Exhibit No.:	
Issues:	Energy Efficient CHP and Obligation to Serve
Witness:	Jane E. Epperson
Sponsoring Party:	Missouri Department of Economic Development, Division of Energy
Type of Exhibit:	Direct Testimony
Case Nos.:	ER-2018-0145 ER-2018-0146

MISSOURI PUBLIC SERVICE COMMISSION

KANSAS CITY POWER & LIGHT COMPANY

AND

KCP&L GREATER MISSOURI OPERATIONS COMPANY

CASE Nos. ER-2018-0145 and ER-2018-0146

DIRECT TESTIMONY

OF

JANE E. EPPERSON

ON

BEHALF OF

MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT

DVISION OF ENERGY

Jefferson City, Missouri
July 6, 2018

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In The Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service	)))	Case No. ER-2018-0145
In The Matter of KCP&L Greater Missouri Operations Company's Request for Authority to Implement a General Rate Increase for Electric Service	))))	Case No. ER-2018-0146

AFFIDAVIT OF JANE E. EPPERSON

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

Jane E. Epperson, of lawful age, being duly sworn on her oath, deposes and states:

1. My name is Jane E. Epperson. I work in the City of Jefferson, Missouri, and I am employed by the Missouri Department of Economic Development, Division of Energy as an Energy Policy Analyst.
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.

Epperson

Jane E. Epperson

Subscribed and sworn to before me this 6th day of July, 2018.

LAURIE ANN ARNOLD
Notary Public - Notary Seal
State of Missouri
Commissioned for Callaway County
My Commission Expires: April 26, 2020
Commission Number: 16808714

Laurie Ann Arnold

Notary Public

My commission expires: 4/26/20

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I. INTRODUCTION AND PURPOSE OF TESTIMONY

Q. Please state your name and business address.

A. My name is Jane E. Epperson. My business address is 301 West High Street, Suite 720, PO Box 1766, Jefferson City, Missouri 65102.

Q. By whom and in what capacity are you employed?

A. I am employed by the Missouri Department of Economic Development ("DED"), Division of Energy ("DE") as an Energy Policy Analyst.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of the Missouri Department of Economic Development, Division of Energy.

Q. Please describe your educational background and employment experience.

A. I received my Masters of Science in Geology from the University of Missouri – Columbia and my Bachelor of Arts degree in Geology from Stephens College, Columbia, Missouri. I began work with DE in 2014 as an Energy Policy Analyst. In that capacity I have filed testimony in prior cases (ER-2014-0370, ER-2014-0351, ER-2014-0258, ER-2016-0179), participated in Missouri Energy Efficiency Investment Act ("MEEIA") rule revision dockets and various electric and gas collaboratives, contributed to development of the Comprehensive State Energy Plan and provided project management for development of Missouri's first, statewide Technical Reference Manual. Prior to working with DE, I was employed by the Missouri Department of Conservation as Supervisor of the Policy Coordination Unit, which was responsible for statewide, regional, and Conservation Area planning; statewide compliance with environmental and cultural resource laws; Missouri River, Mississippi River and White River basin interstate coordination; and human dimensions (survey) research. Prior to working with the Missouri Department of Conservation, I was employed as a Hydrologist III with the Missouri Department of Natural Resources – Director's Office, focusing on interstate water policy and management issues.

Q. What is the purpose of your testimony?

A. DE offers direct testimony to provide the Commission with facts on Combined Heat and Power ("CHP") that may be relevant to its decisions in this case. As the Commission considers the standby service rider ("SR") proposed by Kansas City Power & Light Company ("KCPL") in this case, DE strongly encourages the Commission to create a regulatory environment that is conducive to CHP and to avoid rate designs and tariffs that would hinder a customer from utilizing CHP to improve their process or business. Specifically, my direct testimony will a) clarify the obligation for utilities to provide cost-based standby service to customers who choose to self-generate a portion of their energy requirement, b) describe CHP technology and associated energy efficiency benefits to the customers, c) summarize results of the collaborative Workshop to develop a standby service rider in Ameren Case No. ER-2014-0258, and d) provide components and characteristics of a standby service rider that is not discriminatory. I will provide recommendations specific to KCPL's proposed standby service rider in rebuttal testimony.

Q. What information did you review in preparing this testimony?

A. In preparation of this testimony I reviewed reports and publications about CHP technology, best practices literature, and standby service riders of other states; Direct, Rebuttal and Surrebuttal Testimony by DE on the Standby Service Rider issue in previous rate cases (Case Nos ER-2014-0258, and ER-2016-0179); Direct Testimony filed by Kansas City Power & Light Company by Bradley D. Lutz; and Kansas City Power & Light Company's responses to my Data Request Numbers 300-312 in this case.

II. OBLIGATION TO SERVE

Q. Is a customer's choice to generate a portion of their own energy on-site at the discretion of a Missouri regulated utility?

A. No. Missouri Public Service Commission rules specify an electric utility "obligation" to purchase from, sell to, and interconnect with customer generators—specifically called "qualifying facilities"[1]. This obligation is consistent with the federal Public Utility Regulatory Policy Act of 1978 (PURPA), which defines two distinct types of "qualifying facilities"[2]: small power production facilities[3] (customer generated renewable energy sources) and cogeneration facilities[4] (customer combined heat and power or CHP systems). Missouri regulation requires that rates,

> "… shall be just and reasonable and in the public interest and shall not discriminate against any qualifying facility in comparison to rates for sales

[1] 4 CSR 240-20.060(3)(A),(B),(C)
[2] 18 C.F.R. 292.207
[3] 18 C.F.R. 292.203c, 292.204
[4] 18 C.F.R. 292.203b, 292.205

to other customers served by the electric utility. Rates for sales which are based on *accurate data and consistent system-wide costing principles* shall not be considered to discriminate against any qualifying facility to the extent that those rates apply to the utility's *other customers with similar load* or other cost-related characteristics"[5] (emphasis added).

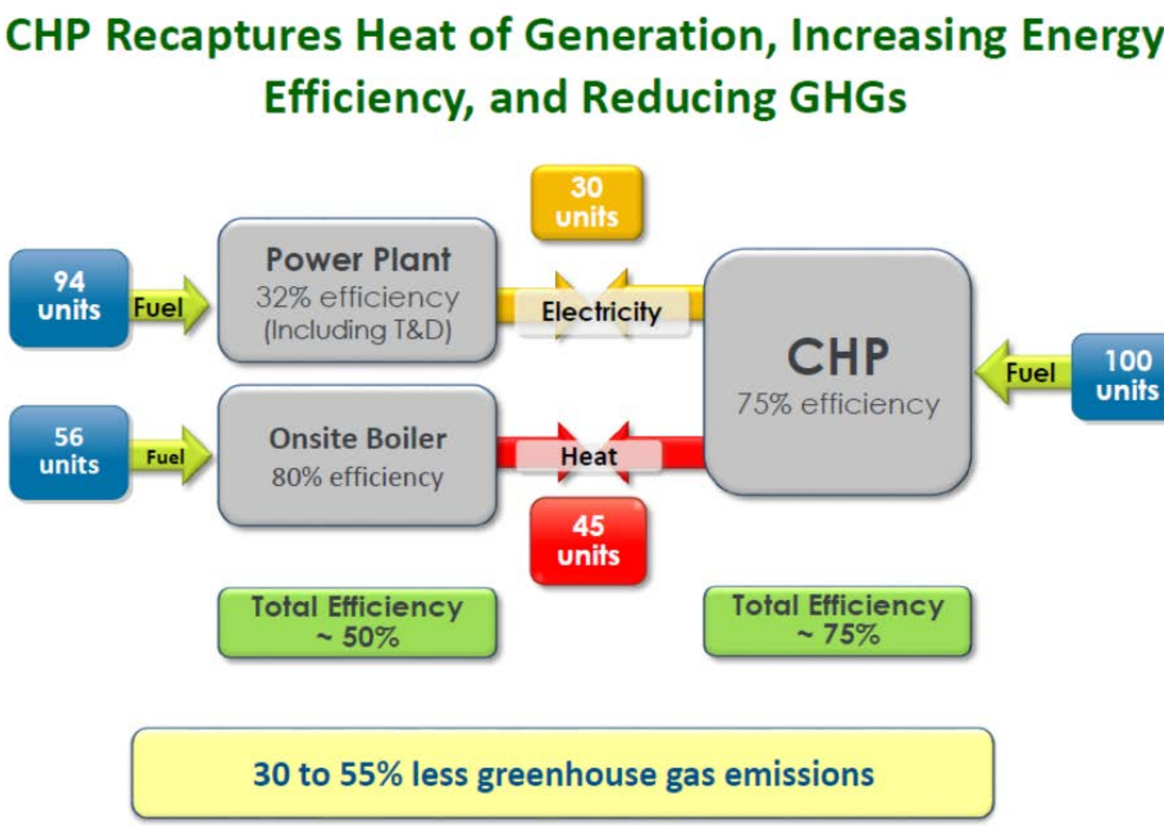
III. ENERGY EFFICIENT COMBINED HEAT AND POWER

Q. What is CHP?

A. CHP refers to an array of proven technologies that concurrently generate electricity and useful thermal energy from the same fuel source (conventional or renewable). A simple illustration of a separate heat and power system is a typical commercial or industrial building that purchases electricity generated by a utility but has a natural gas-fired boiler in the basement that makes hot water to heat the building. Thus, supply of the building's electric and thermal energy requirements necessitates the use of two separate fuel sources. In contrast, CHP systems utilize one fuel to make both electric and thermal energy. This is done by recovering the otherwise wasted heat from the electric generation process and using it to meet the thermal needs of the building. Figure 1 illustrates how CHP uses one source of fuel (100 units) as opposed to two sources of fuel (150 units) in a more efficient (75% vs 50%) way than separate heat and power systems.

[5] 4 CSR 240-20.060(5)(A)

FIGURE 1. ENERGY EFFICIENCY COMPARISON OF CHP VERSUS SEPARATE HEAT AND POWER PRODUCTION[6]

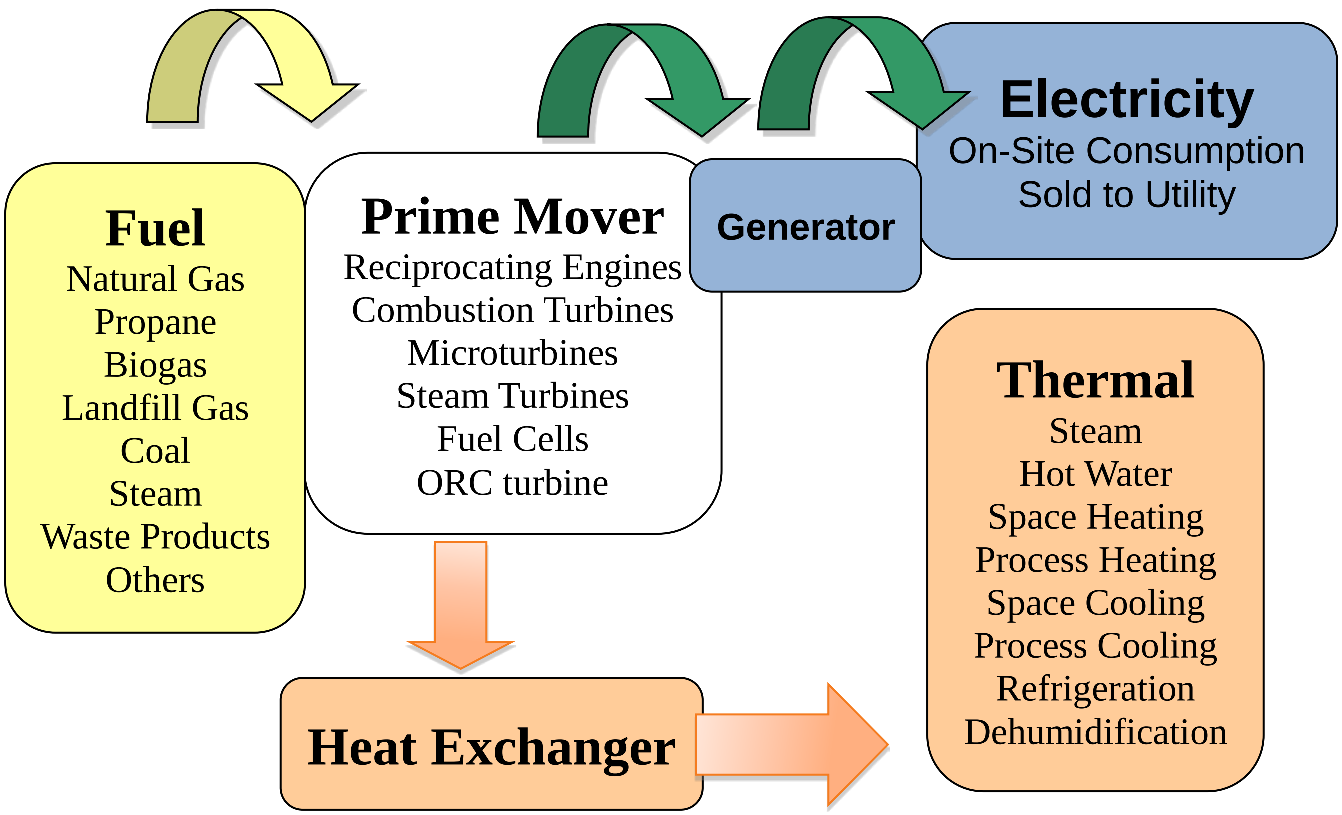


Fuel drives the prime mover, which converts the fuel into other forms of energy that are useful to a device or process. For example, in a car, the engine (prime mover) burns gasoline (fuel) to produce the energy required to move the car. The conversion of fuel to useful energy to move the car also produces heat that is not usable to the car. The car's radiator releases unusable heat to the atmosphere. Hence, a portion of the energy contained in the gasoline was wasted. In CHP systems, a heat exchanger converts waste heat created by the prime mover into

[6] U.S. Department of Energy Central CHP Technical Assistance Partnership, 2018.

thermal energy that is useful for onsite applications. Figure 2 is a schematic that summarizes the basic elements of a typical CHP system. The diversity of fuel sources, prime movers, and thermal applications underscores the incredible potential application of CHP.

FIGURE 2. CHP System Schematic[7]



[7] U.S. Department of Energy Central CHP Technical Assistance Partnership, Cliff Haefke, June, 2018.

Q. Are there benefits associated with CHP for customers and the utilities that serve them?

A. Yes. Reduced overall energy consumption attributable to the increased efficiency of CHP systems creates cost savings, translating into increased availability of funds for capital investment, business expansion or other purposes. When properly configured and maintained, CHP systems operate very reliably, enhancing the customer's ability to maintain normal business operations at all times (increased resiliency). The utility may benefit from a customer with a CHP system when the CHP system contributes to reducing load during peak periods, thus benefiting all utility customers, and particularly when the CHP system is sited in an area of localized grid congestion.

Q. What is a Distributed Energy Resource ("DER")?

A. A DER is a generation source located near the point of energy consumption by a customer-user. The location of DERs near customer-users results in generation sources distributed throughout the grid, separate from centralized utility generation infrastructure. Examples of DERs include, but are not limited to, microgrids, combined heat and power, solar photovoltaic, wind, and energy storage.

Q. Has the Missouri Public Service Commission ordered a workshop on DERs?

A. Yes, the Commission opened working docket EW-2017-0245 seeking responses to nine questions.

Q. How did the EW-2017-0245 docket address CHP?

A. In my opinion, inadequately. While the proposed definition of DER included combined heat and power specifically, the overall effort focused on utility DERs.

The following is an excerpt from DE's formal comments on the proposed revision to the rule:

> "… a regulated utility is obligated to provide non-discriminatory interconnection services, so it is important for, and incumbent upon, regulated utilities and regulators to remove impediments to the customer use of DERs. … the failure to adequately address customer-owned DERs could undervalue customer-owned DERs in the context of utility planning."

Q. What is the link between DE, CHP and Missouri economic development?

A. The Division of Energy assists, educates, and encourages Missourians to advance the efficient use of diverse energy resources to drive economic growth, provide for a healthier environment, and achieve greater energy security for future generations. CHP contributes to all three areas of DE's role in support of economic development.

Q. Is CHP addressed in the Missouri Comprehensive State Energy Plan?

A. Yes. The following are recommendations from the Missouri Comprehensive State Energy Plan that address combined heat and power.

1.1: Modifying the Missouri Energy Efficiency Investment Act.

- Allow electric utilities to treat combined heat and power in the same manner as other energy efficiency measures[8].

[8] https://energy.mo.gov/sites/energy/files/MCSEP.pdf (page 213)

2.6: Maintaining Business Affordability and Competitiveness.

- Continue to review and recommend revisions to regulated utility tariffs to eliminate barriers or incent on-site customer generation of electricity for businesses[9].
- Continue to identify and encourage opportunities for large commercial and industrial customers for cost-effective energy efficiency, demand response programs and on-site generation to help them reduce their energy consumption and resources use and manage their peak energy usage[10] .

3.6: Expanding Combined Heat and Power Applications.

- Establish cost-based stand-by rates and interconnection practices that reflect best practices.[11]

Q. Is CHP the same as a microgrid?

A. No. A microgrid is "… a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid."[12] Microgrids typically consist of a) generator units located at one or more locations within the defined electrical boundary that use the power, b) electrical distribution infrastructure (wires, conduit, transfer switches, etc.) to distribute the electricity from the generator units to multiple locations within the boundary and, c) interconnections with the local

[9] Ibid. (page 226)
[10] Ibid. (page 227)
[11] Ibid. (page 232)
[12] Sandia National Laboratories, 2014, *The Advanced Microgrid: Integration and Interoperability*, https://energy.gov/sites/prod/files/2014/f19/AdvancedMicrogrid_Integration-Interoperability_March2014.pdf.

utility's distribution system, which allows the microgrid to both receive electricity from the utility system, and to export electricity from the microgrid system[13]. In the case of a utility system power outage, the microgrid is capable of disconnecting (islanding) itself from the utility distribution system so the microgrid can continue to function without exporting power to the utility system that may injure workers who may be working on its' repair. Once the utility system is re-energized after its outage, the microgrid is capable of re-synchronizing with it. While each microgrid is unique, all microgrids need a strong, stable source of baseload power, or "anchor", and CHP is often the technology that provides it[14]. So, a microgrid may include CHP but CHP alone is not a microgrid.

Q. Is CHP generally designed to meet or exceed the total energy needs of a customer/facility?

A. No. CHP systems are typically sized and designed around the thermal requirement of a customer's facility. While unique to each customer application, a CHP system sized and designed around the thermal requirements of a facility typically will generate only a portion of the electrical energy requirements of the facility. Thus, a significant portion of the total electrical energy requirements is purchased from the utility, with the customer being subject to full service tariffs as well as a standby service rider.

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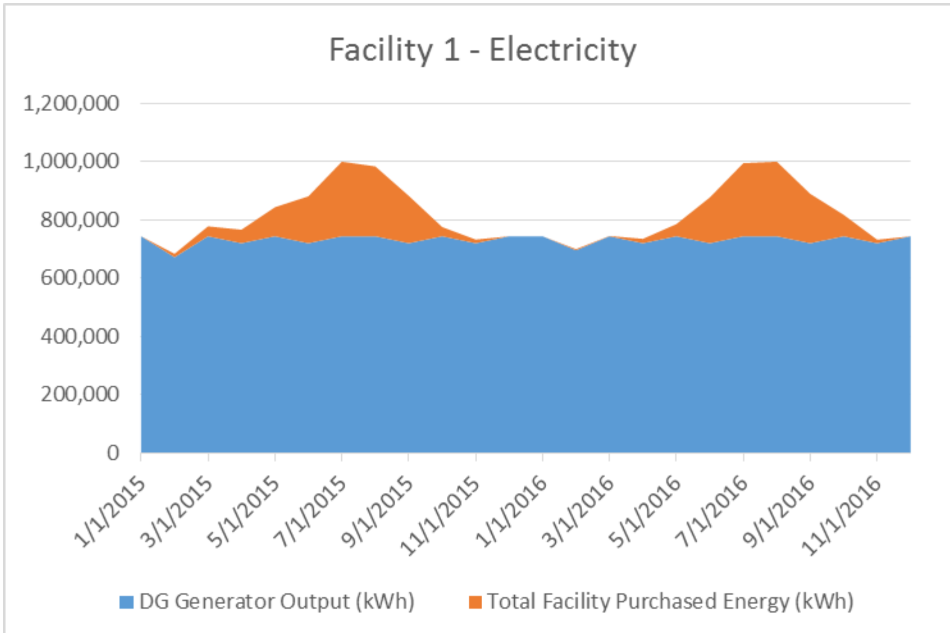
[13] Baier, Martin, Bhavaraju, Vijay, Murch, William, and SercanTleke, 2017, "Making Microgrids Work: Practical and technical considerations to advance power resiliency." http://www.eaton.com/ecm/public/@pub/@electrical/documents/content/wp027009en.pdf.

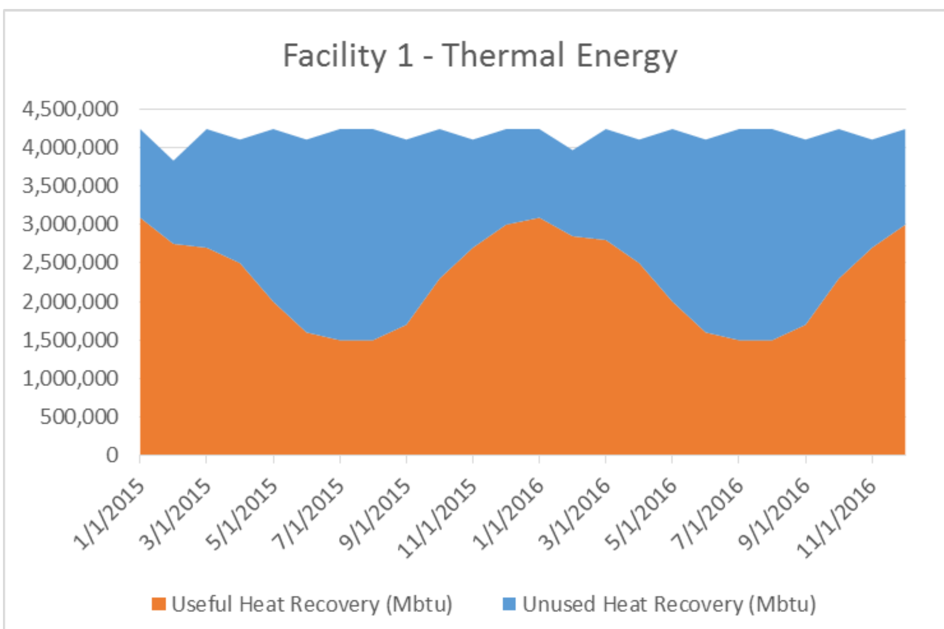
[14] https://www.districtenergy.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=fce6cd6d-0896-b77b-97ce-ab5baae5124c

Q. Why would a customer choose to generate only a portion of their total energy needs through CHP?

A. CHP system's energy efficiency and economic advantage is maximized when 100% of the thermal energy produced is utilized in a productive way. A CHP system sized to meet the total electricity requirement commonly creates thermal energy exceeding that which can be productively used, and the excess thermal energy must be "dumped" or wasted. It is not economical to purchase and operate a CHP system to meet the total electrical energy requirement of a customer's facility unless all of the thermal energy from the CHP system is also productively used. Figure 3 illustrates the unrealistic scenario in which the CHP system generates the majority (about 90%) of the annual facility electricity energy requirements, resulting in a significant amount of unused (wasted) thermal energy. The CHP system efficiency would average less than 60% and, during off-peak thermal periods (summer), its efficiency would fall below 50%.

FIGURE 3. CHP Designed to Meet Total Electricity Requirement[15].



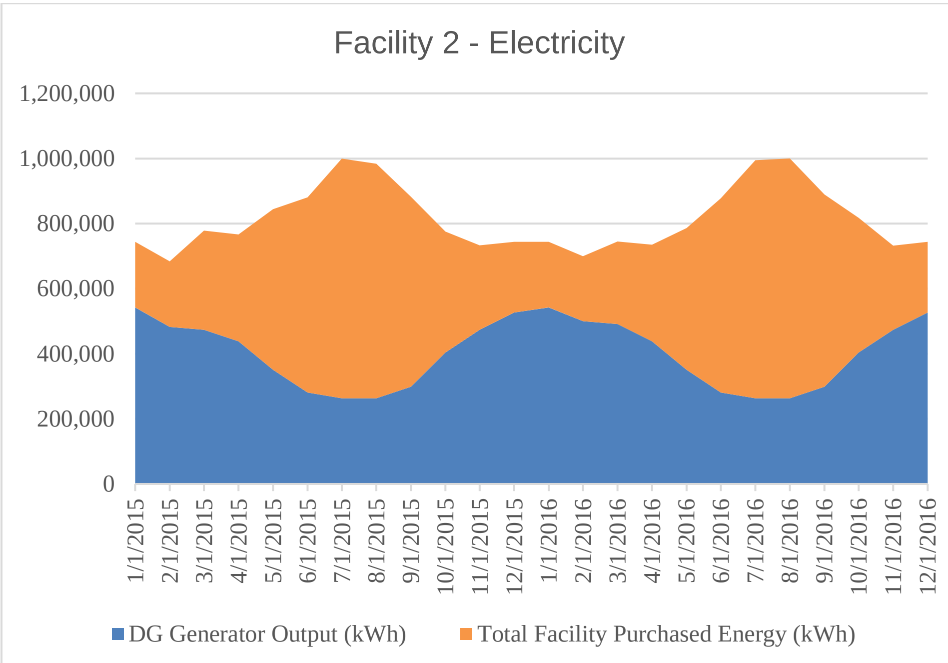


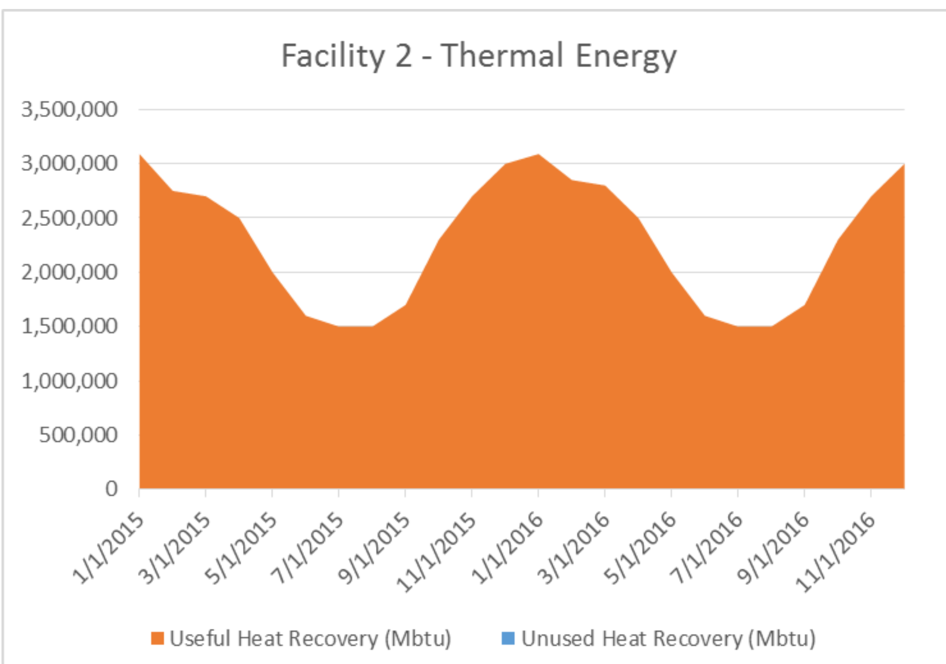
[15] U.S. Department of Energy, Central CHP Technical Assistance Partnership. David Baker, June 2018.

Q. What is "thermal load following" and its implication on rate design?

A. Most CHP systems are designed and operated to "follow the thermal load," meaning the generation is actively managed to satisfy the thermal energy needs of the customer, which may vary significantly depending upon the specific application. Figure 4 illustrates a realistic scenario in which the CHP generator is sized to meet the thermal load and is operated to follow that load. The CHP system supplies about 50% of the annual facility electrical energy requirements and the CHP system efficiency is maximized since all of the heat is being utilized on-site. The implication of thermal load following on SSR rate design is to ensure that the utility does not penalize the customer for operating their CHP system in the way it was designed, which is to maximize efficiency.

FIGURE 4. THERMAL LOAD FOLLOWING CHP APPLICATION[16].





[16] U.S. Department of Energy, Central CHP Technical Assistance Partnership, David Baker, June, 2018.

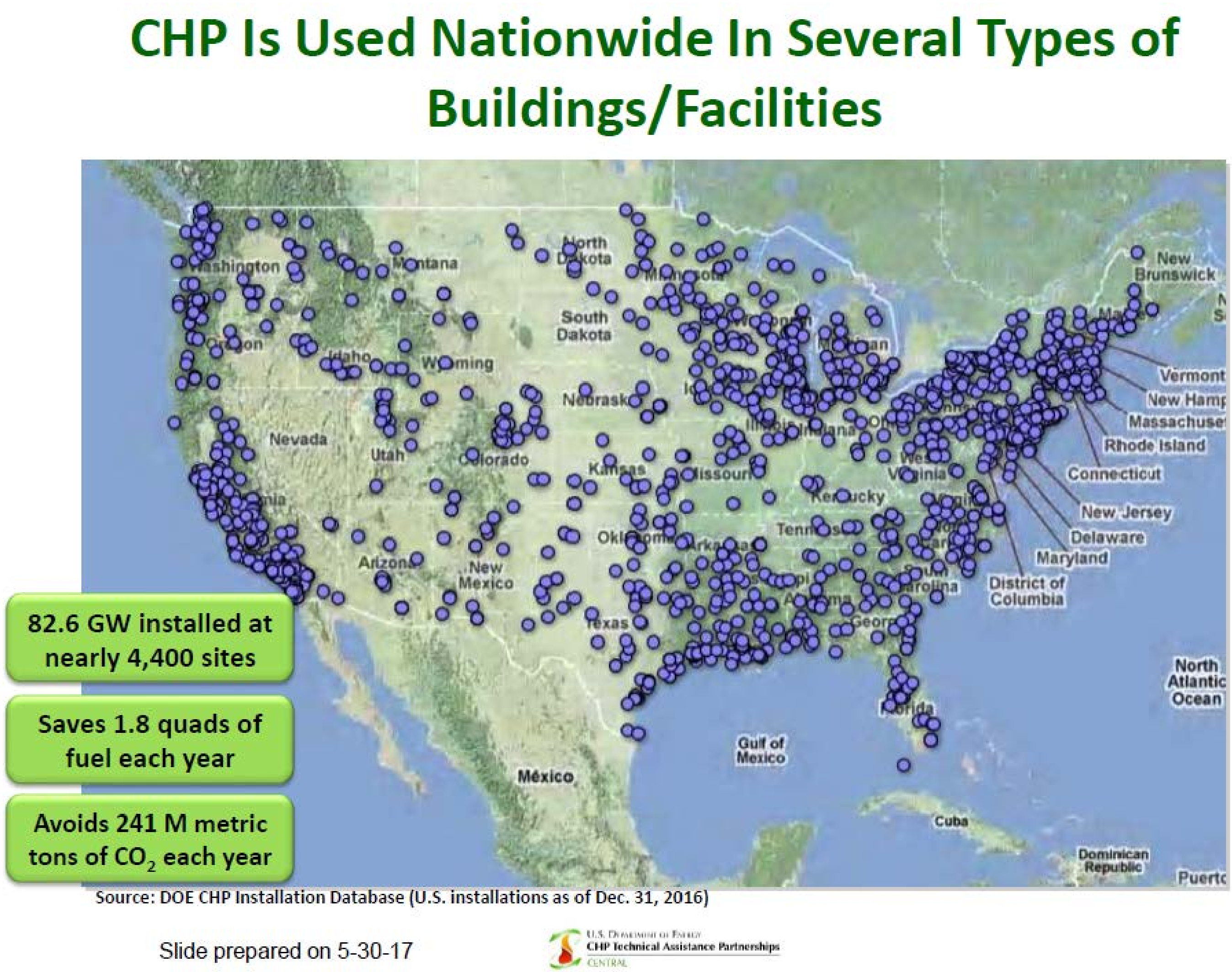
Q. Provide examples of thermal applications for which a CHP system may be beneficial.

A. Thermal energy requirements that can be satisfied by a CHP system include steam for sterilization, domestic hot water heating, space heating, process heating, space cooling, process cooling, refrigeration and dehumidification. CHP can also anchor a district energy system, which is a highly efficient way to heat and cool many buildings from a central plant. District energy systems distribute energy, commonly thermal energy in the form of steam, hot water or chilled water, to multiple buildings within a defined geographic vicinity served by the district system. Heating and cooling using a central plant is more efficient, eliminating the need to install and maintain boilers and chillers at each building. In Missouri, Veolia Energy and the Ashley Plant utilize CHP as the anchor for district energy systems in Kansas City and St. Louis, respectively, and are included in Table 3.

Q. Is CHP an established and commercially available technology?

A. Yes. Figure 5 and Table 1 show that CHP is not new, as there are over 4,000 CHP systems that generate over 83,000 megawatts of energy nationally. Gas turbines (64 percent), followed by boiler/steam turbines (32 percent), account for the greatest share of total capacity; however, over half of the total number of CHP applications use reciprocating engines, though they represent only 2.7% share of total capacity.

FIGURE 5. CHP INSTALLATIONS NATIONWIDE[17].



[17] U.S. Department of Energy, Central CHP Technical Assistance Partnership

TABLE 1: U.S. Installed CHP Sites and Capacity by Prime Mover[18].

Prime Mover	Sites	Share of	Capacity (MW)	Share
Reciprocating Engine	2,194	51.9%	2,288	2.7%
Gas Turbine	667	15.8%	53,320	64.0%
Boiler/Steam Turbine	734	17.4%	26,741	32.1%
Microturbine	355	8.4%	78	0.1%
Fuel Cell	155	3.7%	84	0.1%
Other	121	2.9%	806	1.0%
Total	**4,226**	**100.0%**	**83,317**	**100.0%**

Q. How are the different kinds of CHP technologies categorized?

A. All CHP systems possess a number of basic components: a prime mover (heat engine), a generator, heat recovery equipment, and an electrical interconnection. CHP systems are categorized primarily by the type of prime mover. Table 1 lists prime mover types and provides national statistics regarding the number of sites and capacity, by prime mover. Table 2 provides detailed characteristics of each prime mover, illustrating the large size range of potential applications as well as the technical performance parameters. Table 3 lists CHP installations in Missouri, illustrating the range of size, fuel, and application.

[18] Catalog of CHP Technologies, U.S. Environmental Protection Agency Combined Heat and Power Partnership Program, 2017, Table 1-1.

TABLE 2. COMPARISON OF CHP TECHNOLOGY SIZING, COST, AND PERFORMANCE PARAMETERS[19].

Technology	Recip. Engine	Steam Turbine	Gas Turbine	Microturbine	Fuel Cell
Electric efficiency (HHV)	27-41%	5-40+%2	24-36%	22-28%	30-63%
Overall CHP efficiency (HHV)	77-80%	near 80%	66-71%	63-70%	55-80%
Effective electrical efficiency	75-80%	75-77%	50-62%	49-57%	55-80%
Typical capacity (MWe)	.005-10	0.5-several hundred MW	0.5-300	0.03-1.0	200-2.8 commercial CHP
Typical power to heat ratio	0.5-1.2	0.07-0.1	0.6-1.1	0.5-0.7	1-2
Part-load	ok	ok	poor	ok	good
CHP Installed costs ($/kWe)	1,500-2,900	$670-1,100	1,200-3,300 (5-40 MW)	2,500-4,300	5,000-6,500
Non-fuel O&M costs ($/kWhe)	0.009-0.025	0.006 to 0.01	0.009-0.013	0.009-.013	0.032-0.038
Availability	96-98%	72-99%	93-96%	98-99%	>95%
Hours to overhauls	30,000-60,000	>50,000	25,000-50,000	40,000-80,000	32,000-64,000
Start-up time	10 sec	1 hr -1 day	10 min -1 hr	60 sec	3 hrs -2 days
Fuel pressure (psig)	1-75	n/a	100-500 (compressor)	50-140 (compressor)	0.5-45
Fuels	natural gas, biogas, LPG, sour gas, industrial waste gas, manufactured gas	all	natural gas, synthetic gas, landfill gas, and fuel oils	natural gas, sour gas, liquid fuels	hydrogen, natural gas, propane, methanol
Uses for thermal output	space heating, hot water, cooling, LP steam	process steam, district heating, hot water, chilled water	heat, hot water, LP-HP steam	hot water, chiller, heating	hot water, LP-HP steam
Power Density (kW/m2)	35-50	>100	20-500	5-70	5-20
NOx (lb/MMBtu) (not including SCR)	0.013 rich burn 3-way cat. 0.17 lean burn	Gas 0.1-.2 Wood 0.2-.5 Coal 0.3-1.2	0.036-0.05	0.015-0.036	0.0025-.0040
NOx (lb/MWhTotalOutput) (not including SCR)	0.06 rich burn 3-way cat. 0.8 lean burn	Gas 0.4-0.8 Wood 0.9-1.4 Coal 1.2-5.0.	0.52-1.31	0.14-0.49	0.011-0.016

[19] U.S. Environmental Protection Agency Combined Heat and Power Partnership, 2017. Catalog of CHP Technologies, p 1-6.

TABLE 3. Combined Heat and Power Installations in Missouri[20].

City	Facility Name	Application	Op Year	Prime Mover	Capacity (KW)	Fuel Class-Primary Fuel
Butler	Butler	District Energy	1946	ERENG	13,100	Oil-Distillate Fuel
Columbia	University Of	Colleges / Univ.	1961	B/ST	99,500	BIOMASS - Biomass
Columbia	Columbia	Solid Waste	2015	ERENG	3,000	BIOMASS - LFG
Hannibal	Clemmons	Hotels	1990	ERENG	150	NG - NG
Jefferson	Jefferson City	Justice / Public	2009	ERENG	3,200	BIOMASS - LFG
Kansas	Bolling GSA	General Gov't.	2000	BPST	100	WAST - Steam
Kansas	Veolia Energy	District Energy	2012	B/ST	5,000	BIOMASS - Biomass
Kansas	Trigen-Kansas	District Energy	1990	B/ST	6,000	COAL - Coal
Laddonia	POET	Chemicals	2007	CT	13,000	NG - NG
Lewistown	Lewistown	Schools	2003	MT	60	NG - NG
Macon	Northeast	Chemicals	2003	CT	10,000	NG - NG
Mountain	Smith	Wood Products	1989	B/ST	500	WOOD - Wood
Neosho	La-Z-Boy	Furniture	1984	B/ST	750	WOOD - Wood
North	North Kansas	Agriculture	1987	CC	4,000	NG - NG
St. Louis	Anheuser-	Food Processing	1939	B/ST	26,100	NG - NG
St. Louis	Ashley Plant	District Energy	2000	CT	15,000	NG - NG
St. Louis	Southwestern	Communications	1992	ERENG	6,000	OIL - Distillate Fuel
St. Louis	Brandonview	Office Building	1969	ERENG	4,300	NG - NG
	Agricultural	Agriculture	2014	ERENG	800	BIOMASS - Digester G

Q. What are some examples of facilities that are good candidates for CHP?

A. Customers whose facility has an ongoing requirement for both thermal and electrical energy throughout the year are prime candidates for utilization of CHP generation. Commercial sector candidates include hospitals and nursing homes, public water and wastewater treatment facilities, data centers, hotels, government facilities (federal, state, county and city), and universities and colleges. Industrial sector candidates include food/beverage manufacturers and distributors as well as manufacturers of chemical, wood, agricultural and furniture products.

[20] U.S. DOE Combined Heat and Power Installation Database, accessed June, 2018. https://doe.icfwebservices.com/chpdb/state/MO

Q. When should CHP be considered?

A. New facilities offer the most economical opportunity to implement a CHP system. Existing facilities should consider a CHP system during an expansion, or when a boiler, chiller or emergency generator requires replacement. In addition, CHP should be considered for existing facilities when manufacturing processes produce a significant amount of heat that is currently being wasted. The U.S. Department of Energy estimates that between 20 – 50% of industrial energy input is lost as waste heat in the form of hot exhaust gases, cooling water, and heat lost from hot equipment surfaces and heated products[21]. The recovery and use of wasted heat could result in higher productivity and lower operating costs, which contribute to economic competitiveness. This type of CHP application is referred to as "bottoming cycle" because waste heat is converted to electrical energy, whereas with the more common "topping cycle" heat resulting from electricity generation is recovered and used as thermal energy[22].

IV. BACKGROUND ON STANDBY SERVICE RIDERS IN MISSOURI

Q. What are standby service riders?

A. Standby service riders are charges that a utility levies upon customers who choose to generate a portion of their own electrical requirements. Fees may include a) a capacity (reservation) charge to stand ready to provide electricity during customer-generator outages, and b) charges for actual electricity supplied

[21] U.S Department of Energy, Office of Energy Efficiency & Renewable Energy, Waste Heat Recovery Resource Page, January, 2017. https://www.energy.gov/eere/amo/articles/waste-heat-recovery-resource-page

[22] U.S. Environmental Protection Agency Combined Heat and Power Partnership, Waste Heat to Power Systems. https://www.epa.gov/sites/production/files/2015-07/documents/waste_heat_to_power_systems.pdf

during temporary customer-generator outages (planned maintenance or unplanned outage).

Q. What is the purpose of an SSR?

A. The basic purpose of an SSR is for the electric utility to recover the fully allocated embedded costs associated with providing backup service—no more and no less. Like any other group of customers with similar cost-related characteristics, rates for services provided to customers with CHP should be based on accurate data and consistent system-wide costing principles. A customer with CHP should not pay for costs that they do not cause to be incurred. Missouri regulation requires that costs shall not discriminate against any qualifying facility in comparison to rates for sales to other customers served by the electric utility[23].

Q. Why are SSR's important?

A. Standby service riders have been generally recognized as a barrier to CHP implementation.[24], [25], [26], [27] As regulated utilities have an obligation to serve qualifying facilities in a nondiscriminatory way, SSR proposals warrant thorough consideration.

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[23] 4 CSR 240-20.060(5)(A)

[24] American Council for an Energy Efficient Economy, 2011. Chittum, Anna, and Nate Kaufman, *Challenges Facing Combined Heat and Power Today: A State by State Assessement,* Report Number IE111. Pages 22, 51.

[25] American Council for an Energy Efficient Economy, 2013. Chittum, Anna and Kate Farley, Utilities and the CHP Value Proposition, Report Number IE134. Page 4.

[26] [EPA] Environmental Protection Agency. 2009. *Standby Rates for Customer-Sited Resources: Issues, Considerations, and the Elements of Model Tariffs*. Washington, D.C.: US Environmental Protection Agency.

[27] Casten, S. and M. Karegianes. 2007. "The Legal Case Against Standby Rates." *The Electricity Journal* 20 (9): 37-46.

Q. Have SSRs been addressed in recent PSC cases?

A. Yes. DE filed testimony in Case No. ER-2014-0258 entitled, "CHP and Ameren Missouri's Rider E." In this testimony, DE described CHP, explained the economic, security, and environmental benefits associated with CHP and documented the absence of cost-causation and non-discriminatory rate principles reflected in Ameren Missouri Rider E[28]. The issue was addressed through a Nonunanimous Stipulation and Agreement Regarding Supplemental Service Issues in which Ameren Missouri committed to develop and file, in collaboration with the signatories, a Standby Service Rider by December 31, 2015.[29] On behalf of DE, I participated in all the SSR collaborative Workshop meetings initiated by Ameren, pursuant to the Nonunanimous Stipulation and Agreement.

Q. What were the results of the PSC-ordered Ameren SSR collaborative Workshop effort?

A. The SSR collaborative Workshop resulted in productive dialogue. Specifically, the workshop led to the following outcomes:

- A clear definition of terms.
- A tariff structure that provides transparency regarding fixed charges (administrative, generation and transmission access and seasonal facilities charges); seasonal daily demand charges for back up and maintenance service; seasonal energy charges for back up service on and off peak.

[28] Direct Testimony of Alex Schroeder on Behalf of Missouri Department of Economic Development-Division of Energy, Missouri Public Service Commission Case No. ER-2014-0258, December 19, 2014.
[29] Nonunanimous Stipulation and Agreement Regarding Supplemental Service Issues. ER-2014-0258.

- Stakeholders learned that an important concept for evaluating the treatment of onsite generation is the avoided cost percentage ("ACP"). The ACP reflects a comparison of the value of avoided purchases to the value of the full requirements of electricity on a per kWh basis. Ideally, the reduction in electricity costs should be commensurate with the reduction in purchased electricity.[30] If the onsite system reduces consumption by 80 percent, the cost of electricity purchases would also be reduced by 80 percent. The economics are severely impacted if partial requirement rates are structured so that only a small portion of the electricity price can be avoided. The higher the ratio of avoided costs to the full retail average price, the higher the user's savings. An ACP above 90 percent generally provides savings supportive of customer investment in onsite generation[31].
- The SSR Workshop process led to the development of an annual load profile based upon average customer class data for each of the three classes of service intended to be addressed by the draft SSR. A consistent set of guidelines was established to create CHP generation and outage profiles for each class to use for evaluation. The generation profile nominally represented 40 percent of the total customer load. Outage rates, intended to represent reasonable levels for common CHP technologies, were assumed at approximately 2 percent for maintenance service and 2 percent for backup service. Maintenance service was planned to occur during one continuous time

[30] U.S Environmental Protection Agency, 2009 Standby Rates for Customer-Sited Resources, Issues, Considerations, and Elements of Model Tariffs.
[31] Ibid.

during an off-peak period (November). Backup service was allocated to multiple forced outages occurring during different months, time of day periods, and was assumed to occur for differing durations of time, as would reasonably be expected in reality. The details of the forced outage (FO) occurrences were left to the discretion of Ameren and are depicted in Table 4.

TABLE 4. AMEREN MISSOURI SSR WORKSHOP MODEL OUTAGE PROFILE.

Outages	Additional Purchases		Maint. hours	FO hours
November 22-28	121275	Maintenance	168	
January 17 for 42 hours	33201	FO		42
June 20 for 42 hours	30940	FO		42
February 17 for 24 hours	18873	FO		24
July 17 for 22 hours	17540	Maintenance	22	
March 28 @ hour ending 4, 7	4815	FO		7
August 28 @ hour ending 11, 7	6020	FO		7
October 28 @ hour ending 11, 7	5796	FO		7
April 3, @12:00 24@3:00 3 hours	4239	FO		6
May 2, @12:00 24@3:00 3 hours	4239	FO		6
August 3, @ 12, 3 hours (off peak)	2580	FO		3
September 24@3:00 3 hours	1710	FO		3
December 12@1:00 3 hours	2133	FO		3
Totals	253361		190	150
Percentage of Annual Hours			**2.2%**	**1.7%**

The annual load profiles that were developed by Ameren and based upon average customer class data for each of the three applicable customer classes were then used to evaluate and compare avoided cost percentages for each of the classes on a consistent basis. This evaluation method resulted in an ACP of 84 percent for Large General Service (LGS), 85 percent for Small Primary Service (SPS), and 86 percent for Large Primary Service (SPS), all of which fall below the 90 percent threshold. These below-threshold ACP values suggest that the SSR rate design does not recognize the low probability that CHP customers will experience an outage during peak period.

- The SSR Workshop also resulted in the review of standby service riders from other states, including Minnesota (Schedule 1) and Iowa (Schedule 2).
- While progress was made during the SSR Workshop regarding the definitions and overall structure, a significant impasse occurred regarding the specific rate charges. Schedule 3 is the current SSR for Ameren Missouri.
- An SSR study tool was developed and made available on the Ameren website[32] to educate and inform how a customer's bill may be impacted given various usage and generation assumptions under the SSR.

Q. Did KCPL participate in the Ameren SSR collaborative Workshop effort?

A. Yes.

IV. CRITERIA FOR EVALUATING STANDBY SERVICE RIDERS

Q. What services should CHP customers be charged for in a SSR?

A. A SSR should reflect the cost of 1) the reservation of the generation, transmission, and distribution services needed to provide power when the customer's generator

[32] https://www.ameren.com/missouri/business/rates/electric-rates/rider-ssr

is not producing due to an unplanned (emergency) energy failure/outage, and 2) energy charges for the incremental amount of electricity provided by the utility resulting from the customer-generator outage.

Q. By what evaluative criteria should standby service rider proposals be considered?

A. Standby service rate design should follow the same rate-making objectives that are applied to full requirements customers. Of the generally accepted Bonbright Principles for Rate Structure, four stand out as particularly important in the development and approval of a SSR: 1) simplicity, understandability, public acceptability, and feasibility of application; 2) fairness of the specific rates in the appointment of total cost of service among the different consumers; 3) avoidance of undue discrimination in rate relationships, and 4) promoting efficient use of energy and competing products and services.[33]

The first principle of simplicity, understandability, public acceptability, and feasibility of application cannot be overstated. Definitions should be clear, rate calculations transparent, and the customer should be able to understand what they are being charged for and how the SSR will impact their bill. The concepts and definitions developed through the Ameren SSR collaborative Workshop should be utilized.

[33] Bonbright, James, C., 1961. Principles of Public Utility Rates, Columbia University Press, New York.

Regarding the second principle of fairness of the specific rates, I offer the following metrics for evaluating proposed SSR rates:

- Annual ACP should be 90 percent or more for all classes of service. This means that ACP will be above 90 percent for months when there is no outage and likely less than 90 percent for months where there is an outage.
- Fixed monthly charges for generation, transmission, and distribution should not be higher than the demand charge on the otherwise applicable tariff.
- Generation reservation demand charges should be based on the utility's cost and the forced outage rate, as identified in RAP[34].
- No additional demand charges or higher energy rates should apply to standby customers in conjunction with scheduled maintenance service unless actual demand, including scheduled maintenance, exceeds the supplementary contract capacity.
- No additional demand charges or higher energy rates should apply to standby customers in conjunction with backup service unless actual demand, including backup service, exceeds a supplementary contract capacity.
- There should be a reasonable balance between fixed and variable charges. As an example, with lower fixed costs, higher variable costs may be justified.

[34] http://raponline.org/documents/download/id/7020 (Standby Generation Reservation Charge, page 13)

- An average load profile for each eligible class of the SSR should be developed for study to provide billing examples necessary to analyze rider impact.

Regarding the third principle of particular importance, avoidance of undue discrimination, Missouri regulation is specific:

> "…Rates for sales which are based on accurate data and consistent system-wide costing principles shall not be considered to discriminate against any qualifying facility to the extent that those rates apply to the utility's other customers with similar load or other cost-related characteristics"[35].

The Commission should be confident that undue discrimination against customers who choose to utilize CHP will not occur through the rates charged in standby service riders.

Regarding the fourth rate structure principle, promoting efficient use of energy and competing products and services, CHP provides a distinct opportunity/potential.

V. RECOMMENDATION

Q. What is DE's recommendation to the Missouri Public Service Commission regarding the development of SSRs?

A. DE offers the above CHP testimony to provide the Commission with facts on CHP that may be relevant to its decisions in this case. As the Commission considers stand by service riders and other rate design issues in this case, DE strongly

[35] 4 CSR 240-20.060(5)(A)

encourages the Commission to create a regulatory environment that is conducive to CHP and to avoid rates designs and charges that would hinder a customer from utilizing CHP to improve their process or business. As the Commission evaluates the merits of KCPL's proposed Standby Service Rider in this case, DE recommends consideration of a) the practical tariff rate attributes of simplicity, understandability, and feasibility of application, b) the progress made on the issue from the Ameren case no. ER-2014-0258 (concepts, definitions, structure, transparency, study tool), c) the utility obligation to base rates on accurate data and consistent system-wide costing principles, d) the responsibility to ensure avoidance of undue discrimination, and e) the role CHP plays in promoting the efficient use of energy, reducing emissions, and increasing resiliency. Any SSR proposal should, at a minimum, be based on specific model profiles (for each class of service applicable), and a realistic, consistent set of generation and outage scenarios for evaluation in this case.

Q. Does this conclude your testimony?

A. Yes.