MISSOURI PUBLIC SERVICE COMMISSION

STAFF'S REPORT RESPONDING TO
CERTAIN COMMISSION QUESTIONS

UNION ELECTRIC COMPANY
d/b/a AMEREN MISSOURI

CASE NO. ER-2016-0179

DECEMBER 23, 2016
JEFFERSON CITY, MISSOURI

I. Commission Orders

Ameren Missouri filed tariffs initiating this File No. ER-2016-0179 on July 1, 2016. On August 29, 2016, the Commission entered its *Order Directing Consideration of Certain Questions in Testimony* ("*Customer Service Order*") and on September 7, 2016, the Commission entered its *Order Directing Submittal of Infrastructure Efficiency Tariff* ("*Infrastructure Order*").

In its *Customer Service Order*, the Commission directed Staff to consider certain issues in its direct testimony, specifically:

1. Installation of AMI smart meters for residential and commercial customers;
2. Plug-in Electric Vehicle Rate: The Plug-in Electric Vehicle rate (PEV) provides a discount on electricity during nighttime hours, 11 p.m. until 7 a.m. With the PEV rate, you can save money on your electric bill just by making simple changes like setting a timer for your vehicle to charge at night and shifting your other electricity usage from weekday summer afternoons. The PEV rate has three different time periods: On-peak, Off-peak and Super Off-peak. See: https://www.georgiapower.com/docs/rates-schedules/residentialrates/2.30_TOU-PEV-5.pdf;
3. Optional Residential Time-of-Use rates (hourly) and Time-of-Day rates - https://www.ameren.com/-/media/missourisite/Files/Rates/UECSheet54Rate1MRES.pdf;
4. PACE Property Assessed Clean Energy programs http://energy.gov/eere/slsc/property-assessed-clean-energy-programs; and
5. PAYS Pay As You Save programs http://www.eeivt.com.1.

In its *Infrastructure Order*, the Commission directed Staff to file a proposed tariff that would provide for a discounted volumetric rate or customer charge, or a waiver or reduction of line extension related charges, or some other mechanism to reduce bills of customers accessing infrastructure identified as under-utilized. Any discount provided by the tariff shall be related, at least in part, to a difference in the cost to serve customers who utilize existing infrastructure versus customers requiring infrastructure expansion.

II. AMI "Smart" Metering

Although the term AMI smart meters is generally known and recognized, there does not appear to be a clear consensus of the exact definition. For purposes of this discussion, Staff will use the following definitions:

Analog Meter – This is a meter that uses electro-mechanical components to track electric usage. This type of meter has been used by the utility industry for many years and is still in use today. The display with the current total usage is a set of wheels with numbers on the wheels that turn as the cumulative usage goes up. Historically, a meter reader would physically read and record the meter reading since the meter had no way to transmit the readings to the utility.

Electronic Meter – With advances in electronics, many of the electro-mechanical components of a meter were replaced with electronic components. The most visible change replaced the numbered wheels with a digital display. When members of the general public refer to an electronic meter, they are typically referring to a meter with a digital display. Although these meters are electronic, a meter reader still physically reads and records the meter reading since the meter has no way to transmit the readings to the utility.

AMR Meter – Automated Meter Reading ("AMR") transmits a signal to the utility or its subcontractor that allows a meter reading to be recorded without a meter reader having to physically read the meter. Although various technologies can be used to transmit the meter readings to the utility, including sending the signal through the distribution system's wires, most utilities use cellular technology to transmit the readings to the utility. Typically, a module is added to the analog and electronic meters that were previously discussed, although some meters now fully integrate the AMR components into their design. The primary communication between the meter and the utility is to provide a meter reading, but many AMR devices also have the ability to send out a signal when the customer's power is interrupted. This is commonly referred to as one-way communication. Some AMR devices also have the ability to receive limited information from the utility. Typically, this allows the utility to "ping" the meter to see if it is receiving power. At best, this could be referred to as limited two-way communication. Although AMR has limited capabilities, Missouri electric utilities use these devices to support advanced meter structures, like Time-of-Day ("ToD") service.

AMI Meters – Advanced Meter Infrastructure ("AMI") refers to meters that have the ability to communicate with the utility by both sending and receiving signals. This is commonly referred to as two-way communication. Unlike the early AMR devices, these meters fully incorporate the metering and transmitting functions into the meter and do not use a separate module. As the name implies, this technology requires the development of an infrastructure to allow the communication to

take place; this infrastructure extends well beyond the meter. The infrastructure also includes devices, sometimes referred to as routers, to collect the signals from a group of meters. Those signals are typically collected (bundled) and sent to the utility using cellular technology. However, while AMI infrastructure has the ability to do more than just read the meter, the additional capabilities often require a utility to have an updated billing and customer information system to fully implement the additional capabilities.

Smart Meters – For these discussions, Staff is reserving the term smart meters for a meter that not only has the ability to communicate between the meter and the utility, but also has the ability to communicate with appliances within a home or business. For lack of a better term, Staff would describe this as three-way communication. Realistically, there are very few appliances on the market that have the ability to communicate with the meter, but many appliance manufacturers are conducting research on these capabilities. Staff would note that some meters, both in Missouri and elsewhere, are being installed that have the ability to perform three-way communication, but the additional function is not being utilized. Staff would also note that members of the general public often use the terms AMI meters and smart meters interchangeably or simply refer to any newer technology meter, including AMR, as a smart meter.

Currently, Ameren Missouri uses AMR technology to support the monthly billing of its customers. Ameren Missouri has been using this technology for over ten years and, in addition to reading meters for monthly bills, AMR technology is used to support Ameren Missouri's ToD service.

The other investor-owned electric utilities are utilizing a mix of AMI, AMR, and manual meter reading technologies. Kansas City Power & Light Company ("KCPL") completed a two-year meter refresh project in 2015 for KCPL's service territory near the Kansas City metro area. This refresh program replaced AMR meters with AMI meters. There is a relatively small group of KCPL's Missouri customers, approximately 15,000, that do not have AMI meters. Those customers are located in Saline, Chariton, Carroll, Lafayette, Howard, and Pettis Counties. This is the portion of KCPL's service territory that is geographically separated from KCPL's metro customer base and meter readers are still reading the meters in this area. Although KCPL is planning to replace the existing meters for this group of customers with AMI meters in the next 3 to 5 years, that work has not yet taken place. Since KCPL has installed AMI meters at over 90% of its Missouri customers'

homes and businesses, KCPL has the largest penetration of AMI meters of any of the investor-owned electric utilities in the state of Missouri. Staff would also note that approximately 180,000 KCP&L Greater Missouri Operations ("GMO") customers, which equates to approximately 56% of GMO's customers, received new AMI meters by September 2016. The Empire District Electric Company currently relies solely on manual meter reading.

As the various meter technologies have been deployed, a small but growing number of customers have become concerned with the newer technologies. In the past, a few customers expressed a concern over electronic meters and AMR meters. Recently, since KCPL and GMO have installed a large number of AMI meters in Missouri in the 2014-2016 timeframe, the number of concerns regarding the installation of AMI meters has risen but still remains small when compared to the total number of AMI meters installed. These customers typically have requested that a traditional analog meter, which would require a meter reader to read the meter, be installed at their home. The most common concern from the general public regarding AMI meters is that these meters may contribute to ill-health effects due to what they describe as RF radiation. RF is the abbreviation for Radio Frequency. RF radiation is a fairly new term and generally refers to what previously was referred to as radio waves. Additional concerns include the concern that AMI meters are a potential venue for invasion of privacy, information sharing, and piracy of information, as well as a potential threat for causing fires due to the meter itself overheating. Both informal and formal complaints have been filed with the PSC, in which electric utility customers request alternatives to having an AMI meter installed at their residence, citing the concerns mentioned above. Similar concerns have been raised about AMR and electronic manual-read meters.

Staff is not aware of documented proof that any negative health effects, privacy, or fire risk concerns have been validated. Staff also understands that one of the expected benefits of the installation of AMI and AMR meters is the payroll cost savings associated with meter readers. Staff also realizes that if a customer has a meter that has to be manually read, this meter would be counter-productive to those benefits. However, given the level of customer concern in Missouri and in general across the country, Staff recommends Ameren Missouri modify its tariff to create a program to allow customers the option of having their meter read manually. The cost associated with this non-standard meter program should be cost based and borne by those customers that choose to utilize the program.

Since no Missouri electric utility currently has a non-standard meter program, the data supporting the costs does not currently exist. GMO is the first Missouri electric utility that has an approved non-standard meter program and that program is the result of the Commission approved Stipulation and Agreement in GMO's most recent rate case, Case No. ER-2016-0156. The tariffs resulting from that case will be effective on February 22, 2017, and Section 5.05 Non-Standard Metering Service is the primary portion of the tariff that describes that program. The GMO program rate design includes a $150 one time Initial Setup Charge and a monthly recurring Non-Standard Meter Charge of $45.00 per month. Staff recommends that Ameren Missouri implement a similar program utilizing a cost-based fee recovery.

Therefore, Staff recommends that Ameren Missouri implement a non-standard meter program that is similar to the non-standard meter program that has been approved for use by GMO. Staff would also recommend that Ameren Missouri keep track of the costs associated with the non-standard meter program in order to have cost data in Ameren Missouri's next rate case to evaluate the one-time setup charge and recurring monthly meter read charge.

Staff Expert/Witness: Daniel I. Beck, P.E.

III. Plug-in Electric Vehicle Rate

Ameren Missouri Electric Vehicle Charging Network Background

Ameren Missouri informed Staff of its plans to install and operate six electric vehicle (EV) charging islands in its service territory along the Interstate 70 ("I-70") corridor between St. Louis and Boonville and on Highway 54 in Jefferson City ("pilot project"). Ameren Missouri estimates a $570,000 total capital investment for the six charging islands and approximately $40,000 of annual ongoing hardware operation and maintenance expense for access to those vendors managing the charging station network. In addition, Ameren Missouri anticipates a $10,000 annual marketing and education expense during the first three years of the program.

Ameren Missouri currently offers an optional Time of Day service for up to a maximum of 5,000 customers that are not net metering customers. However, at this time, Ameren Missouri does not offer any hourly, real time or critical peak plans, and has not proposed a rate structure that would be applicable to privately owned charging stations for the charging of EVs at customers' single-family residences or businesses such as hotels. The Commission issued an order on

August 29, 2016, *Order Directing Consideration Of Certain Questions In Testimony*, which directed Staff to consider in its direct testimony the following questions pertaining to EV charging station networks and Time of Use ("ToU") rates:

1. Plug-in Electric Vehicle Rate: The Plug-in Electric Vehicle rate ("PEV") provides a discount on electricity during nighttime hours, 11 p.m. until 7 a.m. With the PEV rate, you can save money on your electric bill just by making simple changes like setting a timer for your vehicle to charge at night and shifting your other electricity usage from weekday summer afternoons. The PEV rate has three different time periods: On-peak, Off-peak and Super Off- peak. See: https://www.georgiapower.com/docs/rates-schedules/residential-rates/2.30_TOU-PEV-5.pdf;

2. Optional Residential Time-of-Use rates (hourly) and Time-of-Day rates - https://www.ameren.com/-/media/missourisite/Files/Rates/UECSheet54Rate1MRES.pdf;

Based on Staff's research, Georgia's model is a good example of utilizing proper incentives to charge EVs in off-peak hours by dividing the off-peak hours into two categories: Off-Peak and Super Off-Peak.

Georgia Plug-In Electric Vehicle Time of Use Rate

Georgia Power has a Plug-in Electric Vehicle – Time of Use (PEV-TOU) rate that is separate from the residential TOU rate, referred to as the PEV-TOU rate. The PEV rate provides a discount on electricity during nighttime hours, 11 p.m. until 7 a.m. With the PEV rate, the ratepayer can save money on his/her electric bill by making simple changes like setting a timer for the vehicle to charge at night. The PEV rate has three different time periods: On-peak, Off-peak, and Super Off-peak.

ON-PEAK:

The On-Peak period is defined as the hours starting at 2:00 p.m. and ending at 7:00 p.m., Monday through Friday, for the calendar months of June through September (Summer Months). For the days in which Independence Day and Labor Day are observed the hours are considered Off-Peak.

OFF-PEAK:

The Off-Peak period is defined as the hours between 7:00 a.m. and ending at 11:00 p.m. for weekends, holidays, and the calendar months of October through May. The Off-Peak period for the calendar months of June through September (Summer Months) is defined as the hours between 7:00 a.m. and 2:00 p.m. and the hours between 7:00 p.m. and 11:00 p.m., Monday through Friday.

SUPER OFF-PEAK:

The Super Off-Peak period is defined as the hours between 11:00 p.m. and 7:00 a.m., Monday through Sunday, for all calendar months.[1]

Staff Analysis

Staff suggests that consistency among Missouri's investor-owned utilities ("IOUs") with the implementation of PEV-ToU charging rates is important. The PEV-ToU rate is most appropriate for customers who have private EV charging stations in their residences, or businesses that operate the stations for their employees and customers to incent EV owners to charge their EVs in Off-Peak and Super Off-Peak timeframes. The rate is also needed to distinguish typical ToU rates from those rates specific to private home and business EV charging stations.

The Georgia Power model provides an example of how a PEV-ToU rate could be implemented in Missouri**.** Staff witness Sarah Kliethermes in Section IV - Residential Time-of-Use and Time-of-Day Rate Design, provides a discussion of limitations associated with Ameren Missouri's current Time of Day offering. Ameren Missouri could use the Georgia model as an example to develop its own ToU rates for residences and businesses that operate private charging stations.

If implemented, the PEV-ToU rate should be offered as an opt-in option to EV owners and businesses- that could have peak/off-peak charges, to distinguish that class' rate from the ToU rate offered to the Residential class.

To learn from the pilot projects, Staff has recommended in conjunction with Ameren Missouri's tariff filing that Ameren Missouri gather data and report annually to the Commission and interested stakeholders on:

1. The impact of EVs on grid reliability.
2. EV Load Leveling.
    a. Did the load increase overnight due to EV charging?
    b. Did the load level as a direct result of the EV charging network?

[1] See: https://www.georgiapower.com/docs/rates-schedules/residential-rates/2.30_TOU-PEV-5.pdf.

c. Did the EV load allow the utilities to spread out fixed generation cost and recover over a greater amount of electricity sold?
d. Impact on customer bills due to EV load and the resulting load leveling?
e. Did the EV network prevent periods of over-generation?
f. Did the EV network smooth out large load ramps in the morning and evening?

3. Exploring various emerging technologies and their impact on the areas of demand-response, supply-side resourcing and second battery life programs.[2]

Staff Expert/Witness: Byron Murray

IV. Residential Time-of-Use and Time-of-Day Rate Design

Ameren Missouri currently makes available to nearly all classes of customers an optional Time-of-Day ("ToD") service. Participation is not available to those with a current net metering agreement, and certain metering configurations are required for participants. Ameren Missouri's tariff limits participation to 5,000 customers. However, actual participation, by month and by class, is provided below:[3]

Revenue Months	*June, 2015*	*July, 2015*	*August, 2015*	*September, 2015*	*October, 2015*	*November, 2015*	*December, 2015*			
Residential ToD	37	39	36	38	38	36	36			
Small Gen Service ToD	6,659	6,653	6,648	6,654	6,657	6,664	6,658			
Large Gen Service ToD	31	31	31	31	31	32	32			
Small Primary ToD	18	18	18	18	18	17	19			
Large Primary ToD	4	4	4	4	4	4	4			
Total	6,749	6,745	6,737	6,745	6,748	6,753	6,749			
	January, 2016	*February, 2016*	*March, 2016*	*April, 2016*	*May, 2016*	*June, 2016*	*July, 2016*	*August, 2016*	*September, 2016*	*October, 2016*
Residential ToD	36	37	36	38	36	37	37	37	38	36
Small Gen Service ToD	6,663	6,662	6,665	6,661	6,664	6,663	6,661	6,665	6,664	6,663
Large Gen Service ToD	33	34	33	33	33	31	30	27	27	28
Small Primary ToD	18	19	18	18	18	18	18	18	18	18
Large Primary ToD	4	4	4	4	4	4	4	4	4	4
Total	6,754	6,756	6,756	6,754	6,755	6,753	6,750	6,751	6,751	6,749

Since the revisions to the ToD option in the last Ameren Missouri rate case, there have been minimal additions of residential customers.

The on-peak/off-peak rate is applicable only to the summer billing months, and normal customer rates apply to these customers during the winter billing months. The rate applicable during summer peak hours is $0.3021/kWh, with a rate of $0.0755/kWh applicable to summer off peak hours. For comparison, the standard summer residential rate is $0.1208/kWh for all kWh.

[2] EFIS, Case No. EW-2016-0123, Corrected Staff Report, Page 30.
[3] *See* Ameren Missouri Response to Staff DR 0519.

Ameren Missouri's "peak" hours are weekdays from 2:00 pm to 7:00 pm, with all other hours including all day on weekends defined as "off-peak." Based on discussions with Ameren Missouri concerning the design of this program during the pendency of the last Ameren Missouri rate case, this arrangement is more understandable to customers than prior configurations, as a "nights and weekends"-type package associated with some telephone and data plans.

ToD customers' meters are equipped with an AMR module, which are read through the AMR network.[4] The meter and the AMR network provide cumulative readings for both on-peak and off-peak energy usage. The bills are computed using the general billing system. The monthly billing readings for on-peak and off-peak kWh energy are retained in Ameren Missouri's system for sixty (60) months.[5]

Ameren Missouri has identified the following as "lessons learned" in the roll out of the current ToD rate option:

> The recent lesson learned related to the 1M TOD rate option is that it can be difficult to make changes to an existing TOD rate option. For example, in the 1M class we were able to contact each customer to explain the rate design changes since there were only 35, but that was a very time consuming task. Also, the transition from the old TOD schedule to the new TOD schedule required "work arounds" in the metering and billing systems during the transition billing period since two TOD schedules were effective for the initial billing month after the change. Also, an up-front challenge is that without detailed interval data for each customer it is not possible to estimate customer bill impacts. [6]

Ameren Missouri does not currently offer any hourly, real time, or critical peak plans in Missouri, although Ameren Illinois energy customers can participate in a critical peak rebate program. The rebate and pricing differentials in the Illinois plan are related to the value of capacity as a product through the Midcontinent Independent System Operator ("MISO") markets. Based on a discussion with Ameren Missouri and Ameren Illinois personnel, at present there is a more significant market value to this capacity arrangement in the Illinois MISO zone than in the Missouri MISO zone.

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[4] The approximate equipment purchase price of a TOD meter is $100. However, there are additional capitalized costs of $33.41 per meter for: 1) labor $20.22, 2) transportation $7.74 and 3) benefits $5.45. *See* Ameren Missouri Response to Staff DR 0519.

[5] *See* Ameren Missouri Response to Staff DR 0519.

[6] Ameren Missouri Response to Staff DR 0519.

Ameren Missouri's residential customers are generally metered with AMR technology. Staff is of the understanding that a barrier to broader implementation of ToD rates would be the capability and cost of Ameren Missouri's contracted meter reading provider to provide multiple reads per day from existing AMR meters.

Staff suggests Ameren Missouri initiate a mandatory geographically-limited dynamic pricing program. The intent of such a program would be to explore the applicability of such a program to mitigate upgrades to the distribution system, in addition to the typical application of peak rebate programs to mitigate purchases of expensive energy and capacity.

Such a program design would likely proceed as follows:

1. Identify a number of premises served on a given distribution circuit, preferably one that is experiencing load growth from existing premises, as opposed to one experiencing load growth due to additional premises taking service;
2. Configure or install meters or meter reading equipment or contract services consistent with a pre-determined program budget;
3. Customers in the study area would continue to be billed on the applicable rate using a manual billing process, but a peak time rebate would be developed and credited against bills. Specific times for the rebate would depend on the load characteristics of the studied circuit, but late afternoon and early evening hours during the summer would be anticipated to be the applicable time period. This also coincides with above-average market prices for energy, and the time of day and year typically associated with MISO capacity requirements; then
4. Study whether the application of a peak time rebate had an impact on delaying the need for distribution system upgrades. The needs of adequately serving the impacted customers would come before the prioritization of this study, such that any necessary upgrades would be made and not unreasonably delayed.

Staff Expert/Witness: Sarah Kliethermes

V. PACE Property Assessed Clean Energy

Property Assessed Clean Energy ("PACE") financing is designed to make payments affordable by offering a fixed interest rate that is payable over an extended period of time.[7] With residential PACE programs, home improvement energy efficiency measures such as HVAC, solar, windows and doors, roofing, air sealing and insulation are permanently installed and assessed to the property and the assessment is designed to transfer with the home.

[7] Up to 20 years.

The Missouri Clean Energy District ("MCED") has partnered with Renovate America ("Renovate") to bring PACE to homeowners in the state of Missouri through the Home Energy Renovation Opportunity ("HERO") program. HERO is the leading program for PACE financing and has provided more than $1.3 billion in financing since 2012 and has 95% market share of residential PACE in California. Previously California was the only state utilizing the HERO program. Renovate selected Missouri to be the next state for HERO and opened a new office in Kansas City, Missouri on May 1, 2016. Contractor training started mid-June, 2016, and HERO was launched in July, 2016. Renovate is acquiring a large and growing contractor network[8] and has created an industry-leading software platform, helping contractors expand their business. HERO registered contractors have access to HERO Pro – an integrated, secure platform designed to make the estimating, approval, documentation and funding process as easy as possible for homeowners and contractors. HERO provides a comprehensive training and registration program, designed to familiarize contractors with the financing terms and the property owner approval process.

In September 2016, residential PACE became available in Jackson County[9] in Missouri. In November 2016, residential PACE expanded availability in the Kansas City[10] and St. Louis[11] areas with possible availability in additional locations in December 2016. The process for initiating PACE starts with getting the County Commission to sign a resolution to have PACE in the county. Jackson County already had a signed resolution by the County Commission to have commercial PACE. An addendum was required to include residential PACE. After County Commission approval, the tax collector of the county has to agree and sign an installment payment agreement ("IPA") to collect as a tax. To date, Renovate, through its HERO program, has $10 million in approved loans in Jackson County, including $2.4 million in current projects and $700,000 in completed projects.

[8] More than 7,000 in California and more than 150 in Missouri.
[9] As of the 2010 census, the population of Jackson County was 674,158 making it the second-most populous county in Missouri.
[10] Lee's Summit, Blue Springs, Buckner, Grain Valley, Grandview, Greenwood, Levasy, Lone Jack, Lake Lotawana, Lake Tapawingo, Raytown, Sugar Creek, Unincorporated Jackson County, River Bend, Sibley, Unity Village, Kansas City – Jackson County, Oak Grove, Pleasant Hill, Kansas City – Clay County, North Kansas City, and Kansas City – Platte County.
[11] Franklin County, Arnold, Ballwin, Berkeley, Black Jack, Charlack, Chesterfield, Crestwood, Ellisville, Eureka, Ferguson, Hazelwood, Olivette, Town and Country, University City, and Valley Park.

Program eligibility through Renovate America's HERO program, which is subject to change, includes the following:

- Maximum 90% loan-to-value (LTV) ratio;
- Current on property taxes for last twelve months and not late more than once over the prior three years;
- Current on mortgage for last twelve months;
- No bankruptcy for last two years;
- No involuntary liens on the property; and
- $2,500 minimum financing; maximum financing is twenty percent of property value (LTV cannot exceed 100%).

Renovate indicated there are plans to implement the HERO program in various, mainly urban, counties throughout Missouri. The biggest obstacle currently is the hesitation from the county tax collectors to sign and agree to the IPA.

PACE financing has been available for Missouri commercial, industrial, agricultural, multi-family, not-for-profit and public facilities since 2011. In January 2011, Jefferson City formed the Mid-Missouri Clean Energy Development Board, now known as the Missouri Clean Energy District ("MCED"), the first local PACE clean energy development board in Missouri. MCED contracted with the Missouri Clean Energy Fund LLC to be its PACE administrator. In July 2015, the Show Me PACE Clean Energy District ("Show Me PACE") began offering funding statewide for clean energy project improvements. Show Me Pace selected the Missouri Energy Initiative as the administrator. In 2016, Show Me PACE completed the largest agricultural PACE project in the country, which utilized $4 million in PACE financing for energy and water improvements to a facility in Pleasant Hope. In downtown Kansas City, a three-story warehouse renovation utilized PACE financing. In Ameren Missouri's service territory specifically, PACE financing was utilized for an office building retrofit in Maryland Heights, a large warehouse and office building retrofit in Shrewsbury, and a manufacturing facility retrofit in Chesterfield.

Staff Expert/Witness: Bradley Fortson

VI. PAYS Pay As You Save

Pay As You Save® ("PAYS®") is a market-based system that enables utility customers to purchase and install cost-effective energy efficiency upgrades or distributed renewable energy assets

through a voluntary program that assures immediate net savings to customers.[12] The idea behind PAYS® is for energy-saving upgrades to be installed in a customer's home or building but the utility pays the up-front cost of the installed energy-saving measures. To recover its costs, the utility puts a fixed charge on the customer's electric bill that is significantly less than the estimated energy savings from the upgrades. Therefore, the customer sees immediate savings by paying a fixed charge that is less than the estimated energy savings. Once the utility recovers its costs, the obligation of the customer to pay ends.

Core elements and general terms and conditions for PAYS® programs typically include the following:[13]

- Customers voluntarily choose to opt into a program that allows a utility to invest in upgrades at a site and recover its costs on the bill.
- Cost recovery charges at most implementing utilities has been equal to or less than 80% of the estimated savings, generating immediate net savings to the customer.
- Cost recovery for the utility, through a fixed charge on a participant's bill, is not more than 80% of the estimated savings over the useful life of the upgrade. As a result, the portion of the estimated monthly net savings that a participant keeps as immediate net savings is 20% or higher.
- The utility will only make investments that are cost-effective with the terms above, but the customer can make an upfront payment to cover the cost premium of upgrades that are not cost-effective under current rates.
- The utility may use any source of capital to make the investment, including third-party capital where permitted.
- The investment is tied to the meter, not to the customer, so the cost recovery charge applies automatically to successor customers at that location.
- Energy and water efficiency are considered essential utility services, so the customer can be disconnected for non-payment.
- Capital provider is assured repayment in full by the utility regardless of the actual collections from customers.
- If upgrades stop working through no fault of the customer, the cost recovery charge ends until the efficiency improvement is repaired.
- If repairs are necessary or a property were to remain vacant for a period of time, the term of the program may be extended to ensure full cost recovery by the utility.
- The utility may harness multiple benefit streams to pay incentives that help more upgrades meet the threshold for cost effectiveness and quality for the program.

[12] http://www.financeforresilience.com/priority/pay-save-financing-distributed-clean-energy-upgrades/

[13] List taken from an Energy Efficiency Institute, Inc. paper titled Financing Distributed Energy Upgrades that was used in a Holmes Hummel Ph.D. presentation to Staff and other parties on August 19, 2016.

- The utility can recover charge-offs from a variety of sources, consistent with how other uncollectibles are recovered.
- Utilities capture multiple value streams, including avoided demand charges and avoided energy procurement, to strengthen their balance sheet while lowering customer bills.

Currently there is no Missouri investor owned utilities participating in the PAYS® system. As a result of the Missouri Energy Efficiency Investment Act ("MEEIA") statewide collaborative process, the idea of on-bill financing is being researched and evaluated. Ameren Missouri is not currently moving forward with PAYS® specifically, and while many details are yet to be worked out, they are moving forward in an attempt to implement some form of an on-bill financing mechanism.

Staff Expert/Witness: Bradley Fortson

VII. Infrastructure Efficiency

In its *Infrastructure Order*, the Commission stated that in Ameren Missouri's comments filed December 8, 2015, in File No. EW-2016-0041, Ameren Missouri noted that it "'supports efforts to encourage new customer growth on portions of its system' where there is excess capacity and where it is both cost effective and not discriminatory to do so."

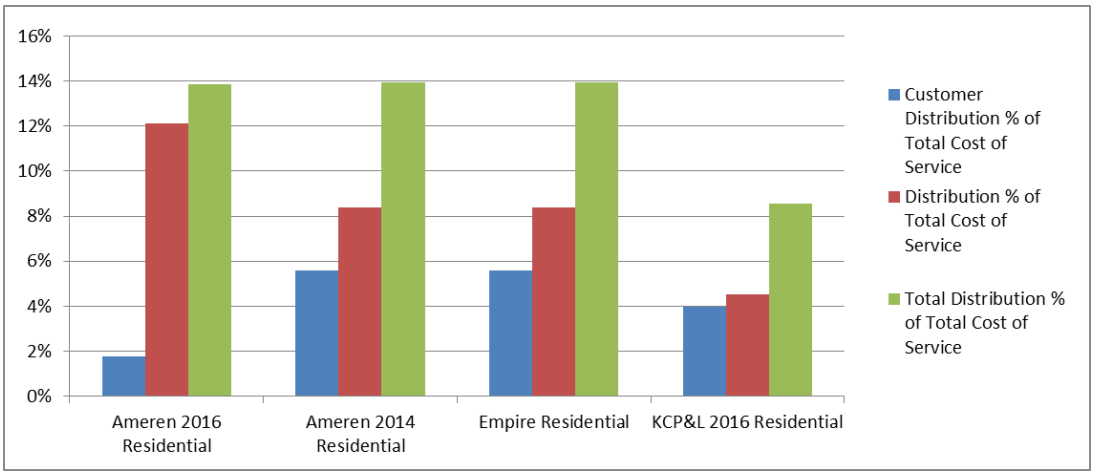
On September 19, 2016, Ameren Missouri filed its *Motion to Modify Order Directing Submittal of Infrastructure Efficiency Tariff*, drawing the Commission's attention to Ameren Missouri's filing of its proposed "Economic Redevelopment and Efficient Infrastructure Utilization Pilot" filed as part of the tariff filing initiating the pending rate case, and requesting the Commission modify its *Infrastructure Order*. On October 5, 2016, the Commission noted its appreciation of Ameren Missouri's tariff filing, but declined to modify its order. Staff will address Ameren Missouri's proposed tariff in its Class Cost of Service and Rate Design pre-filed rebuttal testimony.

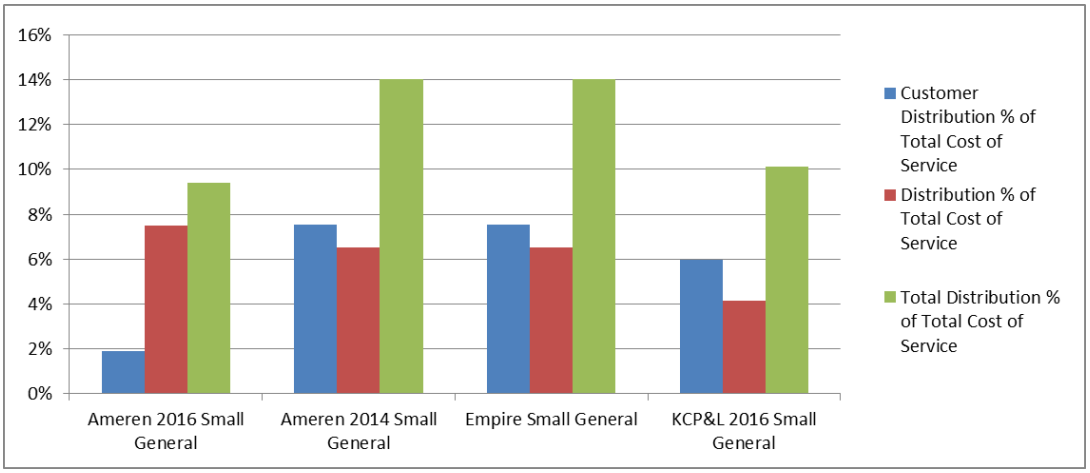
In its *Infrastructure Order*, the Commission directed Staff to propose a "tariff that would provide for a discounted volumetric rate or customer charge, or a waiver or reduction of line extension related charges, or some other mechanism to reduce bills of customers accessing infrastructure identified as under-utilized. Any discount provided by the tariff shall be related, at least in part, to a difference in the cost to serve customers who utilize existing infrastructure versus customers requiring infrastructure expansion." Staff has reviewed the Class Cost of Service Studies

it has prepared in the last rate case for Empire, as well as the pending KCPL and Ameren Missouri rate cases.[14]

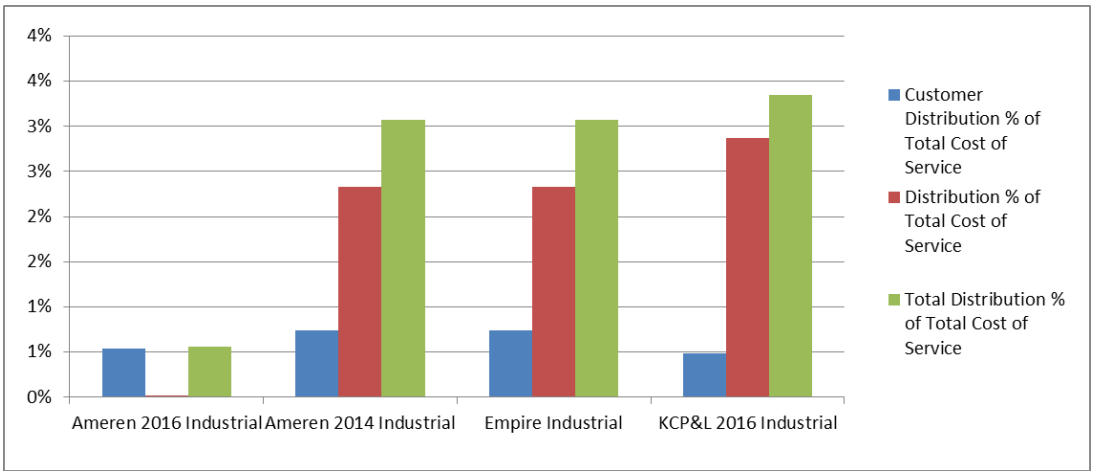
At a class level, and as studied in the direct filing in each of those cases, the customer-related distribution revenue-requirement ranges from approximately less than .02% of industrial cost of service, to 2%-6% of residential cost of service, to 2%-8% of small general cost of service. The customer-related distribution facilities include the service drop, the meter base, and the meter itself.

Across the studied utilities, the entire distribution system cost of service as a percent of class revenues ranges from approximately 1%-3% for industrial customers, to 9%-14% for small general customers, to 9%-14% for residential customers.





[14] There was not a Class Cost of Service Study performed in the last KCP&L Greater Missouri Operations Company rate case.



It would be difficult to conclude that customers in underutilized areas should provide *no* revenue recovery for the distribution system. While functionalized costs are an important consideration of most analysts in designing rates, rates rarely perfectly align with the functionalized costs determined at a class level in a Class Cost of Service ("CCOS"). Further, not only is a given CCOS a snapshot in time based on a particular party's recommended revenue requirement, but that CCOS is also based on a class level study without regard to geography. Finally, as currently configured, CCOS functionalized results are calculated based on a class-average rate of return. As such, even if the exact same facilities were installed for two classes, one under-contributing to rate of return and one over-contributing to rate of return, the functionalized results would show the revenue requirement associated with the facilities for the over-contributing class to be higher than the revenue requirement associated with the same facilities for the under-contributing class.

The Commission's directed inquiry in this case appears to be directed at geographically-specified cost causation, which requires a level of data not typically made available to Staff, and a set of assumptions not typically made in designing rates. Staff expects to continue the discussions with Ameren Missouri, begun in the last case, concerning identification of specific areas to be targeted for redevelopment both in the St. Louis area and throughout its service territory. In the absence of this circuit-specific data, and in the interest of simplicity and ease of implementation, Staff recommends that if a volumetric or monthly-bill based discount is to be implemented, such discount be proportionate to the functionalized customer-related distribution costs for each broad category of class, applied as a percentage to the customer's monthly bill after application of all other applicable surcharges, discounts, and riders.

Specifically for Ameren Missouri, Staff recommends Residential customers in impacted areas would receive a monthly discount of approximately 2%, Small General Service customers would receive a monthly discount of approximately 2%, and all other customer classes (LGS, SPS, and LPS) would receive a monthly discount of approximately .5%. The applicable areas would be similar or identical to those identified in Ameren Missouri's proposed Economic Redevelopment and Efficient Infrastructure Utilization Pilot.

As discussed in its report in File No. EW-2016-0041, Staff recommends that Ameren Missouri modify its facility extension tariff provisions to more fully consider the incremental costs a customer causes to a system in determining how much, if any, customer advance is required. GMO's current tariff provides a model of this approach.[15] By considering these costs, a customer causing new utility investment is more likely to bear some offset to that investment than under other approaches that do not consider incremental costs. As it applies to a customer accessing infrastructure already in place and not requiring any upgrades, this means that the customer would not have to up-front any significant costs, versus if that customer required infrastructure expansion, in which case that customer would have to provide revenues in excess of the cost of the expansion, or provide an up-front payment to hold other customers harmless for the costs of its expansion.

Staff Expert/Witness: Sarah Kliethermes

[15]GMO's tariff calls for consideration of the relationship between "Estimated Margins," and "Fixed Carrying Costs" where Estimated Margins are determined by first multiplying the effective rates for each customer class by the estimated incremental usage – and then subtracting 1) applicable margin allocation for network and infrastructure support costs; and 2) incremental power and energy supply costs. Fixed Carrying Costs are determined as the Company's cost of capital to provide the requisite return on its investment as well as the costs for depreciation, property taxes, and property insurance.

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 Revenues for Electric Service	))))	Case No. ER-2016-0179

AFFIDAVIT OF DANIEL I. BECK, P.E.

STATE OF MISSOURI)
) ss.
COUNTY OF COLE)

COMES NOW Daniel I. Beck, P.E., and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Staff Report Responding to Certain Commission Questions*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Daniel I Beck

Daniel I. Beck, P.E.

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 23rd day of December, 2016.

Dianna L. Vaught

Notary Public

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: June 28, 2019
Commission Number: 15207377

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 Revenues for Electric Service	))))	Case No. ER-2016-0179

AFFIDAVIT OF BRAD J. FORTSON

STATE OF MISSOURI	)	
	)	ss.
COUNTY OF COLE	)	

COMES NOW Brad J. Fortson and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Staff Report Responding to Certain Commission Questions*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Brad J. Fortson

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 23rd day of December, 2016.

Diana L. Vaught
Notary Public

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: June 28, 2019
Commission Number: 15207377

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 Revenues for Electric Service	)))))	Case No. ER-2016-0179

AFFIDAVIT OF SARAH L. KLIETHERMES

STATE OF MISSOURI	)	
	)	ss.
COUNTY OF COLE	)	

COMES NOW Sarah L. Kliethermes and on her oath declares that she is of sound mind and lawful age; that she contributed to the foregoing *Staff Report Responding to Certain Commission Questions*; and that the same is true and correct according to her best knowledge and belief.

Further the Affiant sayeth not.

Sarah L. Kliethermes

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 22nd day of December, 2016.

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: June 28, 2019
Commission Number: 15207377

Dianna L. Vaught
Notary Public

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 Revenues for Electric Service	))))	Case No. ER-2016-0179

AFFIDAVIT OF BYRON M. MURRAY

STATE OF MISSOURI)
) ss.
COUNTY OF COLE)

COMES NOW Byron M. Murray and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Staff Report Responding to Certain Commission Questions*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Byron M. Murray

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 23rd day of December, 2016.

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: June 28, 2019
Commission Number: 15207377

Notary Public