Exhibit No.:	
Issues:	Advanced Metering Infrastructure; Off-Peak Electric Vehicle Rates; Demand Response Rates; Property Assessed Clean Energy Financing; On-Bill Financing; Rate Design
Witness:	Martin Hyman
Sponsoring Party:	Missouri Department of Economic Development – Division of Energy
Type of Exhibit:	Direct Testimony
Case No.:	ER-2016-0179

MISSOURI PUBLIC SERVICE COMMISSION

UNION ELECTRIC COMPANY d/b/a AMEREN MISSOURI

CASE NO. ER-2016-0179

DIRECT TESTIMONY

OF

MARTIN R. HYMAN

ON

BEHALF OF

MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT

DIVISION OF ENERGY

Jefferson City, Missouri
December 23rd, 2016

(Rate Design)

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Increase Its Annual Revenues for Electric Service	)))	Case No. ER-2016-0179

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 22nd 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: 16808714

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 of 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-2016-0179, *In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Increase Its Revenues for Electric Service*, Order Directing Consideration of Certain Questions in Testimony, August 29, 2016.

information about rate design. I also describe DE's proposal to 1) transition away from the declining block rates employed by Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri" 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 rate-design related Direct Testimony filed by Company witness Mr. William R. Davis, the rate design-related areas of the Company's minimum filing requirements in this case, rate design-related workpapers, the Company's current residential rates for general use customers, one of the Company's recent filings in EW-2016-0313 as it pertains to advanced metering infrastructure ("AMI"), 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. I also checked the Company's website to determine if it has information on Property Assessed Clean Energy ("PACE") financing.

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. 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." 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 Ameren Missouri's service territory?

A. Widespread AMI deployment has not yet commenced in the Company's service territory for residential customers.[7] DE encourages the Company to deploy AMI at the earliest date of cost-effectiveness and technological feasibility, with due consideration of the many benefits and security-related issues associated with AMI.

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

[7] See: Missouri Public Service Commission Case No. EW-2016-0313, *In the Matter of a Working Case to Consider Policies to Improve Electric Utility Regulation*, The Critical Need to Replace Aging Electric Infrastructure and Build a Smarter and More Efficient Grid to Meet Customers' Needs and Expectations, September 23, 2016, Attachment A, page 1.
[8] See: CSEP, Page 135.

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.

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") represent 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.

[9] *Ibid*.

Customers are told of these days beforehand. While an AMI meter enhances these rates, only interval metering is required.

- 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 Ameren Missouri's demand response rate offerings?

A. Only 38 customers participate in Ameren Missouri's residential TOD rate; by contrast, 6,670 small general service ("SGS") customers have opted for the SGS TOD rate.[13] The Company does not market these rates, aside from posting the tariffs on its website.[14]

[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] Company response to Data Request DED-DE 200.
[14] Company response to Data Request DED-DE 204.

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

A. DE recommends that the Company reevaluate its residential TOD rate to determine if it should be altered to encourage additional customer adoption; the Company should propose any revisions to its residential TOD rate in its next rate case. The Company should also market its TOD rates to prospective customers, particularly in the residential sector.

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.[15]

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

[15] 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).
Missouri Department of Economic Development – Division of Energy. 2016. "Residential PACE – Frequently Asked Questions." https://energy.mo.gov/residential-pace-frequently-asked-questions.

a PACE board.[16] Residential PACE financing launched in Jackson County in September and has recently expanded into the Kansas City portions of Clay and Platte counties, Franklin County, the City of Arnold, and a number of cities in St. Louis County.[17] In the St. Louis metropolitan area, residential PACE financing is currently available for about 142,022 occupied housing units overall, including approximately 101,425 owner-occupied housing units.[18] St. Louis County and the City of St. Louis have separate PACE ordinances and boards. The city's program is called "Set the PACE St. Louis."[19] The St. Louis County PACE board covers unincorporated areas of the 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.[20] 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.[21] Other recent examples of PACE projects include Kansas

[16] *Ibid*.
[17] In the St. Louis metropolitan area, the participating jurisdictions are Franklin County and the Cities of Arnold, Ballwin, Berkeley, Black Jack, Charlack, Chesterfield, Crestwood, Ellisville, Eureka, Ferguson, Hazelwood, Olivette, Town and Country, University City, and Valley Park. See: Renovate America, 2016, "St. Louis Metro Area," Home Energy Renovation Opportunity ("HERO"), https://www.heroprogram.com/mo/st-louis-metro.
[18] Based on data from: U.S. Census Bureau. 2011-2015 American Community Survey 5-Year Estimates. Table DP04 – Selected Housing Characteristics.
http://factfinder.census.gov/bkmk/table/1.0/en/ACS/15_5YR/DP04/0500000US29071|1600000US2901972|1600000US2903160|1600000US2904906|1600000US2906004|1600000US2913330|1600000US2913600|1600000US2917218|1600000US2921898|1600000US2922834|1600000US2923986|1600000US2931276|1600000US2954650|1600000US2973618|1600000US2975220|1600000US2975472.
[19] Missouri Department of Economic Development – Division of Energy, Undated, "Property Assessed Clean Energy (PACE)."
[20] 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/.
[21] 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/.

City's Walnut Terrace apartments[22] and Wornall Plaza Condominiums, [23] as well as the City of Otterville's wastewater lagoon system.[24] An additional $5.5 million in projects will close soon in Kansas City (a shopping center and condominiums), while an additional $9 million in projects will close soon in the City of St. Louis (a grocery store, an office building, and a multi-use development). [25] Other recent projects in the City of St. Louis include a retrofit of the Missouri Athletic Club (the largest commercial PACE project in the country in 2015), as well as recently closed financing for redeveloping a former school into multi-family lofts.[26] Approximately $15-30 million of projects is "in the pipeline" for the Missouri Clean Energy District, and Renovate America has closed on 70 projects.[27]

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 programs. While utilities do not administer PACE programs, they could guide potential participants in their DSM programs towards PACE financing, where available. The Missouri Energy Initiative is working with both Ameren Missouri and Kansas City Power & Light Company to integrate PACE financing with the companies' MEEIA offerings.[28]

[22] Stafford, Diane. 2016. "Tool debuts in KC to close funding gap in a redevelopment project." *The Kansas City Star*. December 13. http://www.kansascity.com/news/business/article120638493.html.
[23] CSEP, page 162.
[24] *Ibid*.
[25] Campbell, Josh. 2016. Personal communication.
[26] Set the PACE St. Louis. 2016. "UPDATE: Set the PACE St. Louis Closes Financing for Two Redevelopment Conversions." Newsletter. February 9. http://us3.campaign-archive1.com/?u=e87f797578282543c75d04890&id=6f6fc985d7&e=159cda651c.
[27] Campbell, 2016. Personal communication.
[28] *Ibid*.

Q. Does DE recommend that Ameren Missouri guide potential DSM program participants towards PACE financing?

A. Yes. The Company does not have information on its website related to PACE financing. The Company should expand its outreach efforts on DSM savings 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 improvement, they are therefore no longer responsible for paying off the loan, but the

next occupant is responsible.[29] 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.[30] 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,[31] 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

[29] 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/.
[30] 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.
[31] 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,[32] 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,[33] 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.[34]

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

[32] 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.
[33] Clean Energy Works, 2016a.
[34] 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 Ameren Missouri investigated on-bill financing?

A. Yes. Through the collaborative required under the settlement agreement authorizing the second cycle of MEEIA programs for Ameren Missouri,[35] the Company considered on-bill financing at the request of stakeholders and found it to be a cost-effective option.[36] Ameren Missouri has indicated interest in further consideration of financing measures.

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.[37]

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

A. DE recommends that Ameren Missouri 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.[38] On-bill financing programs will require consumer protections to avoid unfair

[35] Missouri Public Service Commission Case No. EO-2015-0055, *In the Matter of Union Electric Company d/b/a Ameren Missouri's 2nd Filing to Implement Regulatory Changes in Furtherance of Energy Efficiency as Allowed by MEEIA*, Non-Unanimous Stipulation and Agreement, February 5, 2016, pages 9-10.
[36] Missouri Public Service Commission Case No. EO-2015-0055, *In the Matter of Union Electric Company d/b/a Ameren Missouri's 2nd Filing to Implement Regulatory Changes in Furtherance of Energy Efficiency as Allowed by MEEIA*, Energy Efficiency Collaborative Report, October 7, 2016, Schedule 5, slide 21.
[37] The Laclede Gas Company. Undated. "EnergyWise Furnace Financing Program." http://www.lacledegas.com/efficiency/Conservation%20&%20Energy%20Efficiency%20Programs/EnergyWise%20Furnace%20Financing%20Program/.
[38] CSEP, page 240.

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 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.[39] 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

[39] 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.

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 (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,[40] 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.

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.

[40] 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.

B. BLOCK RATE DESIGN PROPOSALS

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

A. Generally, yes. Customers will incur both a fixed monthly customer charge and pay flat volumetric rates in the summer and declining block rates in the winter.[41] However, Ameren Missouri has also proposed an "Energy Grid Access Charge" to recover costs related to a theoretical minimum distribution system.[42] DE will address this charge in detail in its Rebuttal Testimony.

Q. What are the Company's proposals for residential general use rates?

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

[41] Missouri Public Service Commission Case No. ER-2016-0179, *In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Increase Its Revenues for Electric Service*, Union Electric Company d/b/a Ameren Missouri, Schedule of Rates for Electricity, Service Classification No. 1(M) – Residential Service Rate, July 1, 2016, Sheet No. 54.

[42] Missouri Public Service Commission Case No. ER-2016-0179, *In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Increase Its Revenues for Electric Service*, Direct Testimony of William R. Davis on Behalf of Union Electric Company d/b/a Ameren Missouri, July 1, 2016, pages 19-20, lines 19-23 and 1-20, and pages 39-41, lines 14-23, 1-23, and 1-4.

Table 1. Ameren Missouri's current and proposed residential rates.[43]

			Current	Ameren Missouri Proposed	Change
Customer Charge			$8.00	$8.00	0.00%
Energy Grid Access Charge			$0.00	$4.89	N/A
Energy Charge	**Summer**		$0.1208	$0.1254	3.81%
	Winter	**First 750 kWh**	$0.0858	$0.0891	3.85%
		Over 750 kWh	$0.0573	$0.0595	3.84%
Energy Efficiency Program Charge	**Summer**		$0.0010	$0.0009	-10.00%
	Winter		$0.0006	$0.0005	-16.67%
Low-Income Pilot Charge			$0.03	$0.03	0.00%

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"

[43] Missouri Public Service Commission Tariff No. YE-2015-0325, Union Electric Company d/b/a Ameren Missouri, Schedule of Rates for Electricity, Service Classification No. 1(M) – Residential Service Rate, May 30, 2015, Sheet No. 54.
Missouri Public Service Commission Case No. ER-2016-0179, *In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Increase Its Revenues for Electric Service*, Union Electric Company d/b/a Ameren Missouri, Schedule of Rates for Electricity, Service Classification No. 1(M) – Residential Service Rate, July 1, 2016, Sheet No. 54.

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, 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 second winter block) and towards an inclining summer block rate (see Table 2). This example assumes that the residential customer charge remains constant and that an Energy Grid Access Charge is not imposed.

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

			Current	DE Proposed	Change (vs. Current)
Customer Charge			$8.00	$8.00	0.00%
Energy Charge	**Summer**	**First 750 kWh**	$0.1208	$0.1166	-3.50%
		Over 750 kWh		$0.1310	8.47%
	Winter	**First 750 kWh**	$0.0858	$0.0834	-2.84%
		Over 750 kWh	$0.0573	$0.0603	5.30%

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 750 kWh as the threshold for the second block of the summer rate?

A. Union Electric Company (now Ameren Missouri) historically had residential block rates in the summer with a threshold of 500 kWh for the final block of usage.[44] 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.[45] Using the winter block threshold for Ameren Missouri customers (750 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 750 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.

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

[44] 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).
[45] 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).

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.

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.[46] 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 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

[46] 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 analyses of the Company's proposed general use residential rate design.

V. BILL FREQUENCY AND BILL IMPACT ANALYSES

A. BILL FREQUENCY ANALYSES

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 analyses are based on a highly confidential, non-weather-normalized data set[47] of residential general use customers provided by the Company in response to Data Request DED-DE 600.

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 the months which comprise the test year in this case, i.e., April of 2015 through March of

[47] Weather normalization is required to adjust usage data for temporal differences in Heating Degree Days ("HDD") and Cooling Degree Days ("CDD"). During the test year, the St. Louis area experienced 3,711 HDDs and 1,563 CDDs (see Weather Underground, 2016, "Weather History for Cahokia, IL," https://www.wunderground.com/history/airport/KCPS/2015/4/1/CustomHistory.html?dayend=31&monthend=3&yearend=2016&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).

2016.[48] I separated my analyses of electric space heating and non-electric space heating customers; additionally, I removed entries for net metered customers, since net metered customers can also produce energy to offset their usage.[49]

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 Tables 3a through 3b and Figure 1.

Table 3a. Bill frequency analysis results for residential general use non-electric space heating customers.

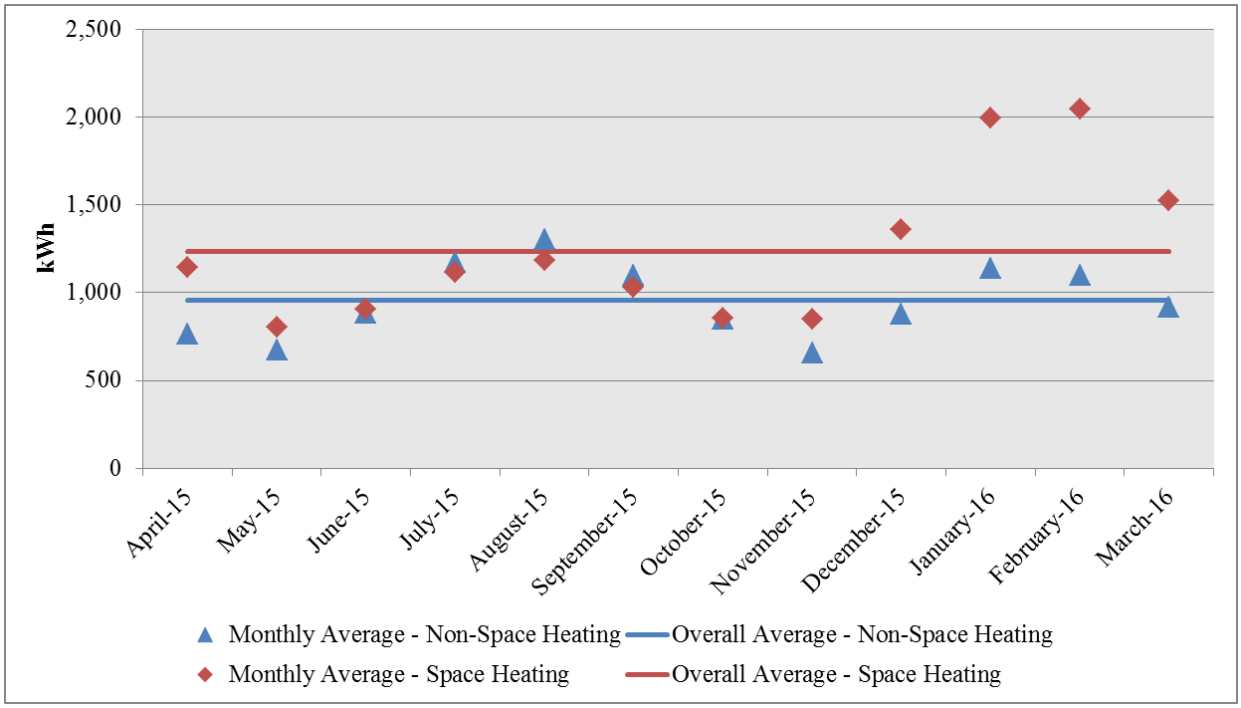
Month	Average	Maximum	95th Percentile	Minimum	Count	Sum
April-15	765.23	13,840	2,029.80	0	7,542	5,771,354
May-15	675.70	23,520	1,553.00	0	8,259	5,580,632
June-15	884.43	18,720	2,006.00	0	8,291	7,332,775
July-15	1,171.60	18,960	2,532.00	0	8,291	9,713,724
August-15	1,303.17	19,800	2,717.90	0	8,302	10,818,932
September-15	1,100.75	19,080	2,397.70	0	8,324	9,162,627
October-15	846.62	19,800	1,951.90	0	8,283	7,012,525
November-15	658.87	16,800	1,577.10	0	8,280	5,455,438
December-15	876.86	19,440	2,392.20	0	8,329	7,303,332
January-16	1,139.06	25,560	3,321.00	0	8,371	9,535,048
February-16	1,096.54	39,720	3,471.80	0	8,369	9,176,934
March-16	916.42	35,760	2,757.60	0	8,349	7,651,176

[48] Davis Direct, page 54, lines 2-3.
[49] There were an insufficient number of data points to allow for a separate analysis of net metered customers.

Table 3b. Bill frequency analysis results for residential general use electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum	Count	Sum
April-15	1,141.84	17,600	2,625.00	0	1,739	1,985,658
May-15	804.40	18,240	1,754.40	0	1,903	1,530,775
June-15	903.53	21,680	2,008.00	0	1,921	1,735,683
July-15	1,113.23	13,120	2,513.00	0	1,914	2,130,717
August-15	1,181.84	12,560	2,676.75	0	1,918	2,266,767
September-15	1,028.91	16,640	2,260.00	0	1,901	1,955,958
October-15	852.42	22,720	1,914.80	0	1,889	1,610,218
November-15	850.90	25,360	1,941.00	0	1,886	1,604,801
December-15	1,356.35	27,760	3,057.60	0	1,895	2,570,283
January-16	1,996.89	37,600	4,611.20	0	1,893	3,780,117
February-16	2,042.45	34,240	4,722.85	0	1,900	3,880,655
March-16	1,521.79	20,720	3,704.05	0	1,894	2,882,276

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



Q. What can you conclude from these results?

A. On average, residential electric space heating customers use more electricity per month (about 1,233 kWh) than residential customers without electric space heating (almost 955 kWh); residential electric space heating customers also have a larger average peak in winter energy use. Non-electric space heating customers exhibit peak use in both the winter and summer, while electric space heating customers exhibit peak use in the winter around the same time as that season's peak for non-electric space heating customer use.

B. BILL IMPACT ANALYSES 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 analyses?

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

Q. How did you conduct your analyses?

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.

Q. What were the results of your analysis?

A. My results are shown below in Tables 4a through 4f and Figure 2.

Table 4a. Current bills for residential general use non-electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	$67.57	$830.74	$146.93	$8.03
May-15	$61.92	$1,391.21	$119.32	$8.03
June-15	$115.75	$2,288.13	$252.36	$8.03
July-15	$150.73	$2,317.36	$316.43	$8.03
August-15	$166.76	$2,419.67	$339.07	$8.03
September-15	$142.10	$2,331.97	$300.07	$8.03
October-15	$73.46	$1,175.83	$142.42	$8.03
November-15	$60.73	$1,002.13	$120.72	$8.03
December-15	$74.73	$1,154.98	$167.91	$8.03
January-16	$91.02	$1,509.33	$221.69	$8.03
February-16	$87.92	$2,329.19	$230.42	$8.03
March-16	$76.78	$2,099.91	$189.07	$8.03

Table 4b. Bills under Ameren Missouri's proposal for residential general use non-electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	$74.65	$865.52	$156.91	$12.92
May-15	$68.80	$1,446.32	$128.30	$12.92
June-15	$124.62	$2,377.26	$266.28	$12.92
July-15	$160.89	$2,407.57	$332.71	$12.92
August-15	$177.51	$2,513.66	$356.19	$12.92
September-15	$151.94	$2,422.72	$315.75	$12.92
October-15	$80.76	$1,223.12	$152.23	$12.92
November-15	$67.57	$1,043.12	$129.75	$12.92
December-15	$82.08	$1,201.52	$178.65	$12.92
January-16	$98.96	$1,568.72	$234.38	$12.92
February-16	$95.75	$2,418.32	$243.43	$12.92
March-16	$84.20	$2,180.72	$200.58	$12.92

Table 4c. Bill impacts of Ameren Missouri's proposal for residential general use non-electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	14.33%	60.90%	33.64%	4.19%
May-15	15.11%	60.90%	37.79%	3.96%
June-15	11.41%	60.90%	31.97%	3.90%
July-15	9.95%	60.90%	28.03%	3.89%
August-15	9.41%	60.90%	25.49%	3.88%
September-15	10.04%	60.90%	26.67%	3.89%
October-15	13.56%	60.90%	35.01%	4.02%
November-15	15.18%	60.90%	36.90%	4.09%
December-15	13.86%	60.90%	36.07%	4.03%
January-16	12.61%	60.90%	32.42%	3.93%
February-16	13.08%	60.90%	32.34%	3.83%
March-16	13.74%	60.90%	32.14%	3.85%

Table 4d. Current bills for residential general use electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	$91.75	$1,048.45	$181.39	$8.03
May-15	$70.69	$1,085.50	$130.99	$8.03
June-15	$118.08	$2,648.65	$252.60	$8.03
July-15	$143.62	$1,606.05	$314.11	$8.03
August-15	$151.98	$1,537.84	$334.06	$8.03
September-15	$133.35	$2,034.78	$283.30	$8.03
October-15	$73.76	$1,344.89	$140.27	$8.03
November-15	$73.59	$1,497.75	$141.79	$8.03
December-15	$104.65	$1,636.71	$206.44	$8.03
January-16	$142.86	$2,206.45	$296.39	$8.03
February-16	$145.56	$2,011.90	$302.86	$8.03
March-16	$114.55	$1,229.09	$243.87	$8.03

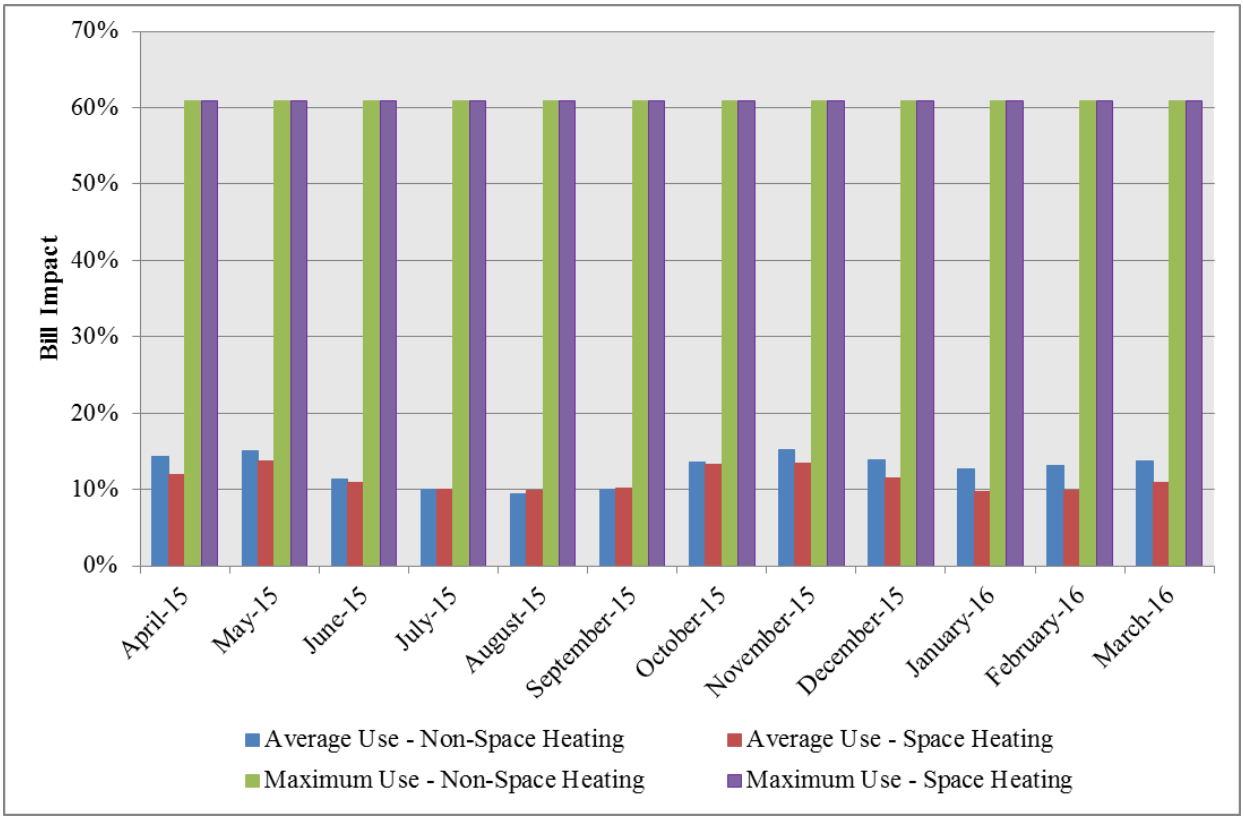
Table 4e. Bills under Ameren Missouri's proposal for residential general use electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	$99.72	$1,091.12	$192.62	$12.92
May-15	$77.89	$1,129.52	$140.38	$12.92
June-15	$127.04	$2,751.10	$266.53	$12.92
July-15	$153.52	$1,669.98	$330.31	$12.92
August-15	$162.19	$1,599.25	$350.99	$12.92
September-15	$142.87	$2,114.55	$298.36	$12.92
October-15	$81.07	$1,398.32	$150.01	$12.92
November-15	$80.90	$1,556.72	$151.58	$12.92
December-15	$113.09	$1,700.72	$218.58	$12.92
January-16	$152.68	$2,291.12	$311.79	$12.92
February-16	$155.48	$2,089.52	$318.49	$12.92
March-16	$123.35	$1,278.32	$257.36	$12.92

Table 4f. Bill impacts of Ameren Missouri's proposal for residential general use electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	11.92%	60.90%	29.27%	4.07%
May-15	13.67%	60.90%	33.95%	4.06%
June-15	10.97%	60.90%	27.43%	3.87%
July-15	9.97%	60.90%	25.15%	3.98%
August-15	9.81%	60.90%	24.41%	3.99%
September-15	10.11%	60.90%	24.41%	3.92%
October-15	13.35%	60.90%	31.69%	3.97%
November-15	13.39%	60.90%	31.17%	3.94%
December-15	11.51%	60.90%	29.84%	3.91%
January-16	9.78%	60.90%	24.01%	3.84%
February-16	9.81%	60.90%	24.76%	3.86%
March-16	10.91%	60.90%	27.49%	4.01%

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



Q. What do you observe about these impacts?

A. Customers with higher use would experience higher bill impacts since the Company is proposing to raise volumetric rates. However, low use customers would still see some bill impacts as a result of both volumetric rate increases and the proposed Energy Grid Access Charge.

C. BILL IMPACT ANALYSES 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 5d and Figure 3.

Table 5a. Bills under DE's proposal for residential general use non-electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	$66.97	$868.64	$148.99	$8.03
May-15	$61.14	$1,458.49	$119.93	$8.03
June-15	$116.37	$2,468.71	$262.03	$8.03
July-15	$153.44	$2,500.40	$331.48	$8.03
August-15	$170.56	$2,611.30	$356.02	$8.03
September-15	$144.17	$2,516.24	$313.75	$8.03
October-15	$72.88	$1,231.82	$144.24	$8.03
November-15	$59.94	$1,049.01	$121.41	$8.03
December-15	$74.34	$1,209.88	$171.07	$8.03
January-16	$91.21	$1,582.80	$227.67	$8.03
February-16	$88.10	$2,445.64	$236.86	$8.03
March-16	$76.55	$2,204.34	$193.34	$8.03

Table 5b. Bill impacts of DE's proposal for residential general use non-electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	-1.48%	4.56%	1.40%	-2.51%
May-15	-1.65%	4.84%	0.51%	-2.51%
June-15	-0.93%	7.89%	3.83%	-3.20%
July-15	0.22%	7.90%	4.76%	-3.20%
August-15	0.74%	7.92%	5.00%	-3.20%
September-15	-0.08%	7.90%	4.56%	-3.20%
October-15	-1.35%	4.76%	1.28%	-2.51%
November-15	-1.68%	4.68%	0.57%	-2.51%
December-15	-1.28%	4.75%	1.88%	-2.51%
January-16	-0.88%	4.87%	2.69%	-2.51%
February-16	-1.01%	5.00%	2.79%	-2.51%
March-16	-1.26%	4.97%	2.26%	-2.51%

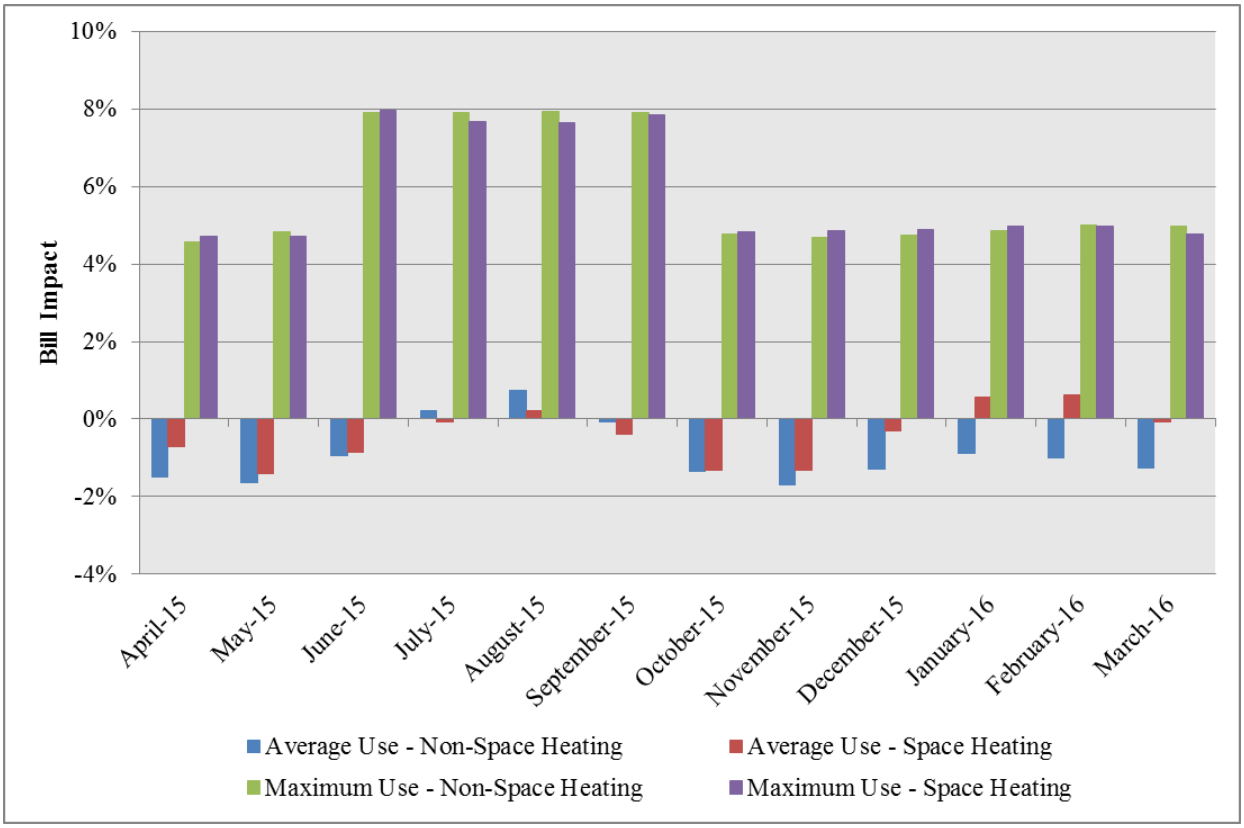
Table 5c. Bills under DE's proposal for residential general use electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	$91.84	$1,097.76	$185.26	$8.03
May-15	$70.04	$1,136.76	$132.20	$8.03
June-15	$118.90	$2,859.51	$262.30	$8.03
July-15	$145.99	$1,729.37	$328.97	$8.03
August-15	$154.91	$1,655.43	$350.59	$8.03
September-15	$134.97	$2,194.10	$295.57	$8.03
October-15	$73.20	$1,409.75	$141.98	$8.03
November-15	$73.05	$1,570.62	$143.58	$8.03
December-15	$105.30	$1,716.86	$211.62	$8.03
January-16	$145.23	$2,316.46	$306.29	$8.03
February-16	$148.06	$2,111.72	$313.09	$8.03
March-16	$115.64	$1,287.88	$251.01	$8.03

Table 5d. Bill impacts of DE's proposal for residential general use electric space heating customers.

Month	Average	Maximum	95th Percentile	Minimum
April-15	-0.70%	4.70%	2.13%	-2.51%
May-15	-1.41%	4.72%	0.93%	-2.51%
June-15	-0.85%	7.96%	3.84%	-3.19%
July-15	-0.06%	7.68%	4.73%	-3.20%
August-15	0.22%	7.65%	4.95%	-3.20%
September-15	-0.39%	7.83%	4.33%	-3.20%
October-15	-1.32%	4.82%	1.22%	-2.51%
November-15	-1.31%	4.87%	1.26%	-2.51%
December-15	-0.30%	4.90%	2.51%	-2.51%
January-16	0.56%	4.99%	3.34%	-2.51%
February-16	0.62%	4.96%	3.38%	-2.51%
March-16	-0.08%	4.78%	2.93%	-2.51%

Figure 3. 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 encourages the Company to deploy AMI at the earliest date of cost-effectiveness and technological feasibility, with due consideration of the many benefits and security-related issues associated with AMI. This recommendation is consistent with the CSEP.[50] Additionally, DE recommends that the Company re-examine its residential TOD rate and market all of its TOD rates to

[50] CSEP, pages 141-143, 151, and 234-235.

prospective customers. 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 Ameren Missouri's proposed rates and DE's proposed rate design. These analyses support moving Ameren Missouri'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.