

Ameren Illinois Rate Zone III
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 precision 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 precision 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 precision 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 precision 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 precision 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 precision 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: 0-5700 kwh summer*, 0-5000 kwh winter*
- Strata 2: 0-5700 kwh summer*, over 5000 kwh winter*
- Strata 3: over 5700 kwh summer*, 0-5000 kwh winter*
- Strata 4: over 5700 kwh summer*, over 5000 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.

Ameren Illinois Rate Zone III								
Section 285.5120								
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	1,283,393	398,012	281,006	9,919	925,160	1,552	47,569	2,935,139
2/18/15 7:00 PM	1,200,952	400,449	279,477	7,797	891,271	1,278	47,569	2,819,717
3/4/15 7:00 PM	1,040,539	395,724	266,644	6,014	928,612	1,336	47,569	2,679,087
4/23/15 8:00 AM	541,251	302,711	264,784	7,290	1,107,142	1,356	-	2,215,888
5/28/15 4:00 PM	868,738	427,631	360,451	3,740	1,083,010	478	-	2,739,830
6/10/15 4:00 PM	1,315,356	548,537	393,418	3,987	981,463	820	-	3,238,774
7/13/15 4:00 PM	1,518,020	597,766	409,154	3,431	1,050,918	741	-	3,575,859
8/3/15 3:00 PM	1,415,556	582,797	400,805	3,990	1,081,030	675	-	3,480,187
9/4/15 3:00 PM	1,472,899	556,313	423,306	6,333	980,277	2,337	-	3,432,796
10/8/15 3:00 PM	521,122	446,028	369,002	24,341	1,081,383	5,564	-	2,417,535
11/30/15 6:00 PM	818,096	333,324	271,255	5,412	855,837	1,689	47,569	2,326,081
12/2/15 6:00 PM	892,923	343,539	278,490	8,289	945,134	1,943	47,569	2,507,655

Ameren Illinois Rate Zone III												
Section 285.5120												
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	1,217,251	1/8/15 12:00 PM	447,073	1/8/15 10:00 AM	339,430	1/7/15 10:00 AM	11,190	1/14/15 1:00 PM	965,386	1/29/15 9:00 AM	4,004	47,569
2/18/15 8:00 PM	1,120,801	2/20/15 11:00 AM	420,742	2/20/15 9:00 AM	333,495	2/12/15 11:00 AM	9,534	2/12/15 10:00 AM	907,262	2/6/15 8:00 AM	4,281	47,569
3/5/15 7:00 PM	969,393	3/6/15 10:00 AM	429,605	3/5/15 9:00 AM	324,603	3/18/15 10:00 AM	8,261	3/10/15 1:00 PM	953,039	3/20/15 9:00 AM	4,310	47,569
4/9/15 7:00 PM	669,671	4/9/15 2:00 PM	392,744	4/9/15 2:00 PM	332,950	4/22/15 11:00 AM	8,381	4/16/15 4:00 PM	1,023,682	4/1/15 7:00 AM	3,995	47,569
5/25/15 4:00 PM	892,313	5/7/15 12:00 PM	462,094	5/18/15 2:00 PM	381,486	5/19/15 11:00 AM	6,370	5/18/15 1:00 PM	1,058,058	5/1/15 9:00 AM	1,388	47,569
6/10/15 5:00 PM	1,264,407	6/10/15 3:00 PM	541,352	6/11/15 2:00 PM	405,802	6/1/15 2:00 PM	5,644	6/22/15 2:00 PM	1,041,223	6/23/15 3:00 PM	1,442	47,569
7/13/15 5:00 PM	1,486,437	7/13/15 4:00 PM	554,343	7/28/15 2:00 PM	426,793	7/23/15 9:00 AM	5,037	7/28/15 1:00 PM	1,094,540	7/22/15 10:00 AM	1,316	47,569
8/2/15 3:00 PM	1,444,050	8/3/15 12:00 PM	576,894	8/17/15 2:00 PM	425,197	8/27/15 3:00 PM	5,661	8/5/15 1:00 PM	1,058,072	8/31/15 1:00 PM	1,696	47,569
9/6/15 3:00 PM	1,456,356	9/4/15 1:00 PM	554,575	9/3/15 2:00 PM	441,754	9/29/15 3:00 PM	25,428	9/2/15 11:00 AM	1,042,370	9/17/15 12:00 PM	7,905	47,569
10/7/15 6:00 PM	678,596	10/7/15 1:00 PM	453,636	10/8/15 2:00 PM	391,080	10/1/15 2:00 PM	28,621	10/22/15 12:00 PM	1,016,598	10/1/15 2:00 PM	7,274	47,569
11/22/15 7:00 PM	869,756	11/1/15 1:00 AM	419,690	11/5/15 11:00 AM	337,361	11/9/15 11:00 PM	15,863	11/5/15 10:00 AM	970,201	11/9/15 5:00 AM	3,342	47,569
12/29/15 5:00 PM	889,267	12/18/15 10:00 AM	403,250	12/17/15 10:00 AM	331,506	12/18/15 7:00 AM	17,652	12/8/15 1:00 PM	906,122	12/19/15 8:00 AM	3,657	47,569

Ameren Illinois Rate Zone III								
Section 285.5120								
Schedule E-7(a)(3): Load Research								
Class Load Factors								
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System
January-15	65%	73%	68%	61%	85%	49%	59%	75%
February-15	77%	81%	72%	65%	87%	45%	55%	80%
March-15	63%	71%	68%	52%	88%	40%	50%	75%
April-15	72%	69%	66%	38%	84%	18%	44%	84%
May-15	61%	62%	64%	38%	85%	25%	40%	73%
June-15	59%	64%	68%	43%	82%	35%	38%	69%
July-15	58%	63%	66%	50%	81%	40%	39%	67%
August-15	53%	61%	66%	49%	87%	28%	43%	67%
September-15	47%	59%	62%	42%	86%	51%	48%	64%
October-15	69%	64%	58%	53%	84%	46%	53%	78%
November-15	64%	66%	66%	45%	81%	49%	57%	81%
December-15	72%	72%	69%	34%	81%	43%	60%	77%

Ameren Illinois Rate Zone III								
Section 285.5120								
Schedule E-7(b)(3)(A): Load Research								
Customers								
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System
January-15	542,986	73,886	1,358	136	195	6	41,149	659,716
February-15	539,109	72,519	1,355	136	192	6	40,273	653,590
March-15	552,268	75,019	1,361	135	198	6	41,593	670,580
April-15	545,901	74,084	1,379	134	200	6	41,018	662,722
May-15	542,247	74,013	1,358	134	192	5	40,529	658,478
June-15	542,325	73,952	1,427	134	185	6	40,757	658,786
July-15	544,261	74,350	1,433	134	186	5	40,961	661,330
August-15	546,297	74,640	1,457	132	197	5	40,903	663,631
September-15	542,280	74,054	1,510	163	182	4	40,402	658,595
October-15	540,066	74,265	1,511	134	196	5	41,768	657,945
November-15	542,742	74,214	1,392	125	183	5	41,066	659,727
December-15	545,295	76,169	1,508	139	193	5	41,370	664,679

Ameren Illinois Rate Zone III							
Section 285.5120							
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	1,085	3,304	126,679	37,108	3,124,902	242,921	503
February-15	1,069	3,154	118,462	30,439	2,766,033	217,456	435
March-15	820	3,028	121,236	23,733	3,168,168	214,595	423
April-15	635	2,623	114,403	17,306	3,100,569	87,926	372
May-15	751	2,891	134,719	13,585	3,486,555	52,342	350
June-15	984	3,355	139,476	12,959	3,336,298	60,069	319
July-15	1,188	3,469	147,176	13,972	3,560,374	78,066	336
August-15	1,043	3,494	143,689	15,620	3,492,681	71,714	368
September-15	907	3,195	129,671	47,216	3,527,688	731,987	403
October-15	646	2,892	112,279	84,336	3,233,683	501,928	447
November-15	741	2,693	115,755	40,958	3,086,058	235,848	478
December-15	876	2,829	112,959	31,989	2,826,317	232,142	510

Ameren Illinois Rate Zone III								
Section 285.5120								
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	2.4	5.4	212.0	72.9	4,708.9	258.7		1.2
2/18/15 7:00 PM	2.2	5.5	209.8	57.3	4,616.9	213.1		1.2
3/4/15 7:00 PM	1.9	5.3	198.3	44.5	4,673.8	222.7		1.1
4/23/15 8:00 AM	1.0	4.1	195.3	54.4	5,513.3	226.0		-
5/28/15 4:00 PM	1.6	5.8	265.4	27.9	5,640.9	95.6		-
6/10/15 4:00 PM	2.4	7.4	275.6	29.8	5,305.9	136.7		-
7/13/15 4:00 PM	2.8	8.0	284.9	25.6	5,654.7	148.3		-
8/3/15 3:00 PM	2.6	7.8	274.9	30.2	5,488.5	135.0		-
9/4/15 3:00 PM	2.7	7.5	281.6	38.9	5,375.9	584.4		-
10/8/15 3:00 PM	1.0	6.0	257.6	181.6	5,413.9	1,112.9		-
11/30/15 6:00 PM	1.5	4.5	196.7	43.3	4,662.8	337.7		1.2
12/2/15 6:00 PM	1.6	4.5	188.2	59.6	4,869.5	388.6		1.1

Ameren Illinois Rate Zone III												
Section 285.5120												
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	2.2	1/8/15 12:00 PM	6.1	1/8/15 10:00 AM	249.9	1/7/15 10:00 AM	82.3	1/7/15 10:00 AM	4,950.7	1/29/15 9:00 AM	667.4	1.2
2/18/15 8:00 PM	2.1	2/20/15 11:00 AM	5.8	2/20/15 9:00 AM	246.1	2/12/15 11:00 AM	70.1	2/12/15 11:00 AM	4,725.3	2/6/15 8:00 AM	713.5	1.2
3/5/15 7:00 PM	1.8	3/6/15 10:00 AM	5.7	3/5/15 9:00 AM	238.5	3/18/15 10:00 AM	61.2	3/18/15 10:00 AM	4,813.3	3/20/15 9:00 AM	718.4	1.1
4/9/15 7:00 PM	1.2	4/9/15 2:00 PM	5.3	4/9/15 2:00 PM	241.4	4/22/15 11:00 AM	62.5	4/22/15 11:00 AM	5,118.4	4/1/15 7:00 AM	665.8	1.2
5/25/15 4:00 PM	1.6	5/7/15 12:00 PM	6.2	5/18/15 2:00 PM	280.9	5/19/15 11:00 AM	47.5	5/19/15 11:00 AM	5,510.7	5/1/15 9:00 AM	277.6	1.2
6/10/15 5:00 PM	2.3	6/10/15 3:00 PM	7.3	6/11/15 2:00 PM	284.4	6/1/15 2:00 PM	42.1	6/1/15 2:00 PM	5,628.2	6/23/15 3:00 PM	240.4	1.2
7/13/15 5:00 PM	2.7	7/13/15 4:00 PM	7.5	7/28/15 2:00 PM	297.8	7/23/15 9:00 AM	37.6	7/23/15 9:00 AM	5,884.6	7/22/15 10:00 AM	263.3	1.2
8/2/15 3:00 PM	2.6	8/3/15 12:00 PM	7.7	8/17/15 2:00 PM	291.8	8/27/15 3:00 PM	42.9	8/27/15 3:00 PM	5,370.9	8/31/15 1:00 PM	339.2	1.2
9/6/15 3:00 PM	2.7	9/4/15 1:00 PM	7.5	9/3/15 2:00 PM	292.6	9/29/15 3:00 PM	156.0	9/29/15 3:00 PM	5,727.3	9/17/15 12:00 PM	1,976.3	1.2
10/7/15 6:00 PM	1.3	10/7/15 1:00 PM	6.1	10/8/15 2:00 PM	258.8	10/1/15 2:00 PM	213.6	10/1/15 2:00 PM	5,186.7	10/1/15 2:00 PM	1,454.9	1.1
11/22/15 7:00 PM	1.6	11/1/15 1:00 AM	5.7	11/5/15 11:00 AM	242.4	11/9/15 11:00 PM	126.9	11/9/15 11:00 PM	5,301.6	11/9/15 5:00 AM	668.4	1.2
12/29/15 5:00 PM	1.6	12/18/15 10:00 AM	5.3	12/17/15 10:00 AM	219.8	12/18/15 7:00 AM	127.0	12/18/15 7:00 AM	4,694.9	12/19/15 8:00 AM	731.5	1.1