LOAD FORECAST

2.0 Overview of the Base Load Forecast

The IPL load forecast is used as the base forecast in the EGEAS model. The elements of the IPL load forecast are described in the following subsections:

- Section 2.1 – Base Forecast;
- Section 2.2 – IPL Energy Forecast;
- Section 2.3 – IPL Demand Forecast;
- Section 2.4 – Sensitivity and Scenarios; and
- Section 2.5 – Forecast Comparison to Previous IRP.

Appendix 2A provides discussion of methodology, data sources, and definitions for the demand and energy forecasts, as well as model details, statistics, and parameters.

The load forecast has two main components: the energy forecast and the demand forecast. The assumptions and methodologies for calculating the energy and demand forecasts are included in sections 2.2 and 2.3. To illustrate the sensitivity of the IRP to changes in the load forecast, confidence intervals, as well as high and low scenarios are found in section 2.4. Section 2.5 provides a comparison of the 2017 IRP load forecast to the 2014 IRP load forecast.

2.1 Base Forecast

Table 2.1.1 summarizes IPL's annual energy and internal peak demand forecast in the base forecast.

Table 2.1.1
IPL Base Forecast: Energy and Internal Peak Demand

Year	Energy (GWH)	Internal Peak Demand (MW)
2017	17,081	3,083.7
2018	16,858	3,048.1
2019	16,788	3,065.0
2020	16,925	3,075.3
2021	17,031	3,091.0
2022	17,145	3,108.1
2023	17,214	3,126.0
2024	17,335	3,144.1
2025	17,459	3,162.4
2026	17,585	3,180.9
2027	17,676	3,199.5
2028	17,768	3,218.2
2029	17,860	3,237.0
2030	17,953	3,256.0
2031	18,046	3,275.0
2032	18,139	3,294.1
2033	18,233	3,313.4
2034	18,328	3,332.8
2035	18,423	3,352.3
2036	18,519	3,371.9
2037	18,615	3,391.6

The translation from the Internal Peak Demand forecast to the EGEAS net load variable is found in Section 4.2.2.

2.2 IPL Energy Forecast

2.2.1 Methods

See Appendix 2A Section A.

2.2.2 Data

See Appendix 2A Section B.

2.3 IPL Demand Forecast

2.3.1 Definitions

See Appendix 2A Section C.

2.3.2 Method

See Appendix 2A Section D.

2.3.3 Data

See Appendix 2A Section E.

2.4 Sensitivity and Scenarios

2.4.1 Sensitivity

To estimate the sensitivity of the load forecast, IPL constructed annualized confidence intervals for the energy and demand forecasts.

2.4.1.1 Energy Confidence Interval

The confidence interval for the energy forecast utilizes a rolling 12-month annual error. The forecast error was determined using the 95% critical value on the standard deviation of the rolling annual errors. The confidence interval is presented below in Table 2.4.1.1. While the large industrial, wholesale, and small classes, like lighting, municipal pumping, and interdepartmental, are not statistically modeled, IPL applies a confidence interval derived from the statistically modeled classes as a percentage to the total annual sales.

Table 2.4.1.1
95% Confidence Intervals IPL Energy Models (GWH)

Year	Lower Confidence Interval	Base Energy	Upper Confidence Interval
2017	16,799	17,081	17,363
2018	16,580	16,858	17,136
2019	16,511	16,788	17,065
2020	16,646	16,925	17,204
2021	16,750	17,031	17,312
2022	16,862	17,145	17,428
2023	16,930	17,214	17,498
2024	17,049	17,335	17,620
2025	17,171	17,459	17,747
2026	17,295	17,585	17,875
2027	17,385	17,676	17,968
2028	17,475	17,768	18,061
2029	17,565	17,860	18,154
2030	17,657	17,953	18,249
2031	17,748	18,046	18,343
2032	17,840	18,139	18,438
2033	17,933	18,233	18,534
2034	18,026	18,328	18,630
2035	18,119	18,423	18,727
2036	18,213	18,519	18,824
2037	18,308	18,615	18,922

2.4.1.2 Demand Confidence Interval

The confidence interval for the demand forecast is derived from the seasonal model which contains the greatest number of peak observations. To illustrate the forecast range stemming from historical variation from the model, the 95% confidence interval for the demand forecast is listed below.

Table 2.4.1.2
95% Confidence Interval
Internal Peak Demand (MW)

Year	Lower Confidence Interval	IPL (MW)	Upper Confidence Interval
2017	2,894.7	3,083.7	3,272.7
2018	2,861.2	3,048.1	3,234.9
2019	2,877.1	3,065.0	3,252.9
2020	2,886.8	3,075.3	3,263.8
2021	2,901.6	3,091.0	3,280.5
2022	2,917.6	3,108.1	3,298.7
2023	2,934.3	3,126.0	3,317.6
2024	2,951.3	3,144.1	3,336.8
2025	2,968.6	3,162.4	3,356.3
2026	2,985.9	3,180.9	3,375.9
2027	3,003.4	3,199.5	3,395.7
2028	3,020.9	3,218.2	3,415.5
2029	3,038.6	3,237.0	3,435.5
2030	3,056.4	3,256.0	3,455.6
2031	3,074.2	3,275.0	3,475.8
2032	3,092.2	3,294.1	3,496.1
2033	3,110.3	3,313.4	3,516.5
2034	3,128.5	3,332.8	3,537.1
2035	3,146.8	3,352.3	3,557.8
2036	3,165.2	3,371.9	3,578.6
2037	3,183.7	3,391.6	3,599.5

2.4.2 Scenarios

To indicate the sensitivity of the resource plan to higher or lower than forecasted growth, IPL modeled a high and low load forecast as noted in Tables 2.4.2.1 and 2.4.2.2. To develop the loads for these scenarios, IPL increased or decreased the expected growth rate of the base forecast by 50 basis points. Load could vary due to changes in variables other than economic variables, such as changes in wholesale contracts, distributed generation installations, conservation actions, economic development or changes in electric prices.

Table 2.4.2.1
Energy Scenarios (GWH)

Year	Low	Base	High
2017	17,081	17,081	17,081
2018	16,773	16,858	16,944
2019	16,619	16,788	16,958
2020	16,671	16,925	17,181
2021	16,693	17,031	17,375
2022	16,721	17,145	17,578
2023	16,705	17,214	17,736
2024	16,738	17,335	17,949
2025	16,775	17,459	18,168
2026	16,812	17,585	18,390
2027	16,815	17,676	18,577
2028	16,818	17,768	18,766
2029	16,821	17,860	18,957
2030	16,824	17,953	19,150
2031	16,827	18,046	19,346
2032	16,831	18,139	19,543
2033	16,834	18,233	19,742
2034	16,837	18,328	19,943
2035	16,840	18,423	20,146
2036	16,843	18,519	20,351
2037	16,847	18,615	20,559

Table 2.4.2.2
Internal Peak Demand
Scenarios (MW)

Year	Low	Base	High
2017	3,083.7	3,083.7	3,083.7
2018	3,032.6	3,048.1	3,063.5
2019	3,034.3	3,065.0	3,095.8
2020	3,029.4	3,075.3	3,121.7
2021	3,029.7	3,091.0	3,153.3
2022	3,031.3	3,108.1	3,186.5
2023	3,033.6	3,126.0	3,220.7
2024	3,035.9	3,144.1	3,255.5
2025	3,038.5	3,162.4	3,290.8
2026	3,041.1	3,180.9	3,326.5
2027	3,043.7	3,199.5	3,362.5
2028	3,046.2	3,218.2	3,399.0
2029	3,048.8	3,237.0	3,435.9
2030	3,051.4	3,256.0	3,473.1
2031	3,054.0	3,275.0	3,510.8
2032	3,056.6	3,294.1	3,548.9
2033	3,059.1	3,313.4	3,587.4
2034	3,061.7	3,332.8	3,626.3
2035	3,064.3	3,352.3	3,665.6
2036	3,066.9	3,371.9	3,705.4
2037	3,069.5	3,391.6	3,745.6

2.5 Comparison to Prior Plan

See table 2.5.1 for a comparison of the Energy forecasts between the current and prior plan.

Table 2.5.1
Comparison of Energy Forecasts (GWH)

Year	2017 IRP	2014 IRP	Variance	Percent
2014	NA	16,928	NA	NA
2015	NA	17,115	NA	NA
2016	NA	17,274	NA	NA
2017	17,081	17,428	-346.8	-2.0%
2018	16,858	17,585	-726.9	-4.1%
2019	16,788	17,728	-939.9	-5.3%
2020	16,925	17,884	-959.2	-5.4%
2021	17,031	18,041	-1,009.8	-5.6%
2022	17,145	18,200	-1,055.1	-5.8%
2023	17,214	18,360	-1,146.0	-6.2%
2024	17,335	18,522	-1,187.5	-6.4%
2025	17,459	18,685	-1,225.7	-6.6%
2026	17,585	18,850	-1,265.1	-6.7%
2027	17,676	19,016	-1,339.9	-7.0%
2028	17,768	19,184	-1,416.2	-7.4%
2029	17,860	19,353	-1,493.1	-7.7%
2030	17,953	NA	NA	NA
2031	18,046	NA	NA	NA
2032	18,139	NA	NA	NA
2033	18,233	NA	NA	NA
2034	18,328	NA	NA	NA
2035	18,423	NA	NA	NA
2036	18,519	NA	NA	NA
2037	18,615	NA	NA	NA

See Table 2.5.2 for a comparison of the Peak forecasts between the current and prior plan.

Table 2.5.2
Comparison of Internal Peak Demand Forecasts (MW)

Year	2017 IRP	2014 IRP	Variance	Percent
2014	NA	3,121.3	NA	NA
2015	NA	3,151.7	NA	NA
2016	NA	3,179.1	NA	NA
2017	3,083.7	3,205.7	-122.0	-3.8%
2018	3,048.1	3,232.8	-184.7	-5.7%
2019	3,065.0	3,257.6	-192.6	-5.9%
2020	3,075.3	3,284.6	-209.3	-6.4%
2021	3,091.0	3,311.8	-220.8	-6.7%
2022	3,108.1	3,339.3	-231.2	-6.9%
2023	3,126.0	3,368.8	-242.8	-7.2%
2024	3,144.1	3,398.5	-254.4	-7.5%
2025	3,162.4	3,428.4	-266.0	-7.8%
2026	3,180.9	3,458.6	-277.7	-8.0%
2027	3,199.5	3,489.1	-289.6	-8.3%
2028	3,218.2	3,519.9	-301.7	-8.6%
2029	3,237.0	3,550.9	-313.9	-8.8%
2030	3,256.0	NA	NA	NA
2031	3,275.0	NA	NA	NA
2032	3,294.1	NA	NA	NA
2033	3,313.4	NA	NA	NA
2034	3,332.8	NA	NA	NA
2035	3,352.3	NA	NA	NA
2036	3,371.9	NA	NA	NA
2037	3,391.6	NA	NA	NA

IPL's current internal peak demand and energy forecasts are lower than the prior forecasts largely due to a combination of lower than forecasted growth in the residential and industrial classes and the anticipated loss of a wholesale contract in 2018.

Overview of the Load Forecast

IPL's Load forecast has two main components—the energy forecast and the demand forecast. The methodologies and data for calculating these components are included in sections A, B, D, and E of this document. Sections C and F include detailed model information for the forecasts, as well as variable definitions.

A. IPL Energy Forecast – Methods

The IPL energy forecast is derived using the following four steps:

Step 1. Customer count forecast. The calculation of IPL's energy forecast starts with a forecast of the number of customers. Residential, commercial, and industrial customer counts are forecasted using regression models that are principally based on economic data purchased from Woods and Poole Economics, INC (W&P).

Step 2. Use per customer forecast. A use per customer forecast is produced for each revenue class using regression modelling techniques. Models incorporate the calendar month, and in the case of the residential and commercial classes, monthly counts of heating and cooling degree days. A select group of large customers are excluded from the regression models and forecasted individually.

Step 3. Multiply customer counts by use per customer forecasts. Forecasted customers are then multiplied by the results of the class-level use per customer regression models. The resulting sales forecasts are added to specific large customer forecasts and then compared with recent historical class-level sales.

Step 4. Forecast adjustments. Sales forecasts are adjusted for external factors that are largely absent from the historical data, including customer-owned generation, changes in lighting standards, and electric vehicles. Forecasts of IPL's smaller classes are also added. Finally, estimated transmission and distribution losses are applied to arrive at the energy forecast. IPL uses the growth in energy sales from the last year of its 10-year forecast (2025 to 2026) to forecast long term energy sales for years 2026 through 2035.

B. IPL Energy Forecast - Data

Sources of information for key factors used in this process include:

- Sales and customer counts (IPL uses 5 years and 8 months of calendar month data).
- Weather is measured using Heating Degree Days (HDD) and Cooling Degree Days (CDD) and matched to the sales. Normal is defined as the 20-year rolling average using the average of the daily high and low temperature with a base of 65 degrees. Weather is reported from the Eastern Iowa Airport in Cedar Rapids, Iowa. Weather is also represented by the hs1314 variable which indicates a colder than normal heating season of 2013-14.
    - Calendar based indicator variables (month)
- Economic data comes from a third party vendor, W&P, unless otherwise stated.

- Customer count regression models use aggregations of the W&P county-level economic data that are representative of the IPL service territory. The three customer count regression models and the industrial sales model use the following W&P economic data:
  - Residential customer count forecast – Aggregation of county-level population estimates.
  - Commercial customer count forecast – Aggregation of county-level non-manufacturing employment.
  - Industrial customer count forecast – Aggregation of county-level manufacturing income.
  - Industrial sales forecast – Aggregation of county-level real per-capita personal income.

C. IPL Demand Forecast - Definitions

Internal Peak Demand is defined as the highest observed hourly load. For forecasting purposes, IPL adds any interruptions or Direct Load Control (DLC) to the Internal Peak Demand to calculate the Theoretical Internal Peak Demand. The forecast regression model is performed on the daily Theoretical Internal Peak Demand less the demands of a number of large customers, whose demands are forecasted individually.

D. IPL Demand Forecast - Methods

To forecast demand, IPL reduces historical theoretical system load data by the load attributed to the large customers which are forecasted individually. The remaining customers are forecasted using a regression model that predicts daily theoretical internal peak demand as a function of multiple variables. Variables include weather, calendar month peak demand, day of week, holidays, gross regional product, binary variables that capture the deviation of monthly and annual peak demands from average daily demands, and a binary variable that corrects for the below average demands that resulted from the flood of 2008, which had meaningful impacts on economic activity within IPL's electric service territory. The individually-forecasted large customer demands are added to the modeled results to arrive at the total IPL system demand forecast. The demand forecast is then compared with the corresponding energy model. For consistency, the growth rate of the demand forecast was adjusted to match the growth rate from the energy forecast.

E. IPL Demand Forecasts - Data

The regression model uses:

- Theoretical demand less large customer demand (large customer demand is forecasted independently from the regression models)
- Calendar based indicator variables (month, day of week, holidays)
- Weather data from the Eastern Iowa Airport in Cedar Rapids, Iowa.
    - Daily max temperature
    - Overnight low temperature
    - Daily max temperature of prior day
    - Daily max dew point
    - Daily average wind speed
- Economic variable (gross regional product) from W&P
- Indicator for the 2008 flood

- Indicator for monthly and annual system peaks

F. IPL Forecast Model Details

1. *IPL Residential Sales*

Residential Customer Forecasts

Table A.1.a provides the summary statistics and parameter estimates of the residential customer prediction model.

Table A.1.a
IPL Residential Customer Model Parameters

Maximum Likelihood Estimates

SSE	1163163.21	DFE	53
MSE	21946	Root MSE	148.14343
SBC	920.819277	AIC	887.526661
MAE	91.4338876	AICC	896.757431
MAPE	0.02239868	HQC	900.718215
Log Likelihood	-428.76333	Regress R-Square	0.7241
Durbin-Watson	1.6412	Total R-Square	0.9839
		Observations	68

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-1790	62990	-0.03	0.9774
feb	1	-25.4074	60.6307	-0.42	0.6769
mar	1	-166.9189	81.7582	-2.04	0.0462
apr	1	-577.8987	95.2365	-6.07	<.0001
may	1	-645.0290	106.0289	-6.08	<.0001
jun	1	-681.8236	111.5286	-6.11	<.0001
jul	1	-745.7590	112.5187	-6.63	<.0001
aug	1	-813.9251	112.7003	-7.22	<.0001
sep	1	-823.8879	109.1187	-7.55	<.0001
oct	1	-765.3487	101.2643	-7.56	<.0001
nov	1	-476.7064	87.9958	-5.42	<.0001
dec	1	-123.8606	65.8621	-1.88	0.0655
ipl_pop_wp	1	333.2893	51.1230	6.52	<.0001
collections	1	-313.6279	119.8962	-2.62	0.0116
AR1	1	-0.9085	0.0553	-16.43	<.0001

Residential Use-Per-Customer Forecast

Table A.1.b shows the results of the IPL Residential model.

Table A.1.b
IPL Residential Sales Model Parameters

The REG Procedure
Model: MODEL1
Dependent Variable: Res_UPC Res_UPC

Number of Observations Read	192
Number of Observations Used	68
Number of Observations with Missing Values	124

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	1.70344	0.12167	147.87	<.0001
Error	53	0.04361	0.00082286		
Corrected Total	67	1.74705			

Root MSE	0.02869	R-Square	0.9750
Dependent Mean	0.79286	Adj R-Sq	0.9684
Coeff Var	3.61797		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.64019	0.04626	13.84	<.0001
Feb	Feb	1	-0.17599	0.01730	-10.17	<.0001
Mar	Mar	1	-0.14503	0.02464	-5.89	<.0001
Apr	Apr	1	-0.15873	0.03530	-4.50	<.0001
May	May	1	-0.14020	0.04250	-3.30	0.0017
Jun	Jun	1	-0.10375	0.04874	-2.13	0.0380
Jul	Jul	1	0.00986	0.05269	0.19	0.8523
Aug	Aug	1	-0.01020	0.04983	-0.20	0.8386
Sep	Sep	1	-0.10175	0.04362	-2.33	0.0235
Oct	Oct	1	-0.15875	0.03531	-4.50	<.0001
Nov	Nov	1	-0.15451	0.02447	-6.32	<.0001
Dec	Dec	1	-0.05392	0.01831	-2.95	0.0048
CR_HDD	CR_HDD	1	0.00026290	0.00003204	8.21	<.0001
CR_CDD	CR_CDD	1	0.00137	0.00009414	14.54	<.0001
hs1314		1	0.01941	0.01707	1.14	0.2604

2. IPL Commercial Sales

Commercial Customer Forecasts

Monthly commercial customer counts are estimated using the following time series econometric model, shown in Table A.2.a.

Table A.2.a
IPL Commercial Customer Model Parameters

Maximum Likelihood Estimates

SSE	204749.912	DFE	54
MSE	3792	Root MSE	61.57650
SBC	799.387692	AIC	768.314584
MAE	39.9538466	AICC	776.239113
MAPE	0.05364903	HQC	780.626701
Log Likelihood	-370.15729	Regress R-Square	0.6304
Durbin-Watson	0.7970	Total R-Square	0.9947
		Observations	68

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	28139	5554	5.07	<.0001
feb	1	-31.7827	24.5817	-1.29	0.2015
mar	1	-78.9513	33.2570	-2.37	0.0212
apr	1	-38.2067	38.8375	-0.98	0.3296
may	1	-9.1847	42.5488	-0.22	0.8299
jun	1	7.0729	44.8812	0.16	0.8754
jul	1	36.4341	46.0224	0.79	0.4320
aug	1	79.3571	46.0897	1.72	0.0908
sep	1	65.8606	44.5724	1.48	0.1453
oct	1	64.7817	41.2926	1.57	0.1225
nov	1	19.1157	35.7962	0.53	0.5955
dec	1	22.4566	26.7033	0.84	0.4041
ipl_emp_no_mfg	1	67.7247	8.1420	8.32	<.0001
AR1	1	-0.9643	0.0317	-30.39	<.0001

Commercial Use-Per-Customer Forecasts

Table A.2.b shows the results of the IPL Commercial model.

Table A.2.b
IPL Commercial Sales Model Parameters

The REG Procedure
Model: MODEL1
Dependent Variable: COM_UPC COM_UPC

Number of Observations Read	192
Number of Observations Used	68
Number of Observations with Missing Values	124

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	6.24375	0.44598	26.94	<.0001
Error	53	0.87731	0.01655		
Corrected Total	67	7.12106			

Root MSE	0.12866	R-Square	0.8768
Dependent Mean	4.34935	Adj R-Sq	0.8443
Coeff Var	2.95811		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	3.56217	0.20747	17.17	<.0001
Feb	Feb	1	-0.24247	0.07758	-3.13	0.0029
Mar	Mar	1	0.05728	0.11053	0.52	0.6064
Apr	Apr	1	-0.04837	0.15833	-0.31	0.7612
May	May	1	0.25982	0.19064	1.36	0.1787
Jun	Jun	1	0.50413	0.21862	2.31	0.0251
Jul	Jul	1	0.58388	0.23630	2.47	0.0167
Aug	Aug	1	0.71073	0.22348	3.18	0.0025
Sep	Sep	1	0.48689	0.19564	2.49	0.0160
Oct	Oct	1	0.56324	0.15837	3.56	0.0008
Nov	Nov	1	0.16700	0.10974	1.52	0.1340
Dec	Dec	1	-0.01760	0.08210	-0.21	0.8311
CR_HDD	CR_HDD	1	0.00062927	0.00014370	4.38	<.0001
CR_CDD	CR_CDD	1	0.00240	0.00042221	5.69	<.0001
hs1314		1	0.06699	0.07654	0.88	0.3854

3. IPL Industrial Sales

Industrial Customer Forecasts

The following model, shown in Table A.3.a, is estimated using a maximum likelihood estimation.

Table A.3.a
IPL Industrial Customer Model Parameters

Maximum Likelihood Estimates

SSE	1456.8962	DFE	65
MSE	22.41379	Root MSE	4.73432
SBC	418.156098	AIC	411.497575
MAE	3.65848947	AICC	411.872575
MAPE	0.22999108	HQC	414.135886
Log Likelihood	-202.74879	Regress R-Square	0.0001
Durbin-Watson	1.2465	Total R-Square	0.9760
		Observations	68

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	1594	167.6505	9.51	<.0001
ipl_mfg_inc_wp	1	0.001249	0.0210	0.06	0.9527
AR1	1	-0.9919	0.0154	-64.38	<.0001

Industrial Use-Per-Customer Forecast

IPL forecasts monthly Industrial sales using the following econometric model of use per meter. Table A.3.b shows the IPL Industrial model results.

Table A.3.b
IPL Industrial Sales Model Parameters

The REG Procedure
Model: MODEL1
Dependent Variable: IND_UPC IND_UPC

Number of Observations Read	192
Number of Observations Used	68
Number of Observations with Missing Values	124

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	11371	947.56653	21.36	<.0001
Error	55	2439.72122	44.35857		
Corrected Total	67	13811			

Root MSE	6.66022	R-Square	0.8233
Dependent Mean	194.79973	Adj R-Sq	0.7848
Coeff Var	3.41901		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	63.68510	21.54741	2.96	0.0046
Feb	Feb	1	-3.30853	3.84562	-0.86	0.3933
Mar	Mar	1	20.37052	3.84651	5.30	<.0001
Apr	Apr	1	2.46498	3.84814	0.64	0.5245
May	May	1	19.89564	3.85036	5.17	<.0001
Jun	Jun	1	23.93188	3.85332	6.21	<.0001
Jul	Jul	1	28.42047	3.85683	7.37	<.0001
Aug	Aug	1	34.58688	3.86111	8.96	<.0001
Sep	Sep	1	8.26591	4.03820	2.05	0.0455
oct	oct	1	24.20801	4.04128	5.99	<.0001
Nov	Nov	1	12.81170	4.04520	3.17	0.0025
Dec	Dec	1	7.48059	4.04971	1.85	0.0701
ipl_rpcpi_wp		1	0.00292	0.00054290	5.38	<.0001

4. IPL Summer Peak

Table A.4 shows the model results.

Table A.4
Summer Peak Parameters

The REG Procedure
Model: d1_b2
Dependent Variable: peak

Number of Observations Read	7670
Number of Observations Used	3862
Number of Observations with Missing Values	3808

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	50	273742632	5474853	1093.05	<.0001
Error	3811	19088495	5008.78900		
Corrected Total	3861	292831127			

Root MSE	70.77280	R-Square	0.9348
Dependent Mean	1843.63550	Adj R-Sq	0.9340
Coeff Var	3.83876		

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1539.54021	27.60245	55.78	<.0001
cs_cool1		1	32.74658	0.59280	55.24	<.0001
cs_cool1L1		1	4.71068	0.59239	7.95	<.0001
cs_cool2		1	-19.55064	4.94169	-3.96	<.0001
cs_cool3		1	5.85465	0.68890	8.50	<.0001
cs_cool3L1		1	3.69558	0.52402	7.05	<.0001
cs_cool4		1	7.31145	0.68810	10.63	<.0001
ss_cool1		1	14.09212	1.07905	13.06	<.0001
ss_cool1L1		1	4.19218	1.15660	3.62	0.0003
ss_cool3		1	8.71689	1.22757	7.10	<.0001
ss_cool3L1		1	7.21004	1.02922	7.01	<.0001
ss_cool4		1	2.91178	1.76958	1.65	0.1000
hs_heat1		1	5.00786	0.20649	24.25	<.0001
hs_heat1L1		1	1.30639	0.20712	6.31	<.0001
ss_heat1		1	2.65607	0.40553	6.55	<.0001
ss_heat1L1		1	1.72701	0.40543	4.26	<.0001
avgwind_cs		1	-8.79179	0.71624	-12.27	<.0001
avgwind_hs		1	4.04777	0.40875	9.90	<.0001

tue		1	3.36117	4.33647	0.78	0.4383
wed		1	2.14328	4.33291	0.49	0.6209
thu		1	-1.93179	4.35727	-0.44	0.6575
fri		1	-37.16639	4.38956	-8.47	<.0001
sat		1	-281.05918	4.35825	-64.49	<.0001
sun		1	-280.05149	4.38438	-63.87	<.0001
feb		1	-35.00243	5.58525	-6.27	<.0001
mar		1	-68.11180	5.99255	-11.37	<.0001
apr		1	-50.14973	12.02786	-4.17	<.0001
may		1	-48.58901	11.30855	-4.30	<.0001
jun		1	101.25160	12.29938	8.23	<.0001
jul		1	176.97879	12.11536	14.61	<.0001
aug		1	184.61339	11.78926	15.66	<.0001
sep		1	116.37684	11.69671	9.95	<.0001
oct		1	50.09475	12.02694	4.17	<.0001
nov		1	2.60191	6.36221	0.41	0.6826
dec		1	29.17359	5.75083	5.07	<.0001
hol_gfr	hol_gfr	1	-151.31440	21.83236	-6.93	<.0001
hol_eas	hol_eas	1	-107.37885	21.79258	-4.93	<.0001
hol_mem	hol_mem	1	-291.05625	22.33251	-13.03	<.0001
hol_lab	hol_lab	1	-318.42062	23.05364	-13.81	<.0001
hol_col	hol_col	1	-7.71842	23.22455	-0.33	0.7397
hol_ind	hol_ind	1	-369.25480	21.76507	-16.97	<.0001
hol_thx	hol_thx	1	-407.16628	24.19245	-16.83	<.0001
hol_bfr	hol_bfr	1	-259.50447	22.99553	-11.28	<.0001
hol_eve	hol_eve	1	-299.07255	27.11402	-11.03	<.0001
hol_xms	hol_xms	1	-441.61618	27.10464	-16.29	<.0001
hol_nye	hol_nye	1	-213.05040	27.13678	-7.85	<.0001
hol_nyd	hol_nyd	1	-281.45722	27.07269	-10.40	<.0001
ipl_grp_wp		1	0.00214	0.00048837	4.38	<.0001
monthly_peak		1	54.65537	6.94288	7.87	<.0001
annual_peak		1	9.30485	24.10495	0.39	0.6995
flood		1	-32.55039	9.62236	-3.38	0.0007