.000	862.940	105,224.660	0.0000	0.0081	0.1124	0.000	24.280	207.135
	2-20 min					0.0000	0.0000	0.0000	0.000	0.000	-
	1 hour	9689	0.000	1,691.935	105,224.660	0.0000	0.0159	0.1124	0.000	47.607	190.280
	4 hours	4909	0.000	4,140.113	104,549.634	0.0000	0.0402	0.1117	0.000	96.820	181.510
	8 hours	404	0.000	11,652.692	104,493.208	0.0000	0.1140	0.1150	0.000	258.907	188.957
	More than 8 hrs	841	0.000	5,590.039	86,393.089	0.0000	0.0408	0.0936	0.000	0.000	-
2001-2002	All durations	2014	1.000	2,545.452	100,200.000	0.0001	0.0133	0.1103	0.014	7.919	173.356
	< 2 min	255	1.000	542.816	20,000.000	0.0001	0.0028	0.0220	0.014	1.689	34.602
	2-20 min	353	1.000	980.312	75,000.000	0.0001	0.0051	0.0825	0.014	3.050	129.758
	1 hour	415	1.000	1,369.007	75,000.000	0.0001	0.0072	0.0825	0.014	4.259	129.758
	4 hours	486	1.000	2,898.829	75,000.000	0.0001	0.0151	0.0825	0.014	9.018	129.758
	8 hours	505	1.000	5,277.434	100,200.000	0.0001	0.0276	0.1103	0.014	16.419	173.356
	More than 8 hrs					0.0000	0.0000	0.0000	0.000	0.000	-

TABLE 6A: RESIDENTIAL WILLINGNESS-TO-PAY AND CREDIT BY REGION

		Willingness to Pay			Credit			
Region	N	Min	Average	Max	N	Min	Average	Max
All regions	11200	0.000	6.82	56.05	6308	0.000	10.519	74.720
Northwest	2243	0.000	7.60	43.54	1782	0.000	13.459	72.569
Southwest	4380	0.000	7.02	52.25	0			
Southeast	3903	0.000	7.17	56.05	4526	0.000	9.362	74.720
West	674	0.000	2.26	52.25	0			
Midwest								

TABLE 6B: RESIDENTIAL WILLINGNESS-TO-PAY AND CREDIT BY DURATION AND YEARS

			Willingness to Pay			Credit			
	Duration	N	Min	Average	Max	N	Min	Average	Max
All years	All durations	28042	0.000	6.493	62.696	12615	0.000	10.241	107.991
	< 2 min	4210	0.000	4.383	56.054	2849	0.000	5.074	56.054
	1 hour	14746	0.000	6.642	56.054	6308	0.000	10.519	74.720
	4 hours	7242	0.000	7.155	62.696	2355	0.000	11.788	80.994
	8 hours	1637	0.000	5.155	62.696	972	0.000	14.767	72.569
	More than 8 hrs	207	10.799	26.268	53.996	131	16.199	47.813	107.991
Before 1990	All durations	1927	0.000	3.869	58.055	1928	0.000	10.515	72.569
	< 2 min								
	1 hour	960	0.000	2.461	43.541	956	0.000	6.192	72.569
	4 hours								
	8 hours	967	0.000	5.267	58.055	972	0.000	14.767	72.569
	More than 8 hrs								
1990-1995	All durations	3115	0.013	6.273	62.267	4274	0.000	7.242	74.720
	< 2 min	911	0.013	4.527	37.360	1394	0.000	3.496	49.813
	1 hour	1433	0.062	6.450	49.813	1908	0.000	8.067	74.720
	4 hours	771	0.062	8.008	62.267	972	0.000	10.993	62.267
	8 hours								
	More than 8 hrs								
1996-2000	All durations	23000	0.000	6.743	62.696	6413	0.000	12.157	107.991
	< 2 min	3299	0.000	4.343	56.054	1455	0.000	6.584	56.054
	1 hour	12353	0.000	6.989	56.054	3444	0.000	13.079	56.054
	4 hours	6471	0.000	7.053	62.696	1383	0.000	12.346	80.994
	8 hours	670	0.000	4.993	62.696	0			
	More than 8 hrs	207	10.799	26.268	53.996	131	16.199	47.813	107.991

Commercial and Industrial Outage Costs

In Table 4a, we see that for the large commercial and industrial companies, the average per event cost for all regions, and all studies (standardized into 2002 dollars) is $59,983, with the Southwest reporting the highest per event cost of over $86,000. The highest Cost per annual kWh (and cost per peak kW) is in the western region.

For the small-medium C&I, the West is not only highest for kWh and kW, it's also the highest for average total cost per event, at $4,581, compared to the average for all regions of $1,859. The cost per peak kW and per annual kWh is also noticeably higher for the West.

When comparing the results for C&I over time, we see that in general, cost per event and cost per peak kW have declined. For large C&I, the one hour event cost averaged nearly $47,000 but by the most recent study in 2002, costs had fallen to under $29,000. A similar pattern was exhibited for the small-medium C&I, where costs declined from $3,124 to $1,369. The cost per kWh and cost per peak kW spiked in the 1990-95 time period, but declined subsequently.

Residential Willingness to Pay and Credit Amounts

Willingness-to-Pay results averaged $6.82, with consistency across all regions except the west. The results across time indicate that costs have doubled, from $3.869 before 1990 for a one hour outage to $6.989 in more recent years. This result is consistent with other internal studies. Credit amounts also doubled, from $6.192 before 1990 for a one hour outage, to $13.079. Numerous demographic and socioeconomic changes (e.g., the growth of the elderly population and the increase in computers and other electronics products in the home) may account for some of this change.

Customer Damage Functions

We also include figures to show the pattern of customer damage functions (Goel and Billinton, 1994), as indicated here (in Figures 1-2) cost per event. Note that the costs spike upward in the longest durations for the West and Southeast, instead of turning downward as one might expect as businesses wind down their working day. This result may be due to a feature of multiple manufacturing shifts. Residential outages tend to increase with length of outage as food spoils and inconvenience mounts.

FIGURE 1: CUSTOMER DAMAGE FUNCTIONS – LARGE C&I

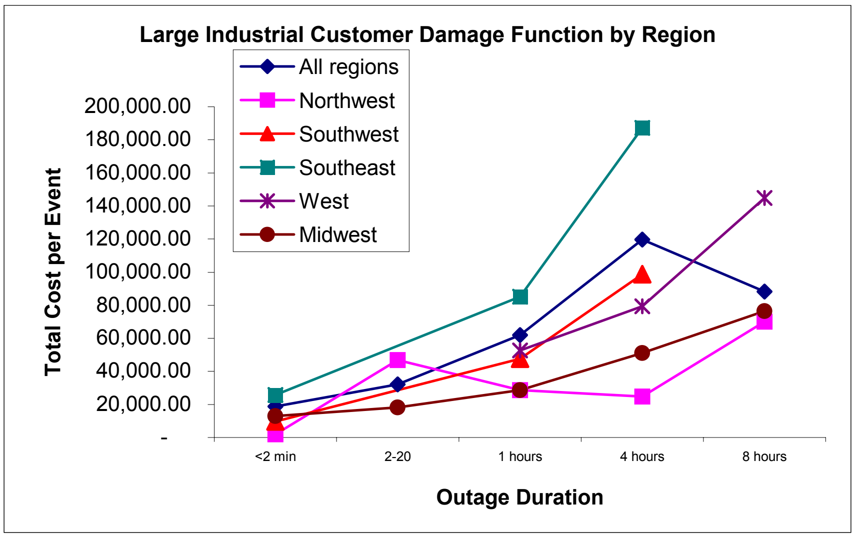


FIGURE 2: CUSTOMER DAMAGE FUNCTION – SMALL-MEDIUM C&I

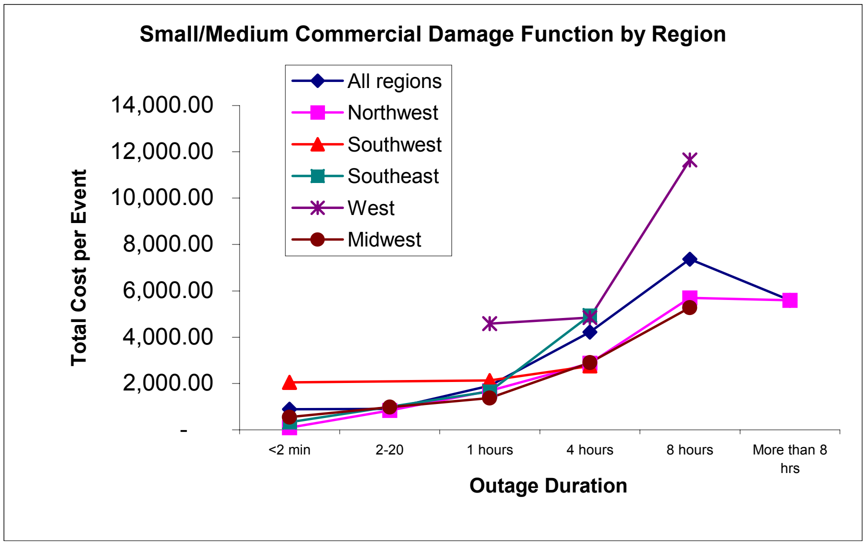
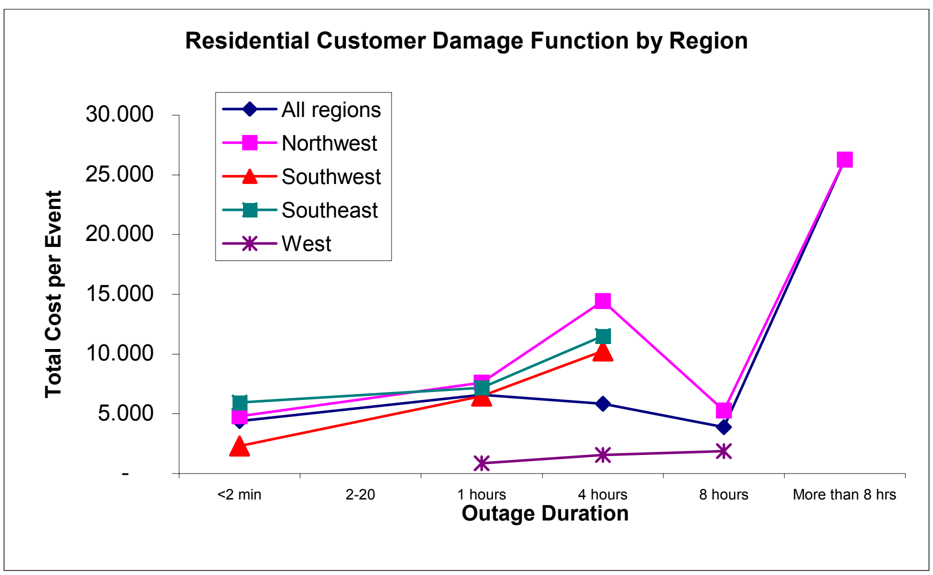


FIGURE 3: CUSTOMER DAMAGE FUNCTION - RESIDENTIAL



Discussion

Results from this paper and the larger study from which these results are drawn are intended to contribute to an improved understanding of the importance of electricity reliability to the nation (Lawton, Eto, Katz, Sullivan 2003). From this perspective, we believe it is essential that more information of the type presented in this paper be made available in the public domain to better inform future public and private decisions on reliability.

In this discussion, however, we turn to a critical issue that must be addressed in pursuing this objective: utility concerns regarding the liability risks that might be created by increasing the amount of information on the value of reliability that is available in the public domain. It is our position that these risks are minimal.

Customers sometimes bring legal actions against utilities attempting to recover economic losses resulting from service interruptions. Historically, these actions have been brought by individual parties, but a few class actions have been filed in recent years. In a case brought by an individual, three things must be proven. They are:

1. defendant was negligent;
2. plaintiff sustained damages (usually monetary in nature); and
3. damages equaled some provable economic loss.

Results from interruption cost surveys cannot be used to prove that a given party sustained damage during an outage or quantify the magnitude of their economic loss. The primary reason this is so is that interruption cost surveys do not measure the damages and economic losses experienced by plaintiffs in the matter at hand. They measure damages and economic losses for a statistical population that may be more or less similar to plaintiff along any number of dimensions. As such, they are nothing more than interesting facts; they are irrelevant to the issues that must be proven in a tort. In a tort, along with proving negligence, plaintiffs must show they were damaged and provide proof of their economic losses; not that the average person would have been damaged and suffered a certain economic loss on the average. Information from interruption cost surveys is useful for proving the latter proposition, but not the former.

In class actions, where the existence of numerous plaintiffs makes the use of statistical methods almost a necessity, legal scholars have been more liberal in their adoption of statistical surveys in finding damages and assessing their economic worth. In these cases, plaintiffs have the added burden of showing that there is a commonality of exposure and injury among class members that justifies treating all the members of the class alike. If any thing, results of interruption cost surveys provide strong evidence that (1) it cannot be presumed that interruption of electric power necessarily damages all customers and (2) costs from power outages vary widely with circumstances, with seemingly similar customers experiencing little or no loss while others suffer serious losses. In effect, these studies show that some parties sustain damages and losses under circumstances when other similarly situated parties do not. These facts lend support to the notion that insufficient commonality exists among electric customers to justify class certification. To date, there have been no successful class action lawsuits brought by electric customers in matters related to service reliability because courts have generally refused to certify classes because of lack of commonality.

CONCLUSION

This paper has presented partial findings from a national database of customer outage costs developed from information developed through 20 studies conducted by provided 7 electric utilities over the past 15 years. We used the database to describe trends in interruption costs, and regional (geographic) differences, differences in interruption costs by customer type. We also provided a short preview of the customer damage functions that are discussed separately in the complete technical report from the project. These results are the first fruits of the extensive study. In the larger study, we will be exploring the effects of other factors related to the outage scenarios and characteristics of the households and firms. Multivariate analyses for the outage details, such as duration, whether a warning was given, season, time of day, day of week, etc. will disentangle the effects of outages. Detailed tables with characteristics such as SIC code will add further insight.

Given the utility concerns regarding the making information from their studies availability in the public domain, we discussed the liability risks that might be created from presenting aggregated information in this fashion and conclude that these risks are minimal. Results from this paper and the larger study from which these results are drawn are intended to contribute to an improved understanding of the importance of electricity reliability to the nation.

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