OFFICIAL
EXHIBITS

VERIFIED REBUTTAL TESTIMONY

OF

ERIC FOX

DIRECTOR

FORECAST SOLUTIONS

ITRON, INC.

IURC
PETITIONER'S
EXHIBIT NO. 25-R
9-29-15 AT
DATE REPORTER

ON BEHALF OF

INDIANAPOLIS POWER & LIGHT COMPANY

IURC CAUSE NOS. 44576 / 44602

INCLUDING IPL WITNESS EF ATTACHMENTS 1-R THROUGH 3-R

VERIFIED REBUTTAL TESTIMONY OF ERIC FOX
ON BEHALF OF
INDIANAPOLIS POWER & LIGHT COMPANY

I. BACKGROUND AND INTRODUCTION

Q1. Please state your name, title, and business address.

A1. My name is Eric Fox. My business address is 20 Park Plaza, Suite 910, Boston, Massachusetts, 02116. I am employed by Itron, Inc. ("Itron"),[1] as Director, Forecast Solutions.

Q2. On whose behalf are you testifying?

A2. I am testifying on behalf of Indianapolis Power & Light Company ("IPL" or the "Company").

Q3. Please state your education, professional and work experience.

A3. I received my M.A. in Economics from San Diego State University in 1984 and my B.A. in Economics from San Diego State University in 1981. While attending graduate school, I worked for Regional Economic Research, Inc. ("RER") as a SAS programmer. After graduating, I worked as an Analyst in the Forecasting Department of San Diego Gas & Electric. I was later promoted to Sr. Analyst in the Rate Department. I also taught statistics in the Economics Department of San Diego State University on a part-time basis.

[1] Itron is a leading technology provider and critical source of knowledge to the global energy and water industries. More than 3,000 utilities worldwide rely on Itron technology to deliver the knowledge they require to optimize the delivery and use of energy and water. Itron provides industry-leading solutions for electricity metering; meter data collection; energy information management; demand response; load forecasting, analysis and consulting services; distribution system design and optimization; web based workforce automation; and enterprise and residential energy management.

In 1986, I was employed by RER as a Senior Analyst. I worked at RER for three years before moving to Boston and taking a position with New England Electric as a Senior Analyst in the Forecasting Group. I was later promoted to Manager of Load Research. In 1994, I left New England Electric to open the Boston office for RER which was acquired by Itron in 2002.

Over the last 25 years, I have provided support for a wide range of utility operations and planning requirements including forecasting, load research, weather normalization, rate design, financial analysis, and conservation and load management program evaluation. Clients include traditional integrated utilities, distribution companies, Independent System Operators, generation and power trading companies, and energy retailers. I have presented various forecasting and energy analysis topics at numerous forecasting conferences and forums. I also direct electric and gas forecasting workshops that focus on estimating econometric models and using statistical-based models for monthly sales and customer forecasting, weather normalization, and calculation of billed and unbilled sales. Over the last few years, I have provided forecast training to several hundred utility analysts and analysts in other businesses.

In the area of energy and load weather normalization, I have implemented and directed numerous weather normalization studies and applications used for utility sales and revenue variance analysis and reporting, and estimating booked and unbilled sales and revenue. Recent studies include developing weather-normalized class profiles for cost allocation and rate design, estimating rate class

hourly profile models to support retail settlement activity, weather normalizing historical billing sales for analyzing historical sales trends, developing customer class and weather normalized end-use profiles as part of a utility integrated resource plan, and developing normal daily and monthly weather data to support sales and system hourly load forecasting. My resume is included as IPL Witness EF Attachment 1-R.

Q4. What are your responsibilities as Director, Forecast Solutions?

A4. I am responsible for directing forecast and load analysis work to support electric and gas utility operations and planning. I manage the day-to-day work of Itron's Boston office. I work with utilities and regulatory organizations across the country and in Canada to address a range of long-term and short-term forecasting and load analysis issues. My work also includes directing the activity of Itron's Energy Forecasting Group (a long-term energy forecasting data and analysis service with over 50 participating utilities), conducting forecast workshops and web-based presentations on specific forecasting and analysis topics. I am an active participant in forecasting and load analysis conferences and forums across the country.

Q5. Have you previously testified before a regulatory commission?

A5. Yes. I provided testimony related to weather normalization and forecasting in several regulatory proceedings. My regulatory experience is listed in IPL Witness EF Attachment 1-R (*Regulatory Experience*).

Q6. What is the purpose of your testimony?

A6. The purpose of my testimony is to address the direct testimony of Michael P. Gorman (representing the Industrial Group ("IG") intervenors) and his proposed residential weather normalization adjustment. I explain why IPL's weather normalization methodology and resulting rate class normalized sales should be approved and Mr. Gorman's adjustment rejected.

Q7. Are you sponsoring any attachments in support of your testimony?

A7. Yes. In addition to IPL Witness EF Attachment 1-R, I am sponsoring: IPL Witness EF Attachment 2-R which includes estimated residential rate class weather normalization models and load analysis used in assessing IPL's estimated test-year residential average use and residential usage trends; and IPL Witness EF Attachment 3-R which provides a copy of the discovery responses I refer to below.

Q8. Were these attachments prepared or assembled by you or under your direction and supervision?

A8. Yes.

Q9. Did you submit supporting workpapers?

A9. Yes. Supporting calculations are provided in the Excel file IPL Workpaper 1 – IPL Witness EF Attachment 2-R.

II. RESPONSE TO MR. GORMAN'S CRITICISM OF IPL'S PROPOSED WEATHER NORMALIZATION ADJUSTMENT

Q10. IG Witness Gorman (pp. 51-52) contends that IPL's residential weather

normal average use understates residential service class kilowatt-hour sales for the test year and as a result overstates revenue deficiency. Do you agree?

A10. No. IPL uses an industry standard approach for weather normalizing sales that appropriately accounts for test-year weather conditions. Because heating and cooling requirements are a substantial proportion of residential electricity usage, rate class sales and demand vary significantly with changing temperatures. The objective of weather normalization is to establish test-year sales that reflect expected or normal weather conditions eliminating test-year variation due to actual weather variation during the test-year.

The IPL test-year period (July 2013 to June 2014) includes a cold winter with heating degree-days ("HDD") 15% higher than normal. As Mr. Gorman recognizes (p. 11) the test year included the "polar vortex". The test year also included a warmer than normal summer with cooling degree-days ("CDD") 8% above normal. Both winter and summer month sales should be weather normalized down and IPL's approach to doing so is reasonable.

I disagree with Mr. Gorman's contention (pp. 52-53) that IPL's adjustment needs correction. IPL used a regression-based model approach for weather normalizing sales. The process entails first estimating HDD and CDD adjustment coefficients based on the relationship between customer usage and HDD and CDD. The resulting HDD and CDD model coefficients give the impact a change in degree-days has on class usage and are used to calculate weather impacts. Given the

estimated HDD model coefficient (b_{HDD}) and estimated CDD model coefficient (b_{CDD}), the weather impact is calculated as:

$$WthrImpact = b_{HDD} \times (HDD_{actual} - HDD_{normal}) + b_{CDD} \times (CDD_{actual} - CDD_{normal})$$

Where HDD_{actual} and CDD_{actual} are actual HDD and CDD, and HDD_{normal} and CDD_{normal} are the normal degree-days.

Weather normalized use is derived by subtracting the weather impact from actual customer usage. The majority of electric utilities use the regression approach for calculating weather impacts as the method works extremely well for determining the impact of weather on sales.

The reason regression models work well can be seen in the IPL residential rate class scatter plots (IPL Witness EF Attachment 2-R (*Residential Billed Sales Scatter Plots, p. 1*)). The scatter plots show the relationship between average monthly use (on the Y axis) and average monthly temperature (on the X axis); to normalize for the number of billing days in each month, usage is shown on a per billing day basis. A separate scatter plot is shown for RS (residential non-electric heating), RC (residential electric water heating), and RH (residential electric heating).

The scatter plots depict a strong relationship between customer average monthly usage and average monthly temperature for the three residential rate classes. This relationship can be captured in a linear regression model that relates usage to HDD (to capture the usage/temperature relationship when temperatures are below 65 degrees) and CDD (to capture the usage/temperature relationship when

temperatures are 65 degrees and above). The scatter plots also show that the usage/temperature relationship varies by rate class. As the usage/temperature relationship differs across rate classes, models estimated at the rate class level (*i.e.*, RS, RC, and RH) will result in more accurate weather normal rate class sales estimates than estimating weather normal sales using aggregated residential usage data.

Regression model-based HDD and CDD coefficients can be estimated using monthly sales data, daily load research data, and in the case of IPL actual customer daily-use data. IPL's use of actual daily customer usage should provide a level of accuracy greater than using representative profiles derived from load research data or aggregated billing data.

Q11. Given weather conditions over the test-year, are IPL's weather normalized residential sales estimates understated as Mr. Gorman claims?

A11. No. I was able to verify the reasonableness of IPL's weather normalized residential sales using historical rate class billing data. Monthly billed sales data is used to estimate monthly average use regression models for each residential rate class - RS, RC and RH. Models are estimated using data from January 2008 through June 2014 (the end of the test-year period). Model variables include monthly HDD and CDD, the number of billing days in the month, and a trend variable to capture the usage trend over the estimation period. As the billed sales reflect usage in the current and prior calendar month, the HDD and CDD weather variables are calculated on a cycle-weighted basis (roughly 50% of the prior and

50% of the current month). The estimated models are statistically strong with high model Adjusted R-Squared statistics (a measure of overall model fit) and highly significant weather adjustment coefficients as measured by the HDD and CDD variable T Statistics.

While monthly models using billed sales data will not be as accurate as IPL's use of actual daily customer data, the estimates should be relatively close. Using the billed sales models, estimated weather normal average use for total RS (includes rate codes RS, RC, and RH) is 12,065 kWh; using the test-year customer count (rather than billing unit counts) the weather normal average use is 12,025 kWh – just slightly higher than that estimated by IPL using actual customer usage data. I would add that my estimates will also vary from IPL's as these estimates are derived from billed sales data which does not totally correspond with calendar month usage. For the same reason, the revenue-month HDD and CDD are slightly different from the calendar-month HDD and CDD. A comparison of the calendar test-year and billing-month HDD and CDD are provided in IPL Witness EF Attachment 2-R (*Test Year Weather, p. 5).*

The estimated model coefficients and model statistics are included in IPL Witness EF Attachment 2-R (*Model Statistics, p. 2*). Test-year weather normal sales estimates are shown in IPL Witness EF Attachment 2-R (*Test Year Weather Normal Average Use, p. 4*). As noted above, the supporting work papers are also provided.

III. RESPONSE TO MR. GORMAN'S PROPOSED RESIDENTIAL WEATHER NORMAL AVERAGE USE

Q12. Mr. Gorman (p. 53) proposes adjusting IPL's revenue requirements down based on his higher residential weather normal average use calculation for the test-year. Is Mr. Gorman's reason for adjusting IPL's residential weather normal use reasonable?

A12. No. Mr. Gorman states in his testimony that IPL's estimated weather normal average use for the residential class is too low. Mr. Gorman provides no evidence as to why the RS weather normal average use is too low other than as he states "[m]y conclusion ... is based on actual sales during periods of normal weather" (Gorman, p. 52). Mr. Gorman asserts that IPL's proposed adjustment is unreasonable but does not identify any specific flaw in IPL's weather normalization methodology. Nor does Mr. Gorman identify any specific issues with weather normalized sales and billing determinants for the other revenue classes. The method used by IPL for estimating weather normal residential sales and billing determinants is the same approach as that used in weather normalizing sales and billing determinants for all revenue classes.

Q13. Is Mr. Gorman's approach for calculating test-year weather normal residential average use reasonable?

A13. No. Mr. Gorman (p. 53) proposes using the average residential customer use between 2011 and 2013 as a proxy for test-year weather normal residential usage (this estimate is used in recommending his revenue adjustment). His rationale is that average HDD and CDD across the three-year period is close to normal, so the

average residential usage must also be close to normal. Mr. Gorman's original testimony used Indiana, not Indianapolis data. When we asked about this, he revised his testimony. The average CDD, however, over this period is not close to normal when CDD are calculated using Indianapolis weather data.

Mr. Gorman's response to IPL's Data Request No. 2-4, included herewith as IPL Witness EF Attachment 3-R, and his Revised Exhibit MPG-9 show Indianapolis HDD over the three-year period (2011 to 2013) are relatively close to normal (7.0% below normal), but the CDD, on average, are 28.5% above normal. Mr. Gorman's revised exhibit shows that his estimation period includes two very hot summers; in 2011 CDD were 34.7% above normal and in 2012 CDD were 42.9% above normal. Even in 2013 CDD were 8.0% above normal. Mr. Gorman's proposed normal average use of 12,469 kWh (Gorman Direct, p 52), would include higher than normal cooling loads as summer CDD are significantly higher than normal.

Q14. Is Mr. Gorman's approach for calculating test-year weather normal residential average use a reasonable means for weather normalizing the test-year?

A14. No. The purpose of a test-year period is to define a 12-month period that as closely as possible reflects market and structural conditions given normal weather. In the residential sector, these conditions include demographics (*e.g,* number of household members, age distribution), economic activity, mix of housing type (*e.g,* single family, multi-family), housing size, appliance saturation,

and end-use stock efficiency. By averaging across three years (even assuming normal weather conditions), Mr. Gorman's estimate reflects the *average* market and structural conditions over a prior three year period that doesn't even include half the months in the test-year period. By averaging across three years, Mr. Gorman's method will by construction be too high as it fails to capture declining average residential usage that has been driven by changing housing stock mix, end-use efficiency improvements, and IPL energy efficiency programs.

Largely as a result of efficiency improvements (driven by new appliance standards, and utility and state energy efficiency programs), residential average use has been trending downwards across the U.S. IPL weather normalized average use has been declining for all three residential rate classes - RS, RC, and RH. Since 2008, non-heating residential average use (RS) has declined 0.7% annually, customers with electric water heating have averaged 1.0% annual declines, and electric heat customer's average use has declined 1.7% annually. The average annual usage decline across all three rate classes is 0.9% (IPL Witness EF Attachment 2-R (*Residential Customer Usage Trends, p. 6*)). These structural changes in customer usage trends will not be captured using Mr. Gorman's approach of averaging customer usage across past years.

Q15. Has the Commission previously recognized this phenomenon of declining residential usage in determining how best to normalize test year consumption?

A15. Yes. In *Indiana Gas Co.*, Cause No. 36816, 49 PUR4th 594, 1982 Ind. PUC LEXIS 115, *13 (PSCI 10/27/1982), the Commission accepted an adjustment to revenues to reflect consumption levels occurring at the end of the test year so as to capture the effects of declining consumption during the test year.

Q16. Do you have other concerns with Mr. Gorman's approach?

A16. Yes, Mr. Gorman's approach of averaging across all three residential rate classifications – RS, RH, and RC fails to account for the differences in the weather/usage relationship across these rate classes. As depicted in IPL Witness EF Attachment 2-R (*Wthr Scatter Plots*) the relationship between winter temperatures and usage is significantly stronger in the RH rate class than in the RS rate class; the RC rate class response to HDD is somewhat more than in the RS class, but less than that of RH rate class. Responses to changes in CDD also vary by rate class. Given differences in weather response relationship coupled with differences in rate class usage trends, IPL's approach of weather normalizing sales at the rate class level will result in more accurate estimates of weather normal rate class sales and billing determinants than applying a single average adjustment factor to all rate classes based on aggregated residential sales.

Mr. Gorman did not evaluate customer usage by rate class as rate-class detailed billed sales data is not available from FERC Form 1 filings and so does not have an opinion as to if residential response to weather varies by rate class (See IG Response 2-2 included with IPL Witness EF Attachment 3-R). Rate-class level

billing data and associated monthly HDD and CDD is available from IPL; Mr. Gorman could have requested this information from IPL.

The approach used by Mr. Gorman (averaging historical sales as a proxy for weather normal use), is a "second-best" solution. The majority of electric utilities, system operators, and regulatory agencies use regression models coupled with calculated actual and normal HDD and CDD to estimate weather normal sales and delivered energy. The regression methodology is straightforward, well established, and accepted by most state regulatory agencies for rate and forecast related filings.

IV. SUMMARY

Q17. Could you briefly summarize your testimony?

A17. Yes. IPL adopted an industry standard approach for weather normalizing customer usage that produces reasonable results. IPL estimated rate-class level weather adjustments using actual customer usage data; this should be more accurate than using other proxy usage data derived from load research samples or customer billing data. While recognizing that the use of rate class billing data is not as accurate as using actual customer usage data, I was able to validate the reasonableness of IPL's weather normal test-year year sales estimates through constructed weather-response functions estimated with billed sales data and billing counts.

Mr. Gorman proposes adjusting residential test-year revenues lower based on his estimate of weather normal residential average use. Mr. Gorman estimates test-

year average use by averaging actual usage over the three-year period (2011 to 2013). The weather over this period was significantly warmer than normal with 2011 CDD 34.7% above normal, 2012 CDD 42.9% above normal, and 2013 CDD 8.0% above normal (Revised Exhibit MPG-9). As a result Mr. Gorman's proposed test-year residential sales adjustment is too high.

There is little to back Mr. Gorman's reasoning for adopting a higher residential weather normalized use. Mr. Gorman does not find issue with the methodology used by IPL nor the results for any of the other revenue classes. Mr. Gorman's proposed test-year residential usage is not a weather normalized estimate, but rather an average across three prior years (2011 to 2013) that even excludes half the months in the test-year period. Averaging across the prior three-years is not representative of customer usage in the test-year period as it fails to reflect test-year demographic and economic conditions and structural characteristics (such as the efficiency of the existing appliance stock) but rather reflects the average of these factors over the prior three years. Averaging across the three rate classes also fails to account for differences in rate class weather/usage relationship, declining customer usage trends, and differences in the rate of decline across rate classes.

I have been able to validate that the IPL residential weather normalized use for the test-year is reasonable. For the reasons discussed in my testimony Mr. Gorman's estimate is not reasonable. Given there are no expressed issues with IPL's methodology, and estimated weather normal usage for all other IPL revenue

classes, I recommend that the Commission adopt IPL's residential weather normal determinant estimates as well as that for the other revenue classes.

Q18. Does this conclude your prefiled rebuttal testimony?

A18. Yes it does.

VERIFICATION

I, Eric Fox, Director, Forecast Solutions for Itron, Inc., affirm under penalties of perjury that the foregoing representations are true and correct to the best of my knowledge, information and belief.

Eric Fox

Eric Fox

Dated: September 2, 2015

Eric Fox

Director, Forecast Solutions
Itron, Inc.

Education

- M.A. in Economics, San Diego State University, 1984
- B.A. in Economics, San Diego State University, 1981

Employment History

- Director, Forecasting Solutions, Itron, Inc. 2002 - present
- Vice President, Regional Economic Research, Inc. (now part of Itron, Inc.), 1999 – 2002
- Project Manager, Regional Economic Research, Inc., 1994 – 1999
- New England Electric Service Power Company, 1990 – 1994
  Positions Held:
  - Principal Rate Analyst, Rates
  - Coordinator, Load Research
  - Senior Analyst, Forecasting
- Senior Economist, Regional Economic Research, Inc., 1987 – 1990
- San Diego Gas & Electric, 1984 – 1987
  Positions Held:
  - Senior Analyst, Rate Department
  - Analyst, Forecasting and Evaluation Department
- Instructor, Economics Department, San Diego State University, 1985 – 1986

Experience

Mr. Eric Fox is Director, Forecasting Solutions with Itron where he directs electric and gas analytics and forecasting projects and manages Itron's Boston office. Mr. Fox has over 30 years of forecasting experience with expertise in financial forecasting and analysis, long-term energy and demand forecasting, and load research.

Most recently, Mr. Fox has focused on developing and implementing forecast applications to streamline and support utility business operations. This work includes directing development and implementation of Itron's integrated sales and revenue forecasting application (*ForecastManager.net*) and load research system (*LRS*). He also engages in forecast support work, which includes developing energy and demand forecasts for financial and long-term planning, billed and unbilled sales and revenue analysis, weather normalization for monthly sales variance analysis and rate case support, and analyzing technology and economic trends and their impact on long-term energy usage.

Mr. Fox has provided expert testimony and support in rate and regulatory related issues. This support has included developing forecasts for IRP and rate filings, weather normalizing sales and demand for rate filing cost of service studies, providing rate case support and direct testimony and conducting forecast workshops with regulatory staff. He is one of Itron's primary forecast instructors. He provides forecast training through workshops sponsored by Itron, utility on-site training programs, and workshops held by other utility organizations.

Prior to joining RER/Itron, Mr. Fox supervised the load research group at New England Electric where he oversaw systems development, directed load research programs, and customer load analysis. He also worked in the Rate Department as a Principal Analyst where he was responsible for DSM rate and incentive filings, and related cost studies. The position required providing testimony in regulatory proceedings.

Projects, Reports, and Presentations

Residential and Commercial End-Use Energy Trends (SAE Update), Itron Webinar for EFG Members, with Oleg Moskatov and Michael Russo, July 22, 2015

Capturing End-Use Efficiency Improvements through the SAE Model, 3rd CLD Meeting, Vaughan, Ontario, June 24 2015

Modeling New Technologies – When Regression Models Don't Work, Itron Webinar Brown Bag Series, with Oleg Moskatov and Michael Russo, June 9, 2015

Long-Term Demand Forecasting Overview and Training, KCP&L, April 2015

Budget Year 2016, Sales, Revenue, and Load Forecast, Green Mountain Power Company, March 2015

Forecast Review and Training for 2015 Rate Filing, PowerStream, January 2015

Rate Class Customer and Sales Forecast: 2015 Rate Filing, Hydro Ottawa, January 2015

Forecast Systems Implementation and Training, Entergy, January 2015

Long-Term Energy and Demand Forecasting, Ontario Ministry of Energy, January 2015

Load Research Sample Design, Nova Scotia Power, November 2014

Vermont Long-Term Energy and Demand Forecast, VELCO, November 2014

Energy Trends and Utility Survey Results, EUFF Meeting, October 2014

Fundamentals of Forecasting Workshop, Boston, MA, October 2014

Gas Forecasting Workshop with Minnesota PUC Staff, Integrys, September 2014

Load Research System Implementation and Training, NVEnergy, June 2014

Forecasting and Modeling Issues Workshop, Ontario, CA, July 2014

Unbilled Sales Analysis and System Implementation, KCP&L March 2014

Gas Sales and Revenue Forecast Model Development, TECo, December 2013

Forecast Model Development and Training, Duke Energy, October 2013

Sales and Revenue Forecast, GMP, August 2013

Forecast Support and Testimony, TECo, June 2013

Long-Term Energy and Demand Forecast, IRP Filing, GMP, May 2013

Long-Term Energy and Demand Forecast, IRP Filing, Vectren, March 2013

Statistical End-Use Model Implementation, Nova Scotia Power, December 2012

Fundamentals of Forecasting, Workshop, Boston, MA, November 2012

Rate Class Profile Development for Settlement Support, NYSEG and RGE (Iberdrola), September 2012

Budget Forecasting System Implementation, and Training, Horizon Utilities, August 2012

Commercial Sales Forecasting: Getting it Right, Itron Brownbag Web Presentation, June 2012

Long-Term Energy Trends and Budget Forecast Assessment, Tampa Electric Company, June 2012

Budget-Year 2013 Sales and Revenue Forecast, Green Mountain Power, April 2012

Long-Term Residential and Commercial Energy Trends and Forecast, Electric Utility Forecasting Week, Las Vegas, May 2012

NV Energy Forecast Workshop, with Terry Baxter, NV Energy, March 2012

Commercial Sales Forecasting, the Neglected Sector, Electric Utility Forecasting Forum, Orlando, November 2011

Vermont Long-Term Energy and Demand Forecast, Vermont Electric Transmission Company, November 2011

Fundamentals of Forecasting Workshop, Boston, September 2011

Forecasting Top 100 PPL Load-Hours, with David Woodruff, AEIC Summer Load Research Conference, Alexandra, VA, August 2011

Budget and Long-Term Energy and Demand Forecast Model Development, Central Electric Power Cooperative, April 2011

Development of an Integrated Revenue Forecasting Application, TVA, March 2011

Integrating Energy Efficiency Into Utility Load Forecasts, with Shawn Enterline, 2010 ACEE Summer Study on Energy Efficiency in Buildings, August 2010

Using Load Research Data to Develop Peak Demand Forecasts, AEIC Load Research Conference, Sandestin, FL, August 2010

Development of a Long-term Energy and Demand Forecasting Framework, Consumer Energy, October 2009

Review of Entergy Arkansas Weather Normalization Methodology for the 2009 Rate Case, Entergy Arkansas Inc., September 2009

Green Mountain Power Budget Year and Rate Case Sales and Revenue Forecast, Green Mountain Power, May 2009

Vectren Gas Peak-Day Design Day Load Forecast and Analysis, Vectren Energy, April 2009

Nevada Power, Long-Term Energy and Demand Forecast, NV Energy, March 2009

Estimating End-Use Load Profiles, Leveraging Off of Load Research Data, Western Load Research Conference, Atlanta, March 2009

Fundamentals of Load Forecasting Workshop, Orlando, March 2009

DPL Long-Term Energy and Demand Forecast, 2009 IRP Filing, Dayton Power & Light, February 2009

Development and Application of Long-Term End-Use Hourly Load Forecasting Model, AEP, October 2008

Load Research from the User's Perspective, AEIC Annual Load Research Conference, Oklahoma City, August 2008

OGE Weather Normalized Sales Study, Estimation of Weather Normalized Sales for 2007 Rate Case, July 2008

Vermont Long-Term and Zonal Demand Forecast, Vermont Power Company, July 2008

Budget Forecast System Implementation, Entergy June 2008

Approaches for Analyzing Electric Sales Trends, Electric Forecasting Group, Las Vegas, May 2008

2008 Budget Sales Forecast, NStar, August 2007

Long-Term Peak Demand Forecast, ITC, August 2007

Long-Term Forecasting Workshops, Ameren and Missouri Public Utilities Commission, April 2007

Fundamentals of Forecasting Workshop, March 2007, Orlando Florida

Statistically Adjusted End-Use Modeling Overview, Vermont Public Utilities Commission, December 2006

2007 Budget Sales and Revenue Forecast, Green Mountain Power Company, October 2006

Estimation of Long-Term Peak, Michigan Electric Transmission Company, August 2006

Review and Estimation of Gas Price Elasticities, with Dr. Stuart McMenamin, PSEG, March 2006

Implementation of Long-Term Energy and Hourly Load Forecasting Application, Project Manager, Florida Power & Light, March 2006

Development of Long-Term Energy and Demand Forecast, Orlando Utilities Commission, February 2006

Development of Long-Term Energy and Demand Forecast, Orlando Utilities Commission, February 2006

Development of Normalized Class Hourly Load Shapes for Cost of Service Study, KCPL, October 2005

Estimation of Long-Term Peak, Michigan Electric Transmission Company, August 2005

Electric Sales and Customer Forecast to Support General Rate Case Filing, (Central Hudson Gas & Electric), July 2005

Development of Long-Term Sales, Energy, and Demand Forecast, Indianapolis Power & Light (IPL), May 2005

Long-Term Gas Sales and Demand Forecast for Vectren of Ohio (submitted to the Ohio Public Utilities Commission, June 2005

Budget Forecasting and Variance Analysis Workshop, Orlando, Florida, April 2005

Residential Fuel Oil Price Response Study, Griffith Oil (subsidiary of Central Hudson Company), November 2004

Review and Analysis of Proposed Changes to Billed and Unbilled Sales Calculation. Indianapolis Power & Light (IPL). September 2004.

Review of 2004 Long-Term Energy and Demand Forecast for Public Service of Colorado. Xcel Energy. August 2004.

Implementation of an Electric and Gas Sale, Revenue, and Variance Analysis and Forecasting Application. NSTAR. Project Manager. June 2004

TVA Implementation of the Interruptible Load Forecast System. Tennessee Valley Authority. Project Manager. May 2004.

Statistically Adjusted End-Use Forecasting Methodology. Electric Forecasting Group. With M. Aydinalp. Las Vegas. April 2004

Fundamentals of Energy Forecasting. New Orleans. April 2004.

Energy and Long-term Hourly Load Forecast. KCP&L. Project Manager. March 2004.

Real Time System Hourly Load Forecasting Application. Florida Power and Light. Project Manager. December 2003

Implementation of an Electric Sales and Variance Analysis Application. Ameren Corporation. Project Manager. October 2003

Implementation of an Electric and Gas Rate Class Sales and Customer Forecast System, Central Hudson Energy. Project Manager. June 2003

Forecasting with Artificial Neural Networks. Workshop. Forecasting Summit. Boston. August 2003

Electric and Water Sales, Customer, and Revenue Forecast. Orlando Utilities Commission. March 2003.

Construction of a Delivery Point Forecast System. Tennessee Valley Authority. Project Manager. November 2002

Delivery of a System Load and Network Demand Forecasting System. Consolidated Edison Company of New York. November 2002

Advanced Forecast Methodologies. Institute of Business Forecasting Workshop. Boston, Massachusetts. August 2002

Implementation of Sales and Revenue Forecasting System. Tampa Electric Company. Project Manager. July 2002

Budget and Long-Term Energy, Demand, and Revenue Forecast. National Grid Company. Project Manager. October 2001

Development of Regional Power Supply Area Forecasts. For National Grid Company. Project Manager. March 2001

Hourly Load Forecast System Implementation and Training. Consumers Energy Company. Project Manager. February 2001

Fundamentals of Energy Forecasting. Forecast Workshop. Orlando, Florida. November 2000

Using Regression Modeling for Weather Normalizing Electric Sales. MetrixND User Group Meeting. San Diego. October 2000

Regulatory Experience

Jan 2015 - current: Assisting PowerStream with developing and supporting the 2015 rate case sales and customer forecast before the Ontario Energy Board

Jan 2015 - current: Assisting Hydro Ottawa with developing and supporting the 2015 rate case sales and customer forecast before the Ontario Energy Board

Oct 2014 – current: Assisting Entergy Arkansas with developing and supporting weather adjusted sales and demand estimates for the 2015 rate case.

September 2014: Assisted with developing the budget sales and revenue forecast and provided regulatory support related Horizon Utilities 2014 rate filing before the Ontario Energy Board

August 2013: Reviewed and provided testimony supporting Sierra Pacific Power Company's forecast for the 2013 Energy Supply Plan before the Nevada Public Utilities Commission

July 2013: Reviewed and provided testimony supporting Tampa Electric's forecast for the 2013 rate case before the Florida Public Service Commission

March 2013: Reviewed and provided testimony supporting Entergy Arkansas sales weather normalization for the 2013 rate filing before the Arkansas Public Service Commission

June 2012: Reviewed and provided testimony supporting Nevada Power Company's 2012 Long-Term Energy and Demand Forecast before the Nevada Public Utilities Commission

May 2010: Provided testimony supporting Sierra Pacific Power's Company's 2010 Long-Term Energy and Demand Forecast before the Nevada Public Utilities Commission

March 2010: Assisted with development of the IRP forecast and provided testimony supporting Nevada Power Company's 2010 Long-Term Energy and Demand Forecast before the Nevada Public Utilities Commission

August 2009: Reviewed Entergy Arkansas weather normalization and provided supporting testimony before the Arkansas Public Service Commission

February 2006: Developed long-term forecast and provided testimony to support Orlando Utilities Commission *Need for PowerApplication* before the Florida Public Service Commission

July 2005: Developed sales and customer forecast and provided testimony to support Central Hudson's electric rate filing before the New York Public Service Commission

April 2004: Held Weather Normalization Workshop with the Missouri Public Service Commission Staff

July 2001: Conducted workshop on long-term forecasting with the Colorado Public Utilities Commission Staff

October 1993: Submitted testimony in support of DSM earned incentives and related rate design before the Massachusetts Department Public Utilities, and Rhode Island Public Utilities Commission. Position: Principal Analyst, Rate Department, New England Power Service Company. Supervisor: Mr. Larry Reilly.

June 1993: Testified in matters related to the annual Energy Conservation Services Charge before Massachusetts Department Public Utilities. Position: Principal Analyst, Rate Department, New England Power Service Company. Supervisor: Mr. Larry Reilly.

June 1990: Submitted testimony in Nevada Power's behalf in matters related to gas transportation rates proposed by Southwest Gas in Southwest Gas rate proceedings

before Nevada Public Utilities Commission. Position: Sr. Analyst, Regional Economic Research, Inc.

October 1988: Testified to development and application of a Gas Marginal Cost of Service Study for unbundling natural gas rates as part of a generic hearing to restructure the natural gas industry in California before the California Public Utilities Commission. Position: Sr. Analyst, Rate Department, San Diego Gas & Electric. Supervisor: Mr. Douglas Hansen

I. Residential Billed Sales Scatter Plots

Average Monthly Use per Billing Day vs. Average Monthly Temperature

Figure 1: RS Average Use vs. Average Monthly Temperature

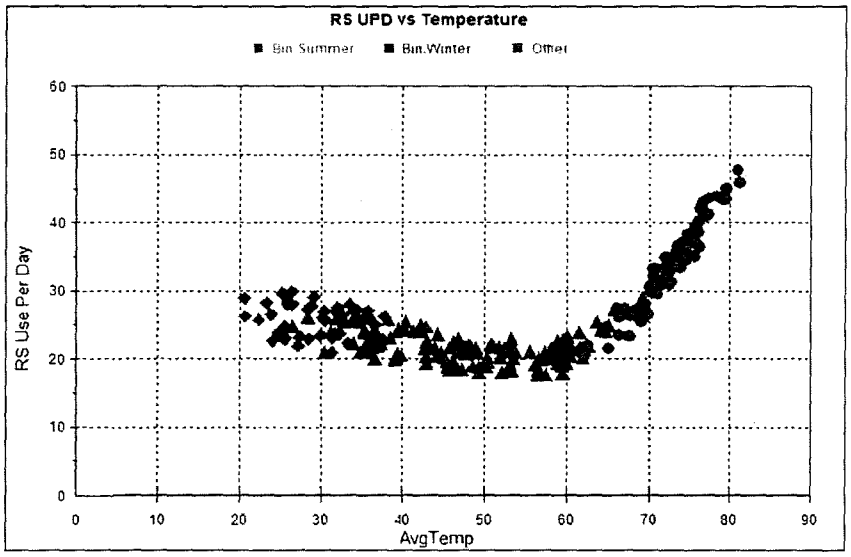


Figure 2: RH Average Use vs. Average Monthly Temperature

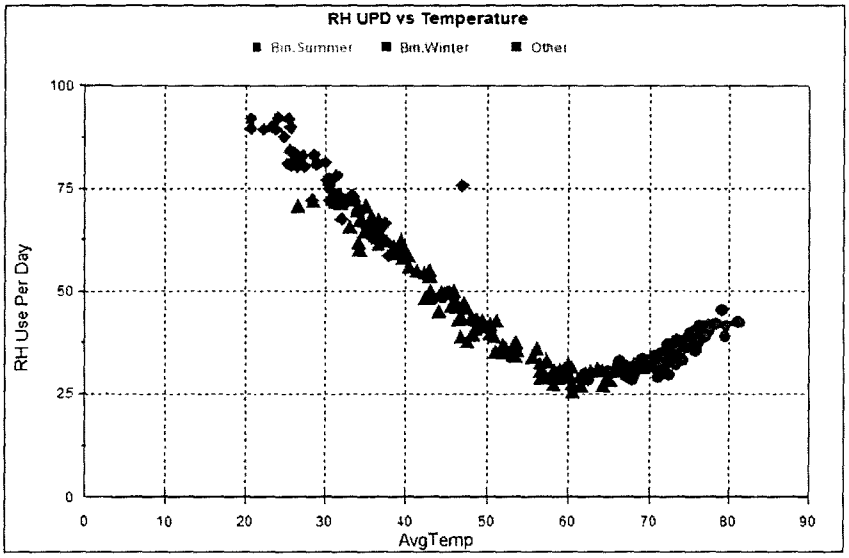
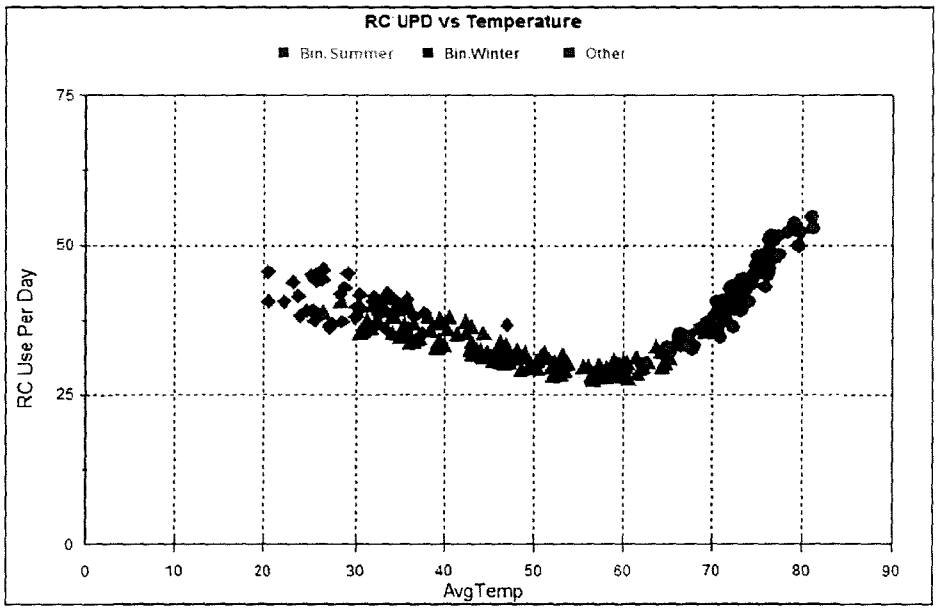


Figure 3: RC Average Use vs. Average Monthly Temperature



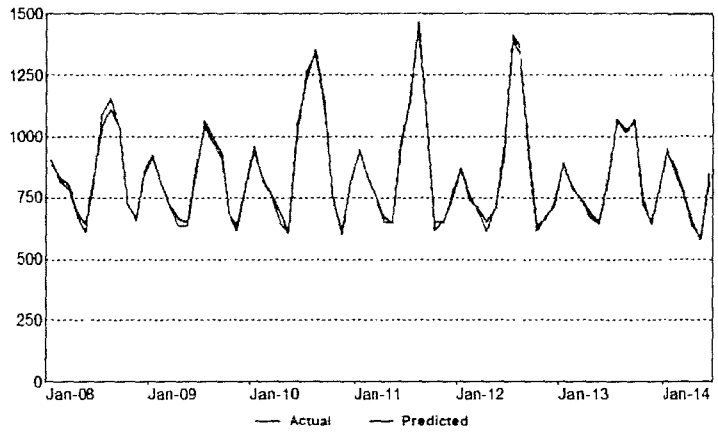
II. Residential Model Statistics

Models estimated using billed sales data and bill counts from January 2008 to June 2014.

RS AvgUse Model

Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	-246.935	92.978	-2.656	0.98%
Bdays	28.646	2.641	10.848	0.00%
HDD	0.292	0.012	24.69	0.00%
CDD	1.896	0.038	50.538	0.00%
July12	-66.631	19.072	-3.494	0.08%
TrendVar	-4.723	2.043	-2.311	2.37%
MA(1)	0.577	0.102	5.667	0.00%

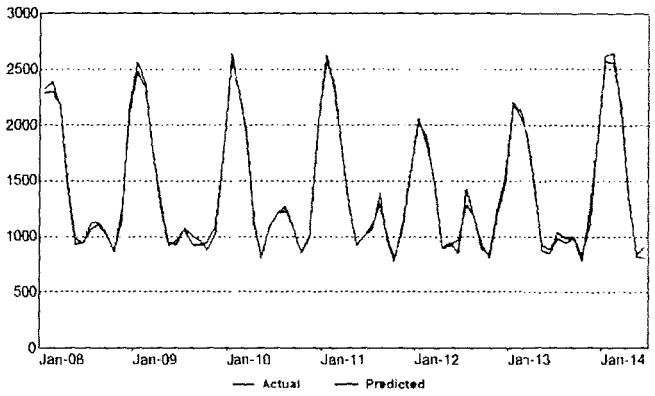
Model Statistics	
Adjusted Observations	78
Deg. of Freedom for Error	71
Adjusted R-Squared	0.988
Std. Error of Regression	21.89
Mean Abs. Dev. (MAD)	17.47
Mean Abs. % Err. (MAPE)	2.12%
Durbin-Watson Statistic	2.008



RH AvgUse Model

Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	11.548	237.911	0.049	96.14%
BDays	32.973	6.77	4.87	0.00%
HDD	1.647	0.029	56.476	0.00%
CDD	1.846	0.089	20.641	0.00%
TrendVar	-25.351	5.165	-4.909	0.00%
MA(1)	0.558	0.102	5.448	0.00%

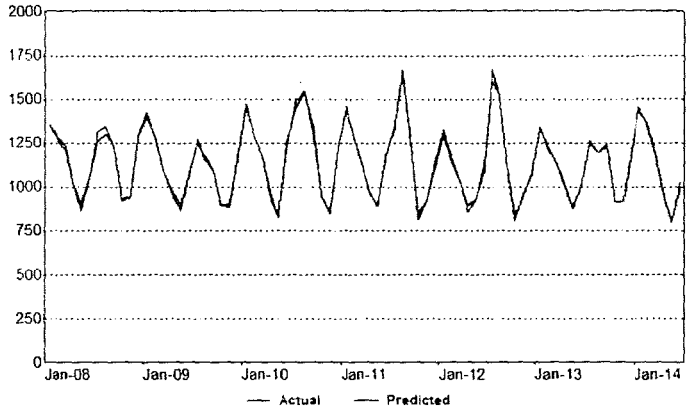
Model Statistics	
Adjusted Observations	78
Deg. of Freedom for Error	72
Adjusted R-Squared	0.990
Std. Error of Regression	55.95
Mean Abs. Dev. (MAD)	42.94
Mean Abs. % Err. (MAPE)	3.38%
Durbin-Watson Statistic	2.086



RC AvgUse Model

Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	-184.383	104.131	-1.771	0.0808
BDays	35.692	3.037	11.754	0.00%
HDD	0.56	0.012	45.142	0.00%
CDD	1.96	0.038	51.17	0.00%
TrendVar	-9.9	2.108	-4.697	0.00%
MA(1)	0.431	0.112	3.865	0.02%

Model Statistics	
Adjusted Observations	78
Deg. of Freedom for Error	73
Adjusted R-Squared	0.986
Std. Error of Regression	25.07
Mean Abs. Dev. (MAD)	19.17
Mean Abs. % Err. (MAPE)	1.70%
Durbin-Watson Statistic	2.038



III. Test-Year Weather Normal Residential Average Use

Total residential test-year weather normal average use is calculated by rate class. Rate classes include RS (non-electric heat), RH (electric heat), and RC (electric water heat). The weather impact is derived using estimated billed sales regression models and actual and normal billing month HDD and CDD. Total residential weather normal sales are derived by adding RS, RH, and RC weather normal sales. Average use is calculated by dividing by the average number of bills issued over the test-year period and by dividing by the test-year customer count. Table 3 shows weather normal test-year billed sales and estimated weather normal billed sales average use.

Table 1: Test-Year Weather Normal Average Use

Billed Sales (MWh)	5,413,811
Average Month Bill Count	423,274
Average Use per Bill (kWh)	12,790
Wthr Nrm Sales (MWh)	5,106,729
Average Month Bill Count	423,274
Average Use per Bill (kWh)	12,065
Test-Year Customer Count	424,688
WN Average Use (kWh)	12,025

Calculations are included in work papers *IPL Witness EF Attachment 2-R.xlsx.*

IV. Test Year Weather

Calendar month HDD and CDD (CalMo HDD and CDD), are based on the daily temperatures that occur in the calendar month. Billing month (BillMo HDD and CDD) are based on the same daily weather data, but are weighted to reflect the billing period.

Customer billing is evenly distributed across the month. Bills at the beginning of the month mostly reflect usage in the prior month. Bills at the end of the month mostly reflect consumption in the current month. Bills in the middle of the month include consumption in the prior month and current month. Billing month HDD and CDD are constructed to be consistent with the billing process and is based off of the meter read schedule. Calendar-month and billing month normal HDD and CDD will vary by month as billing month normal HDD and CDD reflect the billing month period. On an annual basis normal calendar month and billing month HDD and CDD are the same.

Table 1 shows test-year HDD and CDD and Table 2 shows test-year normal HDD and CDD.

Table 2: Test-Year HDD and CDD

Year	Month	CalMo HDD	BillMo HDD	CalMo CDD	BillMo CDD
2013	7	3	1	285	281
2013	8	5	5	319	260
2013	9	26	12	170	291
2013	10	346	113	31	91
2013	11	764	514	-	4
2013	12	1,079	963	-	-
2014	1	1,387	1,282	-	-
2014	2	1,187	1,313	-	-
2014	3	899	1,071	-	-
2014	4	357	621	4	2
2014	5	153	268	100	23
2014	6	2	74	238	140
	Total	6,208	6,237	1,147	1,093

Table 3: Test Year Normal HDD and CDD

Year	Month	CalMo HDD	BillMo HDD	CalMo CDD	BillMo CDD
2013	7	1	2	323	295
2013	8	3	1	288	316
2013	9	71	23	128	202
2013	10	326	173	16	62
2013	11	641	458	1	4
2013	12	1,034	830	-	0
2014	1	1,145	1,151	-	0
2014	2	922	1,086	-	0
2014	3	707	777	2	0
2014	4	372	545	13	1
2014	5	140	261	69	35
2014	6	16	71	226	151
Total		5,378	5,378	1,066	1,066

V. Residential Customer Usage Trends

The graphs below show residential average usage trends for total residential sales and for each residential rate class. Usage has been trending down across all classes largely as a result of significant energy efficiency improvements. The figures below show average annual billed usage trends for total residential, RS, RH, and RC.

Figure 4: Residential Average Use (annual kWh per bill)

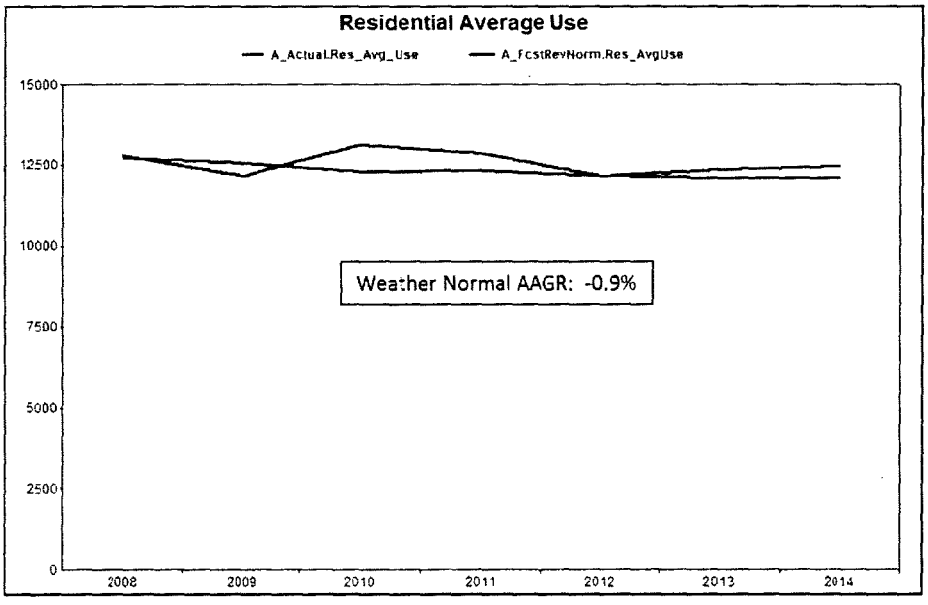


Figure 5: RS Average Use (annual kWh per bill)

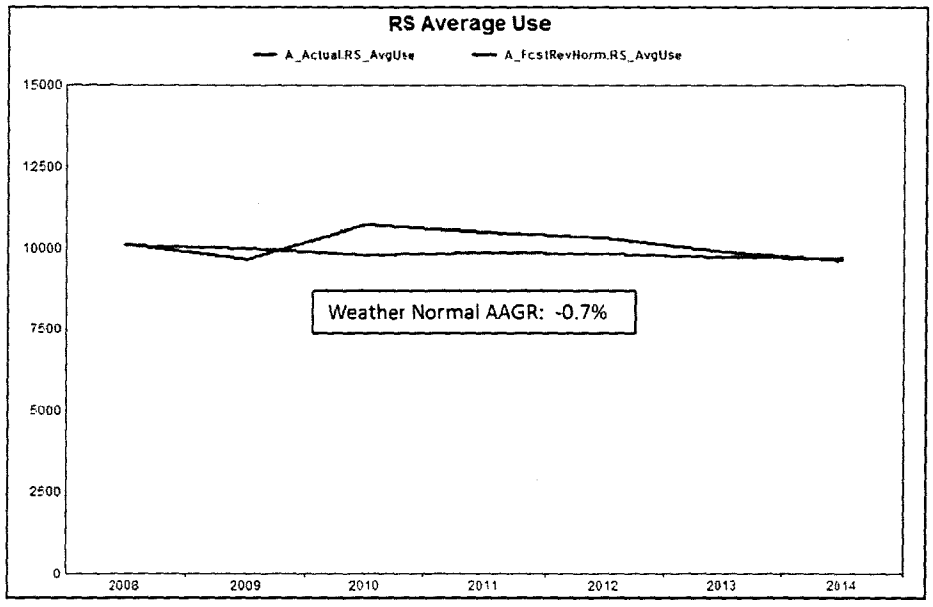


Figure 6: RH Average Use (annual kWh per bill)

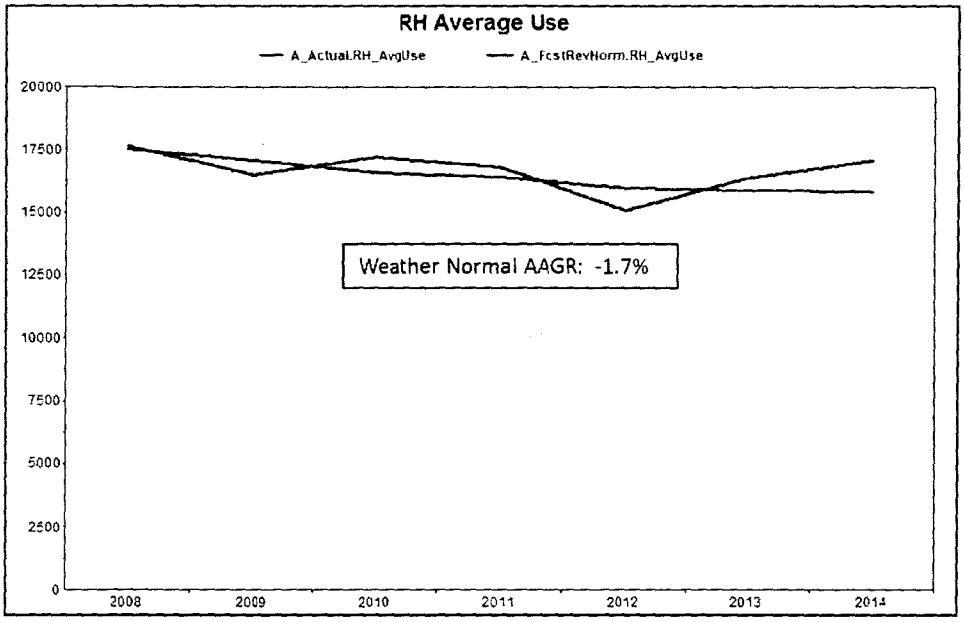
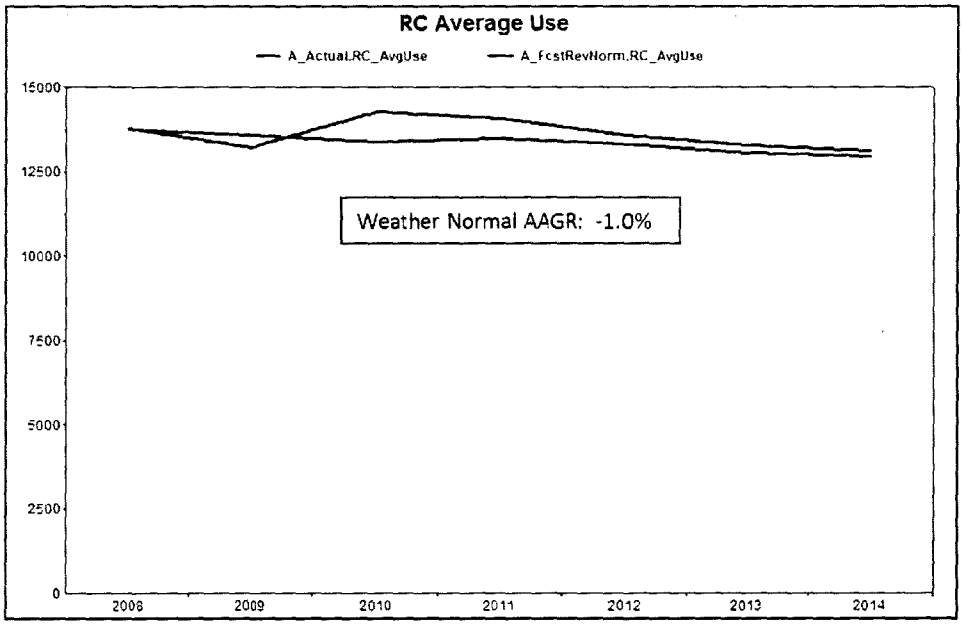


Figure 7: RC Average Use (annual kWh per bill)



STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF INDIANAPOLIS POWER & LIGHT COMPANY ("IPL") FOR AUTHORITY TO INCREASE RATES AND CHARGES FOR ELECTRIC UTILITY SERVICE AND FOR APPROVAL OF: (1) ACCOUNTING RELIEF, INCLUDING IMPLEMENTATION OF MAJOR STORM DAMAGE RESTORATION RESERVE ACCOUNT; (2) REVISED DEPRECIATION RATES; (3) THE INCLUSION IN BASIC RATES AND CHARGES OF THE COSTS OF CERTAIN PREVIOUSLY APPROVED QUALIFIED POLLUTION CONTROL PROPERTY; (4) IMPLEMENTATION OF NEW OR MODIFIED RATE ADJUSTMENT MECHANISMS TO TIMELY RECOGNIZE FOR RATEMAKING PURPOSES LOST REVENUES FROM DEMAND-SIDE MANAGEMENT PROGRAMS AND CHANGES IN (A) CAPACITY PURCHASE COSTS; (B) REGIONAL TRANSMISSION ORGANIZATION COSTS; AND (C) OFF SYSTEM SALES MARGINS; AND (5) NEW SCHEDULES OF RATES, RULES AND REGULATIONS FOR SERVICE.	**CAUSE NO. 44576**
IN THE MATTER OF THE INDIANA UTILITY REGULATORY COMMISSION'S INVESTIGATION INTO INDIANAPOLIS POWER& LIGHT COMPANY'S ONGOING INVESTMENT IN, AND OPERATION AND MAINTENANCE OF, ITS NETWORK FACILITIES.	**CAUSE NO. 44602**

INDUSTRIAL GROUP'S OBJECTIONS AND RESPONSES TO IPL'S SECOND SET OF DATA REQUESTS

Intervenor, Indianapolis Power and Light Industrial Group ("Industrial Group") provides the following responses to Petitioner, Indianapolis Power and Light's ("IPL") Second Set of Data Requests.

PRELIMINARY STATEMENT AND GENERALLY APPLICABLE OBJECTIONS

1. This response is made solely for the purpose of this action.

2. Any response to the propounded data requests is subject to all objections as to competence, relevance, materiality and admissibility, and any and all other objections on

any applicable grounds, all of which objections and grounds are expressly reserved and may be interposed at the time of trial.

3. The Industrial Group has not completed discovery, investigation of the facts or preparation for trial. The following responses are given without prejudice to the Industrial Group's right to produce further or newly discovered responses, witnesses or evidence, or to add, modify or otherwise change or amend the responses herein. The information hereinafter set forth is true and correct as to the best knowledge of the Industrial Group as of this date, and is subject to correction for inadvertent errors, mistakes or omissions.

4. Inadvertent identification or production of privileged writings or information by the Industrial Group is not a waiver of any applicable privilege. Production of writings or information does not waive any objection, including, but not limited to, relevancy to the admission of such writings in evidence.

5. Writings prepared or sent in connection with this litigation, including, but not limited to, pleadings, motions, discovery responses and correspondence from counsel or documents previously given, are not included in the writings produced by the Industrial Group.

6. The Industrial Group objects to each request to the extent that it seeks information protected from disclosure by the attorney/client privilege, attorney work product doctrine and all other applicable privileges. The Industrial Group may produce responsive writings without waiving the foregoing objections.

7. The Industrial Group invites the Petitioner to provide clarification to terms that are denoted as being undefined, vague, ambiguous or unintelligible.

8. The Industrial Group qualifies all responses on the basis that investigation of this matter continues. Additional facts may become available upon further investigation.

9. The Industrial Group objects to the request for information and documents relating to any customers, locations, or practices other than in IPL's service territory on grounds that such requests are overly broad, unduly burdensome and not reasonably calculated to lead to the discovery of admissible evidence.

10. The Industrial Group construes the data requests as being directed to transactions and practices involving electricity. The Industrial Group objects to the extent that any request seeks responses concerning other types of commodities or energy services, on the grounds that such a scope would be overly broad, unduly burdensome and not reasonably calculated to lead to the discovery of admissible evidence.

Request No. 2-2: Please explain why Witness Gorman combined all of the Residential rate classes (RS, RC, RH, CR, and CW) when computing annual average use per customer on Exhibit MPG-10. Does Witness Gorman believe these five customer classes react similarly to weather? Please explain fully.

Objection and Response:

The Industrial Group objects to this request to the extent it is vague and ambiguous as it is posed as a multiple-part, compound, question, and to the extent it is overly broad and unduly burdensome by asking the Industrial Group to "explain fully" the basis of Mr. Groman's adjustment. Notwithstanding these objections, the Industrial Group responds as follows:

As shown on Exhibit MPG-10, the source of the annual data used in developing the exhibit is IPL's workpapers, MSFR filings and FERC Form 1 filings. As IPL combined all Residential rate classes (RS, RC, RH, CR and CW) in those sources, Mr. Gorman combined all Residential rate classes in order to be consistent with IPL's own filings, revenue proof, workpapers, and cost of service study.

Mr. Gorman did not perform a separate analysis based on the rate classes within the Residential class as a whole, instead, he relied on the Company's revenue proof and weather normalization data in order to support his weather normalization adjustment developed Exhibit MPG-10. He therefore has not developed an opinion as to whether or not the individual Residential customer rate classes react similarly or differently to weather events or patterns. He does agree with IPL Witness Chambers' position that residential customers tend to be more sensitive to weather than large commercial and industrial customers. The Company's details, however, do suggest that the actual sales level for the RH rate class appear to reflect the greatest variation and use per customer over the three-year time period he analyzed. Based on that variation it is Mr. Gorman's belief that a majority of the weather normalization adjustment for the Residential class as a whole reflects changes in the RH rate class.

Request No. 2-4: It seems in Witness Gorman Exhibit MPG-9 Workpaper that Indiana degree days were used instead of Indianapolis degree days. Please explain why Indianapolis degree days were not used.

Response:

Mr. Gorman's use of Indiana degree days instead of Indianapolis was an inadvertent error. To the extent necessary, his testimony and exhibits will be corrected to address the error.

Attachment IG 2-4(a) is a revised version of Exhibit MPG-9 that reflects Indianapolis degree days. Attachment IG 2-4(b) is a revised Excel model.

Although Indianapolis degree days over the three-year period were not as close to normal as were Indiana's, they are still reasonably close to normalized sales conditions. Mr. Gorman's adjusted normal sales figure is largely based on residential RH sales, which includes space heating and water heating customers. The three year average of actual HDDs is reasonably close to the level of normal HDDs for that three year period. Thus, Mr. Gorman's conclusions concerning the appropriate weather normalized adjustments to the Company's study have not changed.