

Ameren Illinois Rate Zone I
Section 285.5120
Schedule E-7: Load Research Results and Supporting Materials

The load research was based on a new load research sample which was fully implemented in January 2015. The sample was designed for the post 2006 delivery service rates.

Schedule E-7(a): Load Research Results

- 1) *Monthly class and Illinois jurisdictional loads at the time of the system coincident peaks, along with the date and time of such peak;*

Please see schedule E-7(a)(1)

- 2) *The monthly maximum non-coincident peak demands for each customer class, along with the date and time of each peak for each customer class.*

Please see schedule E-7(a)(2)

- 3) *Class and Jurisdictional Load Factors; and*

Please see schedule E-7(a)(3)

- 4) *The statistical confidence level achieved for each set of load data developed.*

The original samples were designed for an accuracy of +/- 10% at the 90% confidence level at the time of the annual system peak. Due to over sampling and near census analysis for several classes, the resulting precisions in many classes were well below the accuracy design.

Schedule E-7(b): Supporting Materials

- 1) *The time period over which the data was collected:*

The data were collected for calendar year 2015.

- 2) *A full description of the statistical methods used by the Utility to derive load research results, including accuracies and confidence levels its load research samples were designed to achieve; and*

The goal of the load research sample design is to design a sample of customers from each applicable customer class that:

- 1) Provides an accurate representation of the load characteristics of each customer class.
- 2) Provide estimated customer loads with a relative accuracy of +/- 10% at a 90% confidence level.

To achieve these goals, the following sample design steps are followed for each applicable customer class:

- 1) Selection of stratification variable(s)
- 2) Determination of number of strata required for each class
- 3) Computation of strata boundaries
- 4) Calculation of sample size

Step 1- Selection of Stratification variable

Stratified sampling is a technique used to reduce variance when two or more different subgroups of a population exhibit different characteristics. The population is separated into non-overlapping groups called strata. The first step in the stratification procedure involves selection of stratification variable on which to divide the population. The stratification variable must be one which shows a high correlation to the variable of interest (usually system or class peak demand).

The most common stratification variables in use include either non-coincident demands or energy usage for a selected historic time period, usually ranging from one month to a year.

Step 2 – Determination of number of strata required for each class

The number of strata is determined by calculating the coefficient of variation of the sampling distribution for test designs with different number of strata. The coefficient of variation is equal to the standard error of the estimate divided by the mean. The coefficient of variation declines as the number of strata increases, but at a diminishing rate. The point at which the coefficient of variation decreases very little as another stratum is added indicates the number of strata needed.

Step 3 – Computation of Stratum Boundaries

Strata boundaries are designed such that the overall population weighted variance is minimized. The strata boundaries are calculated using a statistical technique called Dalenius-Hodges.

Step 4 – Calculation of sample size

The accuracy of a sample result depends upon the sample size and the degree of variability of in the population itself. Sample size is:

1. Directly proportional to an estimate of the variance of the population,
2. Inversely proportional to the tolerable error (e.g. 10% relative accuracy at the annual system peak), and
3. Directly proportional to the square of the degree of confidence desired.

In most cases Ameren's sample sizes were calculated to yield a relative accuracy of +/- 10% at confidence level of 90%. As previously mentioned the samples are primarily stratified random samples based on the Dalenius-Hodges variance procedure and the Neyman allocation was used to distribute the meters among the strata.

- 3) *A full explanation of the usage strata into which customers in the utility's load research sample is distributed. For each of these usage stratum, the utility must provide the following:*

A combined ratio estimator was used to expand the sample data to the population. The combined ratio estimator utilizes the strata weights as defined in the sample design in conjunction with the kw/kwh ratio to calculate total parameter estimates. This technique produces demand estimates for the class; it does not produce stratum-level demand estimates. However, the total demands are calculated based on the weighed strata kw/kwh ratio and the total energy for the month.

Residential Delivery Service (DS1):

The residential delivery service sample is a stratified two dimensional random sample based on Summer kWh and Winter/Shoulder Ratio. The sample has four strata as follows:

- Strata 1: 0-1300 kwh summer*, 0-1.6 winter/shoulder ratio*
- Strata 2: 0-1300 kwh summer*, over 1.6 winter/shoulder ratio*
- Strata 3: over 1300 kwh summer*, 0-1.6 winter/shoulder ratio*
- Strata 4: over 1300 kwh summer*, over 1.6 winter/shoulder ratio*

*Summer = Average Monthly Usage (June 05, July 05, August 05, September 05)

Winter/Shoulder Ratio = (Winter Use Per Day)/(Shoulder* Use Per Day)

*Winter = December 05, January 06, February 06

*Shoulder = April 05, May 05, October 05, November 05

Small General Delivery Service (DS2):

The small general delivery service sample is a two dimensional random sample based on Summer and Winter kWh. The sample contains four strata as follows:

- Strata 1: 0-5300 kwh summer*, 0-4500 kwh winter*
- Strata 2: 0-5300 kwh summer*, over 4500 kwh winter*
- Strata 3: over 5300 kwh summer*, 0-4500 kwh winter*
- Strata 4: over 5300 kwh summer*, over 4500 kwh winter*

*Summer = Average Monthly Usage (June 05, July 05, August 05, September 05)

*Winter = December 05, January 06, February 06

General Delivery Service (DS3) < 400 kW:

The general delivery service sample is a stratified one dimensional random sample based on load factor. The sample has three strata as follows:

- Strata 1: 0-0.4 Load Factor*
- Strata 2: 0.4-0.6 Load Factor*
- Strata 3: over 0.6 Load Factor*

*Load Factor = Average of Monthly Load Factors for March 05-February 06

General Delivery Service (DS3) >= 400 kW:

This sample is nearly 100% stratified by supply voltage:

- Strata 1 - Primary
- Strata 2 - Sub-Transmission
- Strata 3 – Transmission

Large General Delivery Service (DS4):

This sample is nearly 100% stratified by supply voltage:

- Strata 1 - Primary
- Strata 2 - Sub-Transmission
- Strata 3 – Transmission

A) *Identify the number of customers and the customer types (by class) in that particular stratum;*

Please see schedule E-7(b)(3)(A)

B) *Average monthly usage;*

Please see schedule E-7(b)(3)(B)

C) *Average demand in kW at the time of system peak; and*

Please see schedule E-7(b)(3)(C)

D) *Average non-coincident peak demand.*

Please see schedule E-7(b)(3)(D)

4) *An explanation of how the load research sample was derived and justification provided for the appropriateness of the sample used.*

The sample design was derived based on standard load research procedure using stratified random sample which minimizes estimation error and reduces sampling cost.

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Schedule E-7(a)(1): Load Research								
Class Coincident Peak								
Including Distribution Losses								
Hour Beginning	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System
1/7/15 7:00 PM	923,422	329,733	236,938	14,265	665,016	416	26,747	2,196,537
2/18/15 7:00 PM	879,644	306,401	227,641	11,173	632,130	415	26,747	2,084,151
3/4/15 7:00 PM	728,714	295,634	212,162	10,262	695,424	251	26,747	1,969,193
4/23/15 8:00 AM	394,512	246,498	212,722	8,368	646,217	1,396	-	1,509,714
5/28/15 4:00 PM	548,407	284,539	236,812	3,386	690,840	103	-	1,764,086
6/10/15 4:00 PM	884,753	360,326	260,287	3,945	644,091	490	-	2,153,893
7/13/15 4:00 PM	926,680	402,201	273,902	4,023	700,631	245	-	2,307,683
8/3/15 3:00 PM	859,651	359,829	276,440	4,229	675,248	760	-	2,176,157
9/4/15 3:00 PM	855,920	344,152	284,667	6,264	683,489	2,178	-	2,176,670
10/8/15 3:00 PM	366,637	294,352	273,396	19,998	582,742	2,458	-	1,539,583
11/30/15 6:00 PM	565,495	219,722	198,254	6,852	579,968	538	26,747	1,597,577
12/2/15 6:00 PM	609,172	246,308	210,396	9,844	629,148	1,000	26,747	1,732,615

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Schedule E-7(a)(2): Load Research												
Class Non-Coincident Peak												
Including Distribution Losses												
Hour Beginning	DS1	Hour Beginning	DS2	Hour Beginning	DS3	Hour Beginning	DS3S	Hour Beginning	DS4	Hour Beginning	DS4S	DS5
1/7/15 6:00 PM	944,701	1/8/15 9:00 AM	396,286	1/8/15 9:00 AM	272,269	1/7/15 3:00 PM	16,444	1/7/15 10:00 AM	687,238	1/23/15 9:00 AM	1,913	26,747
2/23/15 7:00 AM	922,207	2/23/15 10:00 AM	362,522	2/23/15 8:00 AM	262,463	2/12/15 10:00 AM	14,114	2/26/15 8:00 AM	694,224	2/4/15 11:00 AM	2,013	26,747
3/6/15 6:00 AM	778,068	3/4/15 10:00 AM	351,191	3/4/15 10:00 AM	249,681	3/5/15 8:00 AM	12,772	3/5/15 8:00 AM	699,596	3/13/15 1:00 PM	1,599	26,747
4/4/15 8:00 AM	484,106	4/29/15 1:00 PM	292,094	4/9/15 1:00 PM	227,865	4/23/15 7:00 AM	8,934	4/16/15 1:00 PM	688,633	4/15/15 3:00 PM	1,718	26,747
5/25/15 7:00 PM	608,829	5/6/15 11:00 AM	344,491	5/28/15 1:00 PM	264,419	4/30/15 8:00 AM	7,941	5/5/15 12:00 PM	692,445	4/30/15 11:00 AM	1,736	26,747
6/10/15 5:00 PM	892,306	6/11/15 1:00 PM	391,808	6/22/15 1:00 PM	284,858	6/10/15 1:00 PM	5,753	6/23/15 8:00 AM	707,715	6/18/15 8:00 AM	1,321	26,747
7/17/15 4:00 PM	977,669	7/28/15 11:00 AM	428,802	7/28/15 1:00 PM	294,979	7/15/15 1:00 PM	6,146	7/17/15 7:00 AM	722,962	7/28/15 8:00 AM	1,680	26,747
8/2/15 4:00 PM	991,470	8/6/15 10:00 AM	399,408	8/18/15 1:00 PM	293,745	8/20/15 9:00 AM	5,930	8/5/15 6:00 AM	693,381	8/28/15 11:00 AM	2,351	26,747
9/6/15 2:00 PM	940,488	9/23/15 10:00 AM	391,941	9/17/15 1:00 PM	310,524	9/21/15 3:00 PM	22,193	9/3/15 9:00 PM	701,750	9/22/15 5:00 PM	4,564	26,747
10/29/15 7:00 AM	467,194	10/8/15 11:00 AM	322,286	10/8/15 1:00 PM	279,625	9/30/15 10:00 AM	25,799	10/21/15 1:00 PM	698,615	9/30/15 3:00 PM	3,633	26,747
11/22/15 7:00 PM	604,022	11/30/15 10:00 AM	273,765	11/23/15 9:00 AM	244,973	11/9/15 6:00 AM	18,023	11/10/15 9:00 AM	699,930	11/10/15 8:00 AM	2,266	26,747
12/31/15 5:00 PM	660,289	12/29/15 9:00 AM	304,375	12/17/15 9:00 AM	254,198	12/18/15 6:00 AM	18,785	12/16/15 9:00 AM	676,054	12/17/15 2:00 PM	2,049	26,747

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Schedule E-7(a)(3): Load Research									
Class Load Factors									
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System	
January-15	64%	64%	65%	67%	84%	55%	59%	75%	
February-15	70%	70%	71%	67%	84%	29%	55%	81%	
March-15	59%	64%	66%	56%	84%	36%	50%	74%	
April-15	65%	66%	67%	61%	84%	24%	44%	83%	
May-15	57%	58%	64%	44%	83%	31%	40%	74%	
June-15	54%	60%	69%	49%	87%	24%	38%	72%	
July-15	57%	58%	68%	49%	87%	30%	39%	72%	
August-15	51%	60%	67%	55%	88%	20%	43%	72%	
September-15	46%	58%	66%	19%	83%	14%	48%	68%	
October-15	67%	60%	63%	58%	82%	60%	53%	84%	
November-15	63%	69%	67%	66%	83%	78%	57%	84%	
December-15	69%	68%	67%	58%	83%	43%	60%	82%	

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Schedule E-7(b)(3)(A): Load Research									
Customers									
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System	
January-15	327,244	55,195	1,358	136	195	6	31,157	415,291	
February-15	323,166	54,383	1,355	136	192	6	30,695	409,933	
March-15	334,808	56,548	1,361	135	198	6	31,871	424,927	
April-15	325,963	55,133	1,379	134	200	6	31,049	413,864	
May-15	325,925	55,170	1,358	134	192	5	30,992	413,776	
June-15	324,246	54,849	1,427	134	185	6	31,012	411,859	
July-15	325,087	54,996	1,433	134	186	5	30,985	412,826	
August-15	325,144	55,160	1,457	132	197	5	30,983	413,078	
September-15	325,541	55,012	1,510	163	182	4	30,865	413,277	
October-15	327,221	55,654	1,511	134	196	5	30,156	414,877	
November-15	326,981	55,223	1,392	125	183	5	29,790	413,698	
December-15	324,004	55,687	1,508	139	193	5	29,708	411,243	

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Schedule E-7(b)(3)(B): Load Research							
Average Usage per Customer							
Including Distribution Losses							
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5
January-15	1,383	3,397	97,445	60,051	2,209,318	129,788	374
February-15	1,346	3,144	91,979	46,914	2,045,764	65,479	321
March-15	1,012	2,943	89,713	39,322	2,196,856	72,058	310
April-15	697	2,507	80,059	29,256	2,092,895	50,145	276
May-15	792	2,685	93,108	19,434	2,238,247	79,648	258
June-15	1,079	3,079	99,180	15,054	2,404,282	38,450	236
July-15	1,278	3,393	104,832	16,745	2,508,766	76,211	250
August-15	1,156	3,207	99,977	18,242	2,308,029	69,408	273
September-15	964	2,989	97,883	18,485	2,315,916	117,348	297
October-15	711	2,587	86,281	82,737	2,186,024	321,850	348
November-15	831	2,473	85,522	68,418	2,272,109	253,489	370
December-15	1,051	2,761	84,119	58,096	2,174,394	131,743	399

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Schedule E-7(b)(3)(C): Load Research							
Average Demand per Customer: Class Coincident Peak							
Including Distribution Losses							
Hour Beginning	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5
1/7/15 7:00 PM	2.8	6.0	174	105	3,410	69	0.9
2/18/15 7:00 PM	2.7	5.6	168	82	3,292	69	0.9
3/4/15 7:00 PM	2.2	5.2	156	76	3,512	42	0.8
4/23/15 8:00 AM	1.2	4.5	154	62	3,231	233	-
5/28/15 4:00 PM	1.7	5.2	174	25	3,598	21	-
6/10/15 4:00 PM	2.7	6.6	182	29	3,482	82	-
7/13/15 4:00 PM	2.9	7.3	191	30	3,767	49	-
8/3/15 3:00 PM	2.6	6.5	190	32	3,428	152	-
9/4/15 3:00 PM	2.6	6.3	189	38	3,755	545	-
10/8/15 3:00 PM	1.1	5.3	181	149	2,973	492	-
11/30/15 6:00 PM	1.7	4.0	142	55	3,169	108	0.9
12/2/15 6:00 PM	1.9	4.4	140	71	3,260	200	0.9

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Schedule E-7(b)(3)(D): Load Research												
Average Demand per Customer: Class Non-Coincident Peak												
Including Distribution Losses												
Hour Beginning	DS1	Hour Beginning	DS2	Hour Beginning	DS3	Hour Beginning	DS3S	Hour Beginning	DS4	Hour Beginning	DS4S	DS5
1/7/15 6:00 PM	2.9	1/8/15 9:00 AM	7.2	1/8/15 9:00 AM	200.5	1/7/15 3:00 PM	84.3	1/7/15 10:00 AM	3,524.3	1/23/15 9:00 AM	318.9	0.9
2/23/15 7:00 AM	2.9	2/23/15 10:00 AM	6.7	2/23/15 8:00 AM	193.7	2/12/15 10:00 AM	73.5	2/26/15 8:00 AM	3,615.8	2/4/15 11:00 AM	335.5	0.9
3/6/15 6:00 AM	2.3	3/4/15 10:00 AM	6.2	3/4/15 10:00 AM	183.5	3/5/15 8:00 AM	64.5	3/5/15 8:00 AM	3,533.3	3/13/15 1:00 PM	266.6	0.8
4/4/15 8:00 AM	1.5	4/29/15 1:00 PM	5.3	4/9/15 1:00 PM	165.2	4/23/15 7:00 AM	44.7	4/16/15 1:00 PM	3,443.2	4/15/15 3:00 PM	286.3	0.9
5/25/15 7:00 PM	1.9	5/6/15 11:00 AM	6.2	5/28/15 1:00 PM	194.7	4/30/15 8:00 AM	41.4	5/5/15 12:00 PM	3,606.5	4/30/15 11:00 AM	347.2	0.9
6/10/15 5:00 PM	2.8	6/11/15 1:00 PM	7.1	6/22/15 1:00 PM	199.6	6/10/15 1:00 PM	31.1	6/23/15 8:00 AM	3,825.5	6/18/15 8:00 AM	220.2	0.9
7/17/15 4:00 PM	3.0	7/28/15 11:00 AM	7.8	7/28/15 1:00 PM	205.8	7/15/15 1:00 PM	33.0	7/17/15 7:00 AM	3,886.9	7/28/15 8:00 AM	336.1	0.9
8/2/15 4:00 PM	3.0	8/6/15 10:00 AM	7.2	8/18/15 1:00 PM	201.6	8/20/15 9:00 AM	30.1	8/5/15 6:00 AM	3,519.7	8/28/15 11:00 AM	470.1	0.9
9/6/15 2:00 PM	2.9	9/23/15 10:00 AM	7.1	9/17/15 1:00 PM	205.6	9/21/15 3:00 PM	121.9	9/3/15 9:00 PM	3,855.8	9/22/15 5:00 PM	1,141.1	0.9
10/29/15 7:00 AM	1.4	10/8/15 11:00 AM	5.8	10/8/15 1:00 PM	185.1	9/30/15 10:00 AM	131.6	10/21/15 1:00 PM	3,564.4	9/30/15 3:00 PM	726.6	0.9
11/22/15 7:00 PM	1.8	11/30/15 10:00 AM	5.0	11/23/15 9:00 AM	176.0	11/9/15 6:00 AM	98.5	11/10/15 9:00 AM	3,824.8	11/10/15 8:00 AM	453.2	0.9
12/31/15 5:00 PM	2.0	12/29/15 9:00 AM	5.5	12/17/15 9:00 AM	168.6	12/18/15 6:00 AM	97.3	12/16/15 9:00 AM	3,502.9	12/17/15 2:00 PM	409.9	0.9