Exhibit No.:	
Issues:	Advanced Metering Infrastructure; Off-Peak Electric Vehicle Rates; Demand Response Rates; Property Assessed Clean Energy Financing; On-Bill Financing; Residential Rate Design
Witness:	Martin Hyman
Sponsoring Party:	Missouri Department of Economic Development – Division of Energy
Type of Exhibit:	Direct Testimony
Case No.:	ER-2016-0285

MISSOURI PUBLIC SERVICE COMMISSION

KANSAS CITY POWER & LIGHT COMPANY

CASE NO. ER-2016-0285

DIRECT TESTIMONY

OF

MARTIN R. HYMAN

ON

BEHALF OF

MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT

DIVISION OF ENERGY

Jefferson City, Missouri
December 14, 2016

(Rate Design)

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Kansas City Power & Light Company's Request for Authority to Implement A General Rate Increase for Electric Service	)))	Case No. ER-2016-0285

AFFIDAVIT OF MARTIN HYMAN

STATE OF MISSOURI)
) **ss**
COUNTY OF COLE)

Martin R. Hyman, of lawful age, being duly sworn on his oath, deposes and states:

1. My name is Martin R. Hyman. I work in the City of Jefferson, Missouri, and I am employed by the Missouri Department of Economic Development as a Planner III, Division of Energy.
2. Attached hereto and made a part hereof for all purposes is my Direct Testimony on behalf of the Missouri Department of Economic Development – Division of Energy.
3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct to the best of my knowledge.

Martin R. Hyman

Subscribed and sworn to before me this 14th day of December, 2016.

LAURIE ANN ARNOLD
Notary Public - Notary Seal
State of Missouri
Commissioned for Callaway County
My Commission Expires: April 26, 2020
Commission Number: 16809714

Notary Public

My commission expires: 4/26/20

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Martin R. Hyman. My business address is 301 West High Street, Suite 720, PO Box 1766, Jefferson City, Missouri 65102.

Q. Please describe your educational background and employment experience.

A. In 2011, I graduated from the School of Public and Environmental Affairs at Indiana University in Bloomington with a Master of Public Affairs and a Master of Science in Environmental Science. There, I worked as a graduate assistant, primarily investigating issues surrounding energy-related funding under the American Recovery and Reinvestment Act of 2009. I also worked as a teaching assistant in graduate school and interned at the White House Council on Environmental Quality in the summer of 2011. I began employment with DE in September, 2014. Prior to that, I worked as a contractor for the U.S. Environmental Protection Agency to coordinate intra-agency modeling discussions.

Q. Have you previously filed testimony before the Missouri Public Service Commission ("PSC" or "Commission") on behalf of DE or any other party?

A. Yes. Please see Schedule MRH-1 for a summary of my case participation.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q. What is the purpose of your Direct Testimony in this proceeding?

A. The purpose of my testimony is to respond to the Commission's *Order Directing Consideration of Certain Question in Testimony*,[1] as well as to provide general

[1] Missouri Public Service Commission Case No. ER-2016-0285, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Order Directing Consideration of Certain Questions in Testimony, August 24, 2016.

information about rate design. I also describe DE's proposal to 1) transition away from the declining block rates employed by Kansas City Power & Light Company ("KCP&L" or "Company") for residential general use customers during the winter, as well as 2) implement inclining block rates for residential general use customers during the summer. This transition will provide better price signals to residential customers, thereby encouraging energy efficiency.

Q. What did you review in preparing this testimony?

A. I reviewed the Direct Testimony filed by Company witnesses Mr. Scott H. Heidtbrink, Ms. Marisol E. Miller, and Mr. Tim M. Rush as these filings pertained to rate design and the issues discussed in this testimony, the rate-design-related areas in Company's minimum filing requirements in this case, rate design-related workpapers, the Company's current residential rates for general use customers, the Company's website as it pertains to Property Assessed Clean Energy ("PACE") financing, various Commission and Commission Staff ("Staff") filings in this and other cases, applicable statutes, and relevant aspects of academic, governmental, utility, news media, and other sources pertaining to the issues discussed below.

III. RESPONSE TO COMMISSION ISSUES

Q. Has the Commission requested testimony in this case as to specific issues?

A. Yes. The Commission ordered Staff (and invited other interested parties) to address five specific issues in testimony:

1. Advanced metering infrastructure ("AMI") smart meter installation for residential and commercial customers;
2. Off-peak rates for electric vehicles ("EVs");

3. Optional residential time-of-use ("TOU") and time-of-day ("TOD") rates (collectively referred to herein by the more generic term "demand-response rates");
4. PACE financing; and,
5. Pay As You Save® ("PAYS®") programs, which are a form of on-bill financing.[2]

I address these topics below.

A. ADVANCED METERING INFRASTRUCTURE

Q. What are AMI meters?

A. AMI meters (sometimes called "smart meters") allow two-way communications between utilities and customers. By contrast, automated meter reading ("AMR") meters only allow utilities to remotely read customer usage and other data.[3]

Q. What are the advantages of AMI meters?

A. AMI meters are one component of a "smart grid." Though difficult to precisely define, a smart grid generally incorporates computerized remote control and automation into electric infrastructure. Smart grids have several benefits, including improved reliability and resiliency, improved safety and security, cost control, and greater energy efficiency.[4] AMI in particular facilitates many of these benefits by allowing both customers and the utility to communicate regarding customer usage. This enhances the ability of utilities to respond to outages, expands the ability to accommodate distributed energy resources

[2] *Ibid*, pages 1-2.
[3] Missouri Department of Economic Development – Division of Energy. 2015. "Missouri Comprehensive State Energy Plan" ("CSEP"). https://energy.mo.gov/energy/docs/MCSEP.pdf. Page 141.
[4] *Ibid*, pages 55, 57, and 275.

("DERs"), provides operational savings related to meter reading, and enables advanced demand response programs and other customer service options.[5]

Q. Are there non-cost concerns about AMI?

A. Yes. While cost is one of the critical considerations for AMI deployment, some have expressed privacy- and health-related concerns. There is no credible evidence that AMI (which uses similar communications technology as AMR) negatively impacts human health.[6] However, privacy concerns are of importance in light of the increased focus on cybersecurity, and should be addressed through the development of appropriate customer protections to avoid unauthorized disclosure.

Q. Does DE support AMI deployment for residential and commercial customers?

A. Generally, yes. Grid modernization, discussed at length in the Comprehensive State Energy Plan ("CSEP"), provides many benefits. Deploying AMI is crucial to recognizing the benefits associated with grid modernization, particularly the ability of customers and authorized third parties to have greater access to their utility usage data. So long as the benefits of AMI outweigh its costs – and to the extent that customer AMI data can be adequately protected from unauthorized disclosure – DE views AMI deployment as vital to enabling utilities to serve evolving customer needs and interests. Nonetheless, AMI adoption, while beneficial, should be approached with consideration of the associated costs and technological and financial barriers.

[5] *Ibid*, page 142.
[6] Missouri Public Service Commission Case No. ER-2016-0156, *In the Matter of KCP&L Greater Missouri Operations Company's Request for Authority to Implement A General Rate Increase for Electric Service*, Staff Report – Revenue Requirement Cost of Service, July 15, 2016, Page 201, lines 5-14.

Q. What is the status of AMI deployment in KCP&L's service territory?

A. The Company completed AMI deployment at the end of 2015.[7] DE commends the Company for taking the initiative to deploy AMI and looks forward to proposals by KCP&L to fully utilize this technology's potential.

B. OFF-PEAK ELECTRIC VEHICLE RATES

Q. Does DE support a rate specific to EV charging?

A. No. While DE supports TOU, TOD, critical peak pricing ("CPP"), peak-time rebates ("PTR"), and other demand response rates that can encourage charging during off-peak hours, DE is concerned that the application of such rates to EV charging may a) inappropriately target a single end use and b) be impractical from an infrastructure perspective.

Q. Why might such rates be inappropriate?

A. The Commission generally does not set rates specific to individual end uses (with the exception of such tariffs as the generally frozen space heating rates). However, there is a public policy interest in reducing or shifting peak demand from all end uses, which can appropriately be addressed through the broader use of demand response rates.[8] Consequently, TOU and/or other demand response rates should be applied to all end uses during designated off-peak periods to encourage more efficient system utilization, starting with opt-in rates for residential customers. Such rates can consider the benefits and costs to the wider electric system from peak versus off-peak system utilization by incenting timely electricity usage from a broad array of applications.

[7] Missouri Public Service Commission Case No. ER-2016-0285, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Direct Testimony of Scott H. Heidtbrink of Behalf of Kansas City Power & Light Company, July 1, 2016, page 9, lines 14-19.
[8] See: CSEP, Page 135.

Q. Why might it be impractical to have a separate rate for residential EV charging?

A. Doing so would require that EVCS charging be separately metered, which would be prohibitively expensive, especially for residential customers. Any savings which a residential customer might experience under an off-peak charging rate might not overcome additional metering costs.

C. OPTIONAL DEMAND RESPONSE RATES

Q. Please describe demand response rates.

A. Demand response rates (sometimes also called "time-differentiated rates") include a broad category of rate designs. In general, these rates are used as part of a strategy to promote customer control of usage and shift or reduce peak demand.[9] Types of demand response rates include, but are not necessarily limited to:

- TOU/TOD – In general, TOU and TOD rates define certain time periods as "on-peak" or "off-peak" (and perhaps "shoulder"), with charges that vary depending on these time periods. While TOU/TOD rates are enhanced by AMI metering, these rates do not require AMI metering – only an interval meter is needed.
- Real-Time Pricing ("RTP") – RTP relies on the power prices in wholesale electricity markets or short-run marginal generation costs. AMI meters are needed for RTP.
- Critical Peak Pricing – CPP rates are similar to TOU/TOD rates, except that a small predetermined time period is used a few times a year to set high prices. Customers are told of these days beforehand. While an AMI meter enhances these rates, only interval metering is required.

[9] *Ibid*.

- Peak-Time Rebates – PTR is the inverse of CPP – customers are credited for reduced usage during the designated peak periods. Customer baseline usage must be known beforehand. As with CPP, an AMI meter is useful, but an interval meter is the bare minimum requirement.[10]

Q. Can these types of rates be offered as demand-side management ("DSM") programs under the Missouri Energy Efficiency Investment Act ("MEEIA")?

A. Yes. MEEIA encompasses demand response and peak reduction measures in addition to energy efficiency measures.[11] Additionally, as part of their integrated resource plan filings, investor-owned electric utilities are required to analyze demand response rates in their assessments of DSM measures and programs.[12]

Q. What is the status of KCP&L's demand response rate offerings?

A. In its Report and Order in ER-2014-0370, the Commission allowed KCP&L to freeze the availability of its residential time-of-use, two-part time-of-use, and real time pricing tariffs; the Commission also ordered that a study of these rates be completed, "… within two years of the effective date of this order."[13] The effective date of the Report and Order was September 15, 2015,[14] so KCP&L is required to complete this study by September 15, 2017. According to Mr. Rush, the Company is "working on" this study, "… and will

[10] Lazar, Jim and Gonzalez, Wilson. 2015. "Smart Rate Design For a Smart Future." The Regulatory Assistance Project. http://www.raponline.org/wp-content/uploads/2016/05/rap-lazar-gonzalez-smart-rate-design-july2015.pdf. Pages 44-45.
[11] Sections 393.1075.2(2), (3), and (5), RSMo.
[12] 4 CSR 240-22.050(4).
[13] Missouri Public Service Commission Case No. ER-2014-0370, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Report and Order, September 2, 2015, page 92.
[14] *Ibid*, page 108.

provide the results … in a timely manner."[15] Unfortunately, the study results will not be available for consideration in the current rate case.

Q. What is DE's recommendation with respect to the Company's demand response rates?

A. DE recommends that the Commission require the Company to file with the Commission both the aforementioned study and supporting documentation no later than September 15, 2017. The recommendation to require the Company to file the study upon its completion is consistent with the Commission's Order in ER-2016-0156 (the recently concluded rate case of KCP&L Greater Missouri Operations Company, or "GMO").[16]

D. PROPERTY ASSESSED CLEAN ENERGY FINANCING

Q. What is PACE financing?

A. PACE financing provides funds for investing in energy efficiency, DERs, and other clean energy technologies on customers' premises. Customers utilizing PACE financing repay their improvement costs with the annual energy savings achieved on the project through a voluntary yearly assessment on their property; these assessments typically take on a senior lien status but may be contractually subordinated if necessary for residential projects. Commercial projects typically require lender consent, and the liens can take on subordination as well. [17]

[15] Missouri Public Service Commission Case No. ER-2016-0285, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Direct Testimony of Tim M. Rush on Behalf of Kansas City Power & Light Company, July 1, 2016, page 32, lines 18-19.
[16] Missouri Public Service Commission Case No. ER-2016-0156, *In the Matter of KCP&L Greater Missouri Operations Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Order Approving Stipulation and Agreements, Rejecting Tariffs, Cancelling True-Up Hearing, and Ordering Filing of Compliance Tariffs, September 28, 2016, page 7.
[17] Missouri Department of Economic Development – Division of Energy. Undated. "Property Assessed Clean Energy (PACE)." https://energy.mo.gov/energy/communities/assistance-programs/property-assessed-clean-energy-(pace).

Q. Is PACE financing available in Missouri?

A. Yes. Missouri law allows for PACE programs to be offered at the discretion of local jurisdictions that may join an existing clean energy district and receive representation on a PACE board.[18] Residential PACE financing launched in Jackson County in September and has recently expanded into Clay and Platte counties, Franklin County, the City of Arnold and a number of cities in St. Louis County. Any community that chooses to participate in the Missouri Clean Energy District may offer residential PACE financing. Missouri is the second state in the nation to offer residential PACE.[19] While PACE has financed a number of commercial projects, Missouri has become one of the pioneering states in the PACE financing area by making it available for large agricultural projects, with a PACE loan for Moon Ridge Foods announced this summer.[20] Other recent examples of PACE projects include Kansas City's Wornall Plaza Condominiums and the City of Otterville's wastewater lagoon system.[21]

Q. What is the relationship of PACE financing to utility programs?

A. There is not currently a direct link between PACE financing and utility programs in Missouri. Customers could participate in a PACE program in order to finance energy efficiency improvements, enabling greater participation in utility-sponsored DSM

Missouri Department of Economic Development – Division of Energy. 2016. "Residential PACE – Frequently Asked Questions." https://energy.mo.gov/residential-pace-frequently-asked-questions.

[18] *Ibid.*

[19] Uhlenhuth, Karen. 2016. "Missouri to be second state with residential PACE later this summer." *Midwest Energy News.* July 18. http://midwestenergynews.com/2016/07/18/missouri-to-be-second-state-with-residential-pace-later-this-summer/.

[20] Uhlenhuth, Karen. 2016. "Missouri project may open door to agricultural PACE financing." *Midwest Energy News.* July 29. http://midwestenergynews.com/2016/07/29/pace-project-in-missouri-may-open-door-to-more-agricultural-applications/.

[21] CSEP, page 162.

programs. While utilities do not administer PACE programs, they could guide potential participants in their DSM programs towards PACE financing, where available.

Q. Does DE recommend that KCP&L guide potential DSM program participants towards PACE financing?

A. Yes. The Company already has information on its website related to PACE financing for businesses.[22] The Company should expand its outreach efforts by linking to PACE financing-related information for businesses and residents on its homepage, sending a mailer to customers on financing options, and notifying customers of their financing options during interactions with customer service representatives and energy efficiency contractors.

E. ON-BILL FINANCING

Q. What is PAYS®?

A. PAYS® is a specific type of on-bill financing option. Under PAYS®, a customer receives a loan for an energy-related improvement to his or her property, which is then repaid on the customer's utility bill. PAYS® loans have bill-neutral payback and cost-savings requirements to ensure that customers receive a net financial benefit (i.e., a reduction in their utility bills) even with the loan payments. A customer is required to pay off a specific portion of a PAYS® loan on his or her utility bill, with a risk of disconnection for non-payment. The customer who resides at a property that received a PAYS®-backed improvement (and, hence, is benefitting from the improvement) is responsible for loan repayment; if a customer moves and no longer benefits from the

[22] Kansas City Power & Light Company. 2016. "Energy Efficiency Upgrade Funding." http://www.kcpl.com/~/media/Files/Save%20Energy%20and%20Money/2016%20MEEIA%20Documents/Business%20Energy%20Saving%20Tips/0516KCPLBEER396513PACEUpgradeFundingFactSheetR1.pdf.

improvement, they are therefore no longer responsible for paying off the loan, but the next occupant is responsible.[23] While the trademarked PAYS® product attaches repayment to the meter, similar programs might tie repayment to the customer account.

Q. How is PAYS® distinct from PACE financing?

A. PACE financing is repaid through annual property assessments and is secured by the property itself, while PAYS® is based on repayments through utility bills. This means that PACE is only available to property owners (which could include landlords), while PAYS® could be available to renters as well.[24] PAYS® could either be used by a renter directly with a landlord's permission; by a landlord whose renters pay electric utility bills (in which case the direct benefits and costs of an energy-related improvement would be passed through to the renters); or by a landlord who pays renters' electricity bills (in which case the direct benefits and costs of an energy-related improvement would be passed through to the landlord).

Q. Does the potential for PAYS® deployment in rental housing also mean that PAYS® has greater applicability to low-income customers?

A. Yes, to a degree. A higher proportion of renters have an income below the poverty line as compared to people who own their homes,[25] so PAYS® would be more applicable to the needs of low-income customers and renters than PACE. However, renters would need to coordinate with their landlords before undertaking PAYS® financing; additionally, a

[23] Clean Energy Works. 2016a. "Pay As You Save® (PAYS®) harnesses a proven utility investment model to offer virtually all consumers cost-effective energy upgrades." http://cleanenergyworks.org/blog/pays-financing/.
Clean Energy Works. 2016b. "Basics." http://cleanenergyworks.org/blog/knowledgebase_tags/basics/.
[24] The financial case for PACE funding at a rental property would make the most sense for landlords that are also responsible for renters' electricity bills.
[25] U.S. Census Bureau. 2015 American Community Survey 1-Year Estimates. Table C17019 – Poverty Status in the Past 12 Months of Families by Tenure. Missouri.
http://factfinder.census.gov/bkmk/table/1.0/en/ACS/15_1YR/C17019/0400000US29.

large proportion of low-income customers have limited or non-existent credit records,[26] which can serve as a barrier to receiving PAYS® financing if the program uses credit scores to determine eligibility. Ideally, a PAYS® program would only examine creditworthiness to the extent that such a metric is defined by utility bill payment history; however, even this metric may be unnecessary if a property is assumed to be occupied by anyone in a manner which allows for timely loan repayment. Additionally, on-bill financing can experience very low default rates due to its use of utility bill payments,[27] so checking potential participants' creditworthiness may not be necessary.

Q. Is PAYS® the only option for on-bill financing?

A. No. PAYS® is a specific type of on-bill financing which is tied to the meter; however, financing does not have to be tied to the meter, and program design aspects can vary in other ways. Examples of other financing program designs include those of the Tennessee Valley Authority, Manitoba Hydro, and Alliant Energy; differing aspects of these programs include various funding sources and eligible measures.[28]

Q. What is the relationship of on-bill financing to DSM programs?

A. On-bill financing is, at the least, one mechanism for improving participation in MEEIA programs. On-bill financing benefits all ratepayers, since all costs not covered by utility incentives would ultimately be borne by participants in on-bill financing programs. However, on-bill financing could occur outside the context of MEEIA or other DSM programs, though it would need to be promoted along with DSM programs to maximize

[26] Consumer Financial Protection Bureau, Office of Research. 2015. "Data Point: Credit Invisibles." http://files.consumerfinance.gov/f/201505_cfpb_data-point-credit-invisibles.pdf. Pages 14-15.
[27] Clean Energy Works, 2016a.
[28] Missouri Public Service Commission Case No. EW-2013-0519, *In the Matter of a Working Docket for the State-Wide Advisory Collaborative to Address the Requirements of Commission Rule 4 CSR 240-20.094(8)(B)*, Kristy Manning, "Financing Tools," November 22, 2016, slide 6.

effectiveness. Offering on-bill financing outside the context of MEEIA would avoid complicated decisions regarding throughput disincentives and earnings opportunities, but would also require consideration of how a separate program fits with the utility's other obligations.

Q. Has KCP&L investigated on-bill financing?

A. Yes. Through the collaborative required under the settlement agreements authorizing the second cycle of MEEIA programs for both KCP&L and GMO,[29] the Company considered on-bill financing at the request of stakeholders and indicated that it, "… will investigate the concept of procuring and attracting third party financing to the region, as well as the formation of associations and partnerships with relevant financing institutions…."[30]

Q. Is there an investor-owned utility in Missouri which offers on-bill financing?

A. Yes. The Laclede Gas Company has an "EnergyWise Furnace Financing Program" which provides up to $10,000 per efficient heating system or air conditioner (as well as certain other appliances) for residential and commercial customers.[31]

[29] Missouri Public Service Commission Case No. EO-2015-0240, *In the Matter of Kansas City Power & Light Company's Notice of Intent to File an Application for Authority to Establish a Demand-Side Programs Investment Mechanism*, and Missouri Public Service Commission Case No. EO-2015-0241, *In the Matter of KCP&L Greater Missouri Operations Company's Notice of Intent to File an Application for Authority to Establish a Demand-Side Programs Investment Mechanism*, Non-Unanimous Stipulation and Agreement Resolving MEEIA Filings, November 23, 2015, pages 7-8.

[30] Missouri Public Service Commission Case No. EO-2015-0240, *In the Matter of Kansas City Power & Light Company's Notice of Intent to File an Application for Authority to Establish a Demand-Side Programs Investment Mechanism*, and Missouri Public Service Commission Case No. EO-2015-0241, *In the Matter of KCP&L Greater Missouri Operations Company's Notice of Intent to File an Application for Authority to Establish a Demand-Side Programs Investment Mechanism*, MEEIA 2017-2018 Collaborative Program Review – KCP&L Findings, October 12, 2016, page 7.

[31] The Laclede Gas Company. Undated. "EnergyWise Furnace Financing Program." http://www.lacledegas.com/efficiency/Conservation%20&%20Energy%20Efficiency%20Programs/EnergyWise%20Furnace%20Financing%20Program/.

Q. What is DE's recommendation regarding on-bill financing?

A. DE recommends that KCP&L offer some form of on-bill financing, either as a DSM program or as a method to both boost participation in DSM programs and increase the adoption of customer-owned DERs. This recommendation is consistent with the CSEP.[32] On-bill financing programs will require consumer protections to avoid unfair lending practices and assure benefits to participants, and should be promoted alongside PACE as a financing option to increase participation in DSM programs. Offering on-bill financing programs may require funding for additional billing system improvements, and the Commission may need to determine the role of on-bill financing as it relates to the traditional obligation of utilities to serve customers' energy needs.

IV. RATE DESIGN ISSUES

A. GENERAL CONSIDERATIONS

Q. What are some of the principles involved in evaluating alternative rate designs?

A. There are many factors to consider when evaluating rate designs proposals. Some of the chief considerations involve efficiency, gradualism, affordability, and relating rates charged to the costs incurred by their causers ("cost-causation").

Q. What are the typical components of a residential electric utility bill?

A. Currently, Missouri residential customers of investor-owned electric utilities are charged through two components. The first is a "customer charge," a fixed monthly amount which represents the costs incurred for connecting an individual customer to the utility's system irrespective of usage. The second component is a series of "energy charges" which vary

[32] CSEP, page 240.

by season and amount of energy used. Other classes may have a larger number of (or different) billing components based on factors such as demand and reactive power needs.

Q. How do general rate design considerations affect the determination of customer charges?

A. Customer charges traditionally represent the costs for a utility to serve an additional customer regardless of usage. Since it is a fixed charge, the customer charge cannot be avoided by customers absent disconnection from a utility's system. Consequently, customer charges do not encourage efficient usage and have disproportionate impacts on low-use customers and low-income customers as a group.

Q. In what ways do general rate design considerations factor into determining energy charges?

A. Typically, residential customers in Missouri pay "declining block" energy charges in the winter, i.e., they pay less per amount of energy used after a certain threshold or thresholds of usage. In the summer, these customers pay a "flat" rate, i.e., the same charge per amount of energy used for all amounts of usage. A declining block rate sends poorer efficiency signals to customers, since the effective price signal is that higher amounts of usage cost less. Flat rates provide slightly better price signals, but the best efficiency-inducing price signals are provided by inclining block rates (which charge more per amount of energy used after a certain threshold or thresholds of usage). Inclining block rates signal to customers that higher use incurs higher costs, encouraging greater energy efficiency.

Q. Are there cost-based justifications for inclining block rates?

A. Yes. Some claim that a low customer charge necessitates the recovery of "fixed" (in the accounting sense) costs through the first block of volumetric rates. However, the long-run view of utility costs is that they are all variable – lower demand results in lower plant investment.[33] The recovery of historic costs, while important for utilities, should not "lock in" future utility spending decisions by encouraging higher use (and a subsequent need for greater investment in plant). Inclining block rates can not only be used to recover short-run "fixed" costs, but signal to customers that higher usage spurs greater investment in future plant; this signal will reduce future rate increases and provide benefits to all customers.

Q. How do different volumetric rate designs affect low-use, low-income, and electric space heating and/or cooling customers?

A. The effects of volumetric rate designs on low-use and low-income customers depends on the specifics of the rates. Generally, however, low-use and low-income customers would fare the worst under declining block rate designs, since they would be paying more per unit of energy than high-use customers (and, consequently, paying disproportionately more for short-run "fixed" costs than high-use customers). By contrast, space heating and cooling customers (who generally use more electricity than customers with other energy sources for space heating and cooling) benefit from traditional declining block rates. Based on these considerations, an appropriately designed inclining block rate would set the first, lowest charge block such that it charged for the most basic amounts of usage

[33] Lazar, Jim, et al. 2016. *Electricity Regulation in the US: A Guide.* 2nd ed. Montpelier, VT: The Regulatory Assistance Project. http://www.raponline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf. Pages 185-186.

(e.g., some space heating and cooling, cooking, and lighting). Determining what constitutes "basic" usage will take careful research and assessment, and separate rates may need to be designed for space heating (and potentially space cooling for vulnerable households).

Q. You have mentioned low-use and low-income customers together several times. Is there evidence that low-income customers tend to use less electricity?

A. Yes. Regional data from the federal government show that low-income customers in the Midwest generally use less electricity than non-low-income customers. The same data show that customers receiving assistance through the Low Income Home Energy Assistance Program ("LIHEAP") use more electricity than the general low-income population,[34] which is a logical outcome of receiving a fixed bill credit.

Q. Is there a conflict between promoting flat or inclining block rates and demand response rates?

A. No. Demand response rates, discussed above, are important types of rate designs as well. However, there is not necessarily a conflict between the consideration of demand response rates and more traditional rate designs. Flat or inclining block rates can be seen as important for generally increasing efficiency-inducing price signals absent time-varying rates, which are focused more on reducing peak use; additionally, these volumetric rate designs can be included in demand response rates.

[34] U.S. Department of Health and Human Services, Administration for Children and Families, Office of Community Services, Division of Energy Assistance. 2014. "LIHEAP Home Energy Notebook For Fiscal Year 2011." Appendix A, Table A-2, page 93. https://www.acf.hhs.gov/sites/default/files/ocs/fy2011_hen_final.pdf.

Q. What do you mean when you reference "gradualism?"

A. "Gradualism" refers to the concept that rates should not change suddenly, minimizing customer confusion and bill impacts. This is closely related to the avoidance of "rate shock."

Q. Please summarize your discussion of rate design.

A. Rates should be set in a manner which induces efficiency, maintains gradualism, ensures affordability, and reflects cost-causation. This is best accomplished through low customer charges which only recover costs to serve individual customers irrespective of usage, as well as through flat or inclining volumetric rate designs which account for basic customer usage.

B. BLOCK RATE DESIGN PROPOSALS

Q. Has the Company proposed a continuation of its current residential general use rate design?

A. Generally, yes. Residential customers will incur both a fixed monthly customer charge and pay flat volumetric rates in the summer and declining block rates in the winter.[35] Customer charges would also increase for residential customers;[36] DE will address the Company's customer charge proposal in detail in its Rebuttal Testimony.

Q. What is the Company's proposal for residential general use rates?

A. KCP&L's proposals are shown below in Table 1, along with comparisons to the Company's current rates.

[35] Missouri Public Service Commission Case No. ER-2016-0285, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Information Filed in Accordance with 4 CSR 240-3.030, July 1, 2016 Appendix 1 – Proposed Tariff Change Schedules, Sheet No. 5A.
[36] *Ibid*.

Table 1. KCP&L's current and proposed residential general use rates.[37]

Rate Component	Season	Block	Current	KCP&L Proposal	Change
Customer Charge			$11.88	$13.18	10.91%
Energy Charge	Summer		$0.13328	$0.14781	10.90%
	Winter	First 600 kWh	$0.11982	$0.13289	10.91%
		Next 400 kWh	$0.07183	$0.07966	10.90%
		Over 1000 kWh	$0.06003	$0.06658	10.91%

Q. Does DE have an alternative recommendation for residential general use volumetric rates?

A. Yes. As a step toward rates that send improved price signals for efficiency, DE recommends that the Company move towards the adoption of flat volumetric rates for residential general use customers during the winter, and that the Company implement an inclining block rate for residential general use customers during the summer. The Commission should also set a goal of moving towards fully flat and/or inclining block rates for residential general use customers during the winter in subsequent cases, ideally on an incremental basis.

Q. Why not immediately transition to inclining winter block rates for residential general use customers?

A. First, as noted above, rate design should follow the principle of gradualism, avoiding sudden changes to rate designs. Gradualism mitigates the level of "rate shock" experienced by customers. Second, inclining block rate design requires careful analysis in order to identify typical basic customer usage, determine the number of blocks in the rate,

[37] Missouri Public Service Commission Tariff No. YE-2016-0078, Kansas City Power & Light Company, Schedule of Rates for Electricity, Residential Service – Schedule R, September 29, 2015, Sheet Nos. 5A and 5C.
Missouri Public Service Commission Case No. ER-2016-0285, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Information Filed in Accordance with 4 CSR 240-3.030, July 1, 2016 Appendix 1 – Proposed Tariff Change Schedules, Sheet No. 5A.

evaluate bill impacts, avoid adverse impacts to low-income and low-use customers, allocate costs based on cost causation, and ensure that the utility has a reasonable prospect of meeting its revenue requirement. Movement towards flat volumetric rates in the winter provides for a more gradual transition.

Q. Does DE have an example rate design for residential general use customers?

A. Yes. Based on the Company's current revenues and billing units, DE has prepared an example residential general use rate design which incorporates movement away from flat winter rates (by raising the third block) and an inclining summer block rate (see Figure 2). This example assumes that the residential customer charge remains constant.

Table 2. DE's proposed residential general use rate design.

Rate Component	Season	Block	Current	DE Proposal	Change
Customer Charge			$11.88	$11.88	0.00%
Energy Charge	Summer	First 600 kWh	$0.13328	$0.12521	-6.05%
		Over 600 kWh		$0.14485	8.68%
	Winter	First 600 kWh	$0.11982	$0.11878	-0.87%
		Next 400 kWh	$0.07183	$0.07183	0.00%
		Over 1000 kWh	$0.06003	$0.06372	6.14%

Q. Why use a two-block inclining block rate rather than a three-block (or more) rate?

A. A two-block rate design is relatively simple for a customer to understand; an increased number of blocks could create confusion for customers trying to understand their rates.

Q. Why did DE choose 600 kWh as the threshold for the second block of the summer rate?

A. KCP&L has not had block cutoffs for summer use, but Union Electric Company (now Union Electric Company d/b/a Ameren Missouri, or "Ameren Missouri") historically had residential block rates in the summer with a threshold of 500 kWh for the final block of

usage.[38] However, usage since the last time these rates were in effect (late 1979 to mid-1980) is likely lower than the usage of today's electric customers.[39] Using the first block winter threshold for KCP&L customers (600 kWh) as a basis for inclining summer block rates thus represents a conservative attempt at including enough customer usage to avoid significantly adverse impacts, but not including so much usage as to negate an efficiency-inducing price signal.

Q. How did you design the inclining block rate?

A. I allocated usage to the first block based on the product of the number of summer bills in the test year and usage at 600 kWh. The remaining kWh of billing units were allocated to the second block. I then solved for an inclining block rate design with a maximum single-month bill impact of five percent at the 95th percentile.[40]

Q. Why did you use the maximum bill impact at the 95th percentile?

A. Finding the 95th percentile in a range of numbers provides information about the upper end of that range while excluding extremely high maxima (i.e., the last five percent of the range). In the context of usage, this value eliminates extremely high maximum usages; in the context of bill changes and impacts, extremely high bill impacts and bill changes are excluded. Using the 95th percentile as the criterion in the summer is reasonable since it excludes unusually high bill impacts, and summer use is more flexible than winter use.

[38] Missouri Public Service Commission Tariff No. 80-104, Union Electric Company, Schedule of Rates for Electricity, Service Classification No. 1(M) – Residence Rate, October 1, 1979, Sheet No. 28(M).
[39] Effective May 30, 1980, the Company instituted a minimum bill for all usage at or below 100 kWh and a flat rate thereafter for the summer season. See: Missouri Public Service Commission Tariff No. 80-17, Union Electric Company, Schedule of Rates for Electricity, Service Classification No. 1(M) – Residential Service Rate, May 30, 1980, Sheet No. 28(M).
[40] As described below, some customers had bills which crossed both billing seasons; in those cases, the partial month impact (i.e., summer or winter impact) was included with full month impacts from other months in determining bill impacts for ratemaking purposes.

Q. How did you revise the winter rates?

A. Raising the third block towards the level of the second block increases revenue collected within the third block. To compensate, I removed the additional revenue from the first block, simultaneously solving for a rate design with a maximum single-month bill impact of five percent.

Q. If customers respond to these rates by reducing usage, will the Company need to revise billing unit estimates to factor in this reduced usage in establishing rates?

A. Yes. In economics, the concept of "price elasticity of demand" refers to responses in consumption based on different prices. Estimates of the price elasticity of demand for electricity vary, and can also differ over different time frames. For example, in 2013, The Brattle Group used elasticities of -0.130 and -0.260 (i.e., 0.130 and 0.260 percent declines in consumption for a one percent price increase) when evaluating an inclining block rate for Ameren Missouri.[41] The Company would need to use reasonable estimates of the price elasticity of demand for residential customers to adjust the residential general use rates such that they collect revenues at a level of consumption reflecting changes in demand.

Q. Is DE proposing any revisions to rates for Small General Service ("SGS") customers?

A. Not at this time. SGS customers are billed under a different tariff structure than residential customers, so different analyses would be required to determine appropriate

[41] Faruqui, Ahmad, and Hledik, Ryan. 2013. "The Potential Impact of Demand-Side Rates for Ameren Missouri: Final Report." The Brattle Group. Slide 23.

rate designs. DE recommends that the Commission order the consideration of new rate designs for SGS customers.

Q. Have you prepared a bill impact analysis of DE's proposal?

A. Yes. This is presented below, along with an analysis of the Company's proposed residential general use rate design.

V. BILL IMPACT ANALYSIS

A. BILL FREQUENCY ANALYSIS

Q. What is the purpose of a bill frequency analysis?

A. The purpose of a bill frequency analysis is to determine the average (mean), minimum, and maximum amount of use for various groups of customers. This analysis can serve as the basis for other calculations, such as a bill impact analysis.

Q. What is the basis of your analysis?

A. My analysis is based on a highly confidential, non-weather-normalized data set[42] of residential general use customers provided by the Company in response to Data Request DED-DE 600.1.

Q. How did you conduct your analysis?

A. I analyzed the data provided by the Company in Excel to determine the monthly average, maximum, and minimum usages, as well as usage at the 95th percentile. My focus was on

[42] Weather normalization is required to adjust usage data for temporal differences in Heating Degree Days ("HDD") and Cooling Degree Days ("CDD"). In 2015, Kansas City International Airport experienced 4,578 HDDs and 1,366 CDDs (see Weather Underground, 2016, "Weather History for Kansas City International, MO," https://www.wunderground.com/history/airport/KMCI/2015/1/1/CustomHistory.html?dayend=31&monthend=12&yearend=2015&req_city=&req_state=&req_statename=&reqdb.zip=&reqdb.magic=&reqdb.wmo=). The 30-year population-weighted normal for HDDs in this region of the country from 1971 through 2000 was 6,750, and the normal for CDDs was 927 (see U.S. Energy Information Administration, 2012, "Annual Energy Review 2011," https://www.eia.gov/totalenergy/data/annual/pdf/aer.pdf, pages 21 and 23).

the months which comprise the test year in this case, i.e., January through December of 2015.[43]

Q. Did you independently conduct your statistical analysis?

A. Yes.

Q. What were the results of your analysis?

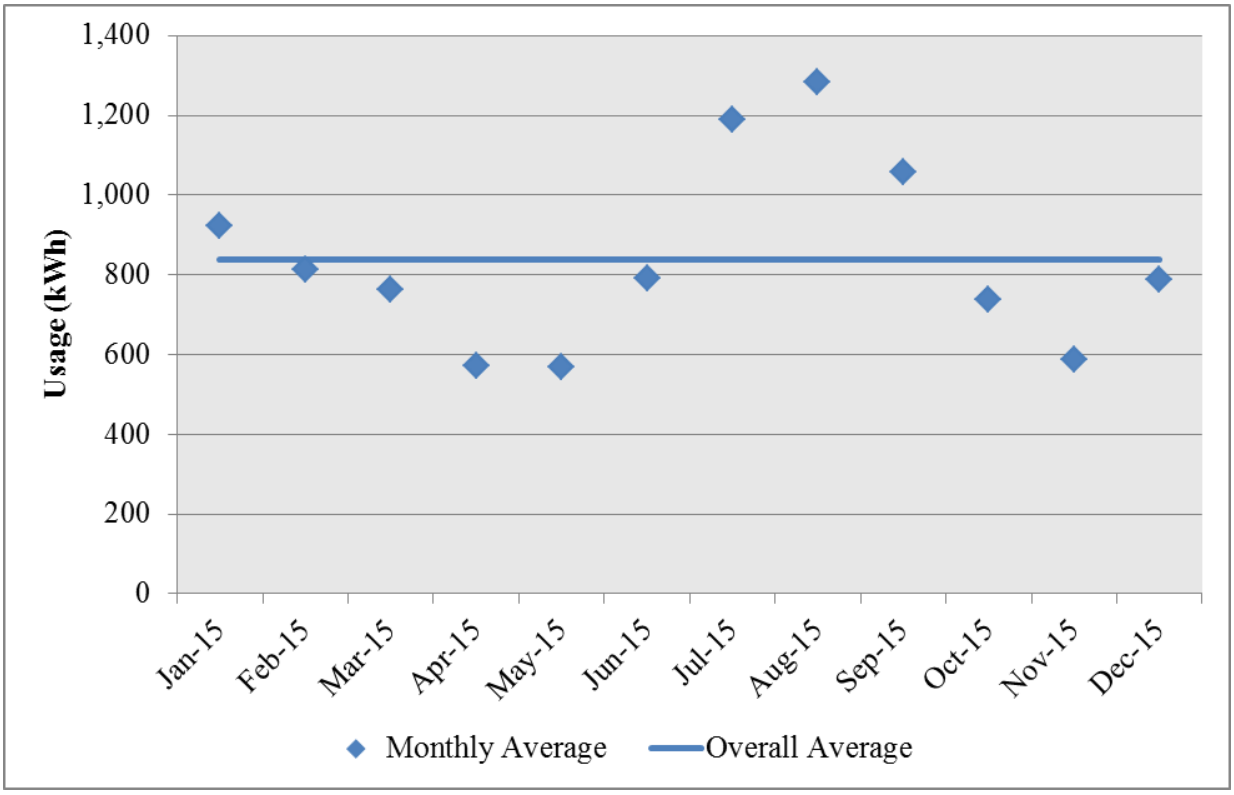
A. My results are shown below in Table 3 and Figure 1.

Table 3. Bill frequency analysis results for residential general use customers.

Month	Average	Maximum	95th Percentile	Minimum	Count	Sum
Jan-15	922.34	8,481	2,208.50	0	795	733,262
Feb-15	811.97	7,746	1,992.10	0	794	644,708
Mar-15	763.90	8,150	1,855.10	0	794	606,537
Apr-15	571.49	7,687	1,259.20	0	797	455,474
May-15	569.13	9,199	1,292.35	0	794	451,887
Jun-15	790.38	9,617	1,666.00	0	796	629,143
Jul-15	1,188.67	10,996	2,459.00	0	795	944,993
Aug-15	1,284.41	12,614	2,523.10	0	795	1,021,104
Sep-15	1,058.75	11,285	2,151.60	0	795	841,708
Oct-15	737.76	10,861	1,598.75	0	794	585,778
Nov-15	588.89	9,084	1,261.00	0	795	468,171
Dec-15	786.85	10,126	1,840.60	0	795	625,549

[43] Missouri Public Service Commission Case No. ER-2016-0285, *In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service*, Information Filed in Accordance with 4 CSR 240-3.030, July 1, 2016 Appendix 2 – Graphical Depiction of KCP&L's Rate Increase Request.

Figure 1. Bill frequency analysis results for residential general use customers.



Q. What can you conclude from these results?

A. On average, residential general use customers use almost 840 kWh each month. Usage varies throughout the year, with maximum use occurring during the summer. Relatively high use also occurs during the winter, albeit not at the same level as during the summer.

B. BILL IMPACT ANALYSIS OF COMPANY PROPOSAL

Q. What is the purpose of a bill impact analysis?

A. The purpose of a bill impact analysis is to determine the changes to customer bills as the result of changes in rates. While such an analysis is often based on the "average" customer's use, it should also take into account customers who use greater or lesser amounts of a given commodity to determine equity and efficiency impacts.

Q. What is the basis of your analysis?

A. My analysis is based on the bill frequency analysis described above, along with the Company's current and proposed rates.

Q. How did you conduct your analysis?

A. I derived the average, minimum, and maximum bills (as well as bills at the 95th percentile) by month based on calculations of the bills for all customers during each month. Use of the maxima and minima illustrates the bill impacts of the Company's proposal based on variations in residential customer usage. Some customers had bills within a month which spanned both billing periods; in these cases, I prorated usage within each season based on the number of billing days which fell within that season.

Q. What were the results of your analysis?

A. My results are shown below in Tables 4a through 4c.

Table 4a. Current bills for residential general use customers.

Month	Average	Maximum	95th Percentile	Minimum
Jan-15	$99.47	$561.59	$185.05	$11.88
Feb-15	$91.24	$517.47	$172.06	$11.88
Mar-15	$87.96	$541.72	$163.84	$11.88
Apr-15	$73.30	$513.92	$128.06	$11.88
May-15	$75.67	$604.69	$136.88	$11.88
Jun-15	$115.72	$1,075.93	$232.81	$11.88
Jul-15	$170.31	$1,477.43	$339.62	$11.88
Aug-15	$183.07	$1,693.07	$348.16	$11.88
Sep-15	$151.47	$1,515.94	$294.51	$11.88
Oct-15	$95.12	$1,075.73	$176.26	$11.88
Nov-15	$74.93	$597.79	$128.17	$11.88
Dec-15	$90.05	$660.34	$162.97	$11.88

Table 4b. Bills under KCP&L's proposal for residential general use customers.

Month	Average	Maximum	95th Percentile	Minimum
Jan-15	$110.31	$622.86	$205.24	$13.18
Feb-15	$101.19	$573.92	$190.83	$13.18
Mar-15	$97.55	$600.82	$181.71	$13.18
Apr-15	$81.29	$569.99	$142.03	$13.18
May-15	$83.92	$670.66	$151.81	$13.18
Jun-15	$128.34	$1,193.25	$258.18	$13.18
Jul-15	$188.87	$1,638.49	$376.64	$13.18
Aug-15	$203.02	$1,877.65	$386.11	$13.18
Sep-15	$167.98	$1,681.21	$326.62	$13.18
Oct-15	$105.50	$1,193.03	$195.49	$13.18
Nov-15	$83.10	$663.01	$142.15	$13.18
Dec-15	$99.87	$732.38	$180.74	$13.18

Table 4c. Bill impacts of KCP&L's proposal for residential general use customers.

Month	Average	Maximum	95th Percentile	Minimum
Jan-15	10.91%	10.94%	10.92%	10.84%
Feb-15	10.91%	10.97%	10.92%	10.97%
Mar-15	10.91%	10.96%	10.92%	10.87%
Apr-15	10.91%	10.97%	10.92%	10.86%
May-15	10.91%	10.97%	10.92%	10.87%
Jun-15	10.90%	10.94%	10.91%	10.87%
Jul-15	10.90%	10.94%	10.91%	10.86%
Aug-15	10.90%	10.97%	10.91%	10.86%
Sep-15	10.90%	10.96%	10.91%	10.86%
Oct-15	10.91%	10.95%	10.92%	10.86%
Nov-15	10.91%	10.95%	10.92%	10.95%
Dec-15	10.91%	10.94%	10.92%	10.86%

Q. What do you observe about these impacts?

A. KCP&L's proposal would result in a relatively uniform bill increase for all customers. This is a result of the Company's allocation of its residential rate increase equally across all bill components.

C. BILL IMPACT ANALYSIS OF ALTERNATIVE PROPOSAL

Q. Did you conduct a similar bill impact analysis as that presented above with respect to DE's rate design proposal?

A. Yes. The analysis compares DE's proposed rates to the Company's current rates.

Q. What were the results of your analysis?

A. My results are shown below in Tables 5a through 5b and Figure 2.

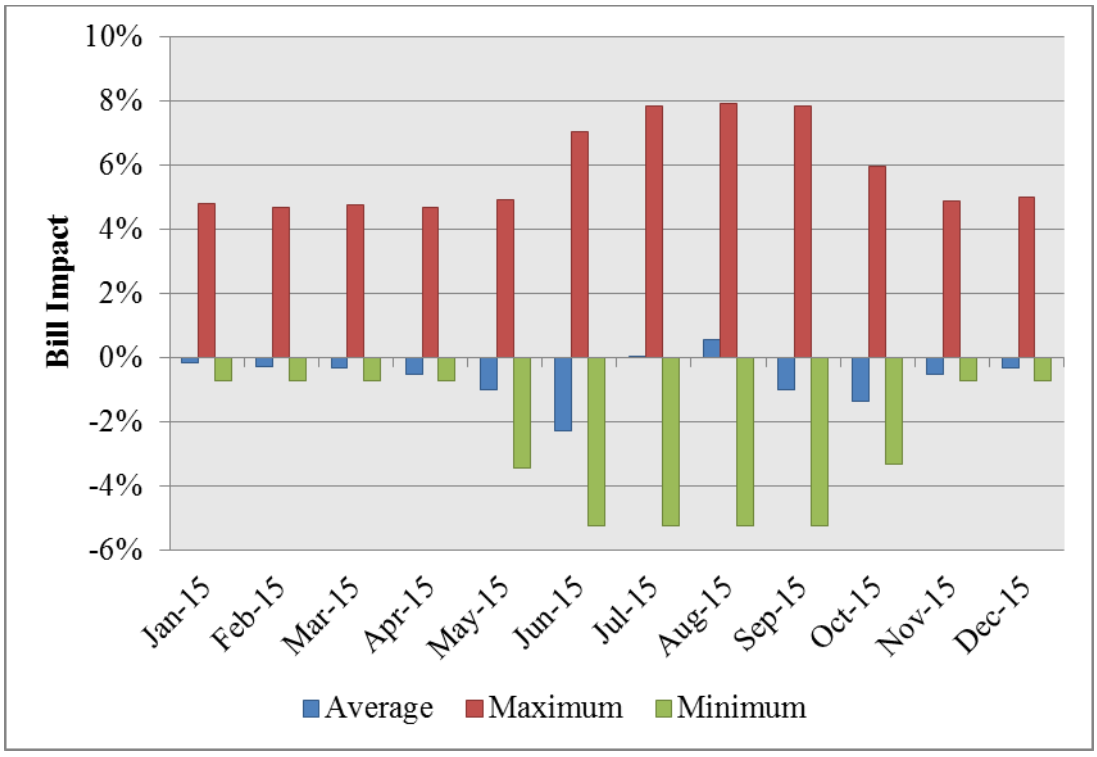
Table 5a. Bills under DE's proposal for residential general use customers.

Month	Average	Maximum	95th Percentile	Minimum
Jan-15	$99.84	$588.54	$188.88	$11.88
Feb-15	$91.43	$541.71	$175.09	$11.88
Mar-15	$88.02	$567.45	$166.36	$11.88
Apr-15	$73.03	$537.95	$128.40	$11.88
May-15	$74.97	$634.29	$135.77	$11.88
Jun-15	$114.73	$1,143.31	$239.47	$11.88
Jul-15	$173.33	$1,592.87	$356.29	$11.88
Aug-15	$187.05	$1,827.23	$365.57	$11.88
Sep-15	$152.29	$1,634.73	$307.03	$11.88
Oct-15	$93.89	$1,139.63	$175.50	$11.88
Nov-15	$74.67	$626.96	$128.51	$11.88
Dec-15	$90.12	$693.35	$165.44	$11.88

Table 5b. Bill impacts of DE's proposal for residential general use customers.

Month	Average	Maximum	95th Percentile	Minimum
Jan-15	-0.16%	4.80%	2.07%	-0.75%
Feb-15	-0.28%	4.68%	1.76%	-0.75%
Mar-15	-0.33%	4.75%	1.54%	-0.75%
Apr-15	-0.52%	4.68%	0.26%	-0.75%
May-15	-1.00%	4.90%	-0.12%	-3.44%
Jun-15	-2.29%	7.04%	2.88%	-5.27%
Jul-15	0.04%	7.81%	4.91%	-5.27%
Aug-15	0.56%	7.92%	5.00%	-5.27%
Sep-15	-1.03%	7.84%	4.14%	-5.27%
Oct-15	-1.36%	5.94%	-0.02%	-3.33%
Nov-15	-0.52%	4.88%	0.27%	-0.75%
Dec-15	-0.32%	5.00%	1.52%	-0.75%

Figure 2. Bill impacts of DE's proposal for residential general use customers.



Q. What do you observe about these impacts?

A. As designed, the proposal would not increase the bills of any given customer in the sample by more than five percent in a single winter month. Additionally, the proposal would not raise single-month summer bills by more than five percent for 95 percent of customers in the sample. Those customers with the highest bill impacts are likely customers who also have exceptionally high usage. On average, customers would actually see bill decreases (on a percentage basis) in most months. Lower-use customers would benefit the most from this rate design, as they would see greater bill reductions than customers with higher use (who would more likely experience bill increases).

The results suggest that the proposal would have the desired effect of sending an efficiency-inducing price signal to higher users. An added benefit would be the reduction of bills for lower use customers, since low-income customers tend to have lower use. In addition to meeting equity and efficiency criteria, this rate design also supports a gradual movement towards flat and/or inclining block rates which would not cause significant rate shock. This is an important consideration given the possibility of a rate increase, the impacts of which would be added to the impacts from revising the Company's rate design.

Q. Can revenue-neutral adjustments be made to the Company's rates regardless of the particular revenue requirement approved?

A. Yes. Revenue-neutral adjustments maintain the Company's present revenues, absent any accompanying changes in customer behavior. These adjustments can be made either before or after the inclusion of revenue requirement-based changes in customer rates.

VI. CONCLUSIONS

Q. Please summarize your conclusions and the positions of DE.

A. In response to the Commission's order to address certain issues, I provided DE's perspective on AMI metering, off-peak rates for electric vehicles, demand response rates, PACE financing, and PAYS® financing. DE commends the Company for taking the initiative to deploy AMI and looks forward to proposals by KCP&L to fully utilize this technology's potential. DE recommends that the Commission require KCP&L to file both its study of demand response rates and supporting documentation no later than specified in the Report and Order in the Company's last rate case so that the study will be available to inform parties' rate design proposals in KCP&L's subsequent rate case. DE also supports taking action to promote financing options for customer energy improvements. DE supports broadly applicable off-peak rates for residential customers.

I also presented bill frequency and impact analyses for residential general use customers based on both KCP&L's proposed rates and DE's proposed rate design. These analyses support moving KCP&L's residential general use rate towards a flat structure in the winter and an inclining structure in the summer, with iterative transitions in subsequent cases to fully flat or inclining winter block rates.

Q. Does this conclude your Direct Testimony in this case?

A. Yes.