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Issues:	CHP and Standby Rates
Witness:	Alex Schroeder
Sponsoring Party:	Missouri Department of Economic Development - Division of Energy
Type of Exhibit:	Direct Testimony
Case No.:	ER-2014-0351

MISSOURI PUBLIC SERVICE COMMISSION

THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO. ER-2014-0351

DIRECT TESTIMONY

OF

ALEX SCHROEDER

ON

BEHALF OF

MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT

DIVISION OF ENERGY

Jefferson City, Missouri
February 11th, 2015

(Rate Design)

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of The Empire District Electric Company for Authority To File Tariffs Increasing Rates for Electric Service Provided to Customers In the Company's Missouri Service Area	)))))	ER-2014-0351

AFFIDAVIT OF ALEX SCHROEDER

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Alex Schroeder, of lawful age, being duly sworn on his oath, deposes and states:

1. My name is Alex Schroeder. 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.

alex Schroeder
Alex Schroeder

Subscribed and sworn to before me this 11th day of February, 2015

Kay A Johannpeter
Notary Public

My commission expires:

KAY A. JOHANNPETER
Notary Public - Notary Seal
STATE OF MISSOURI
Cole County
My Commission Expires: Aug. 4, 2015
Commission # 11551987

KAY A. JOHANNPETER NOTARY PUBLIC SEAL STATE OF MISSOURI

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Q. Please state your name and business address.

A. My name is Alex Schroeder. 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 - Division of Energy (DE) as a Planner III - Senior Energy Policy Analyst.

Q. Have you testified previously in this case?

A. Yes. On January 29th, 2015 I submitted direct testimony on behalf of DE pertaining to Empire Electric's energy efficiency programs.

Q. What is the purpose of your direct testimony in this proceeding?

A. The purpose of my testimony is to:

a) Briefly define and describe Combined Heat and Power (CHP);

b) List and detail the various benefits associated with CHP;

c) Present an overview of the status of CHP in Empire's Missouri service territory;

d) Outline the parameters that should govern a future standby rate framework.

II. OVERVIEW OF CHP AND ITS BENEFITS

Q. What is Combined Heat and Power (CHP)?

A. The EPA defines CHP (also known as cogeneration) as an integrated energy system - located near the energy user - that simultaneously generates electricity from a single fuel source and captures the resultant heat, much of which would otherwise be wasted. This captured heat can then be used to further generate electricity, or can be utilized for thermal energy. Almost three quarters of CHP units in the United States are powered by natural gas (biomass, process wastes, and coal power the rest). The overwhelming majority (almost 90 percent) of U.S. CHP capacity is installed at industrial facilities. However, CHP is potentially applicable beyond industrial contexts in commercial or institutional facilities as well. CHP can function either as a replacement or supplement for other energy sources.[1]

A CHP system can be categorized according to its prime mover, which powers the electricity generator.[2] In the U.S., five types of prime movers make up 99 percent of installed CHP capacity and 97 percent of CHP sites: reciprocating engines, gas turbines, and boiler/steam turbines, microturbines, and fuel cells. Each of these technologies comes with its own set of advantages and disadvantages in measures of emissions, maintenance costs, efficiency, reliability, ease of use, etc.[3]

CHP systems can be further categorized as either "topping cycle" or "bottoming cycle". In a "topping cycle" system, electricity is generated by means of a prime mover, in which some form of fuel is combusted. Heat associated with this process - which would otherwise be lost - is then captured to provide useful thermal energy. In a "bottoming cycle" system, the heat generated from an existing industrial process is used to generate electricity via a prime mover. CHP is considerably more efficient than separate heat and power (SHP), often reaching efficiency levels between 60 and 80 percent, compared to

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1 This paragraph draws on two sources: 1) EPA, "Combined Heat and Power Partnership, Basic Information". (http://www.epa.gov/chp/basic/index.html). Accessed November 17th, 2014; and 2) EPA, "Combined Heat and Power: A Clean Energy Solution", August 2012. (http://www.epa.gov/chp/documents/clean_energy_solution.pdf). Accessed November 18th, 2014.

2 Center for Sustainable Energy, "Combined Heat and Power". (http://energycenter.org/self-generation-incentive-program/business/technologies/chp). Accessed November 20th, 2014.

3 EPA, "Combined Heat and Power Partnership: Catalog of CHP Technologies", September, 2014. Guide authored by Ken Darrow, Rick Tidball, James Wang, and Anne Hampson. (http://www.epa.gov/chp/documents/catalog_chptech_full.pdf). Accessed December 2nd, 2014.

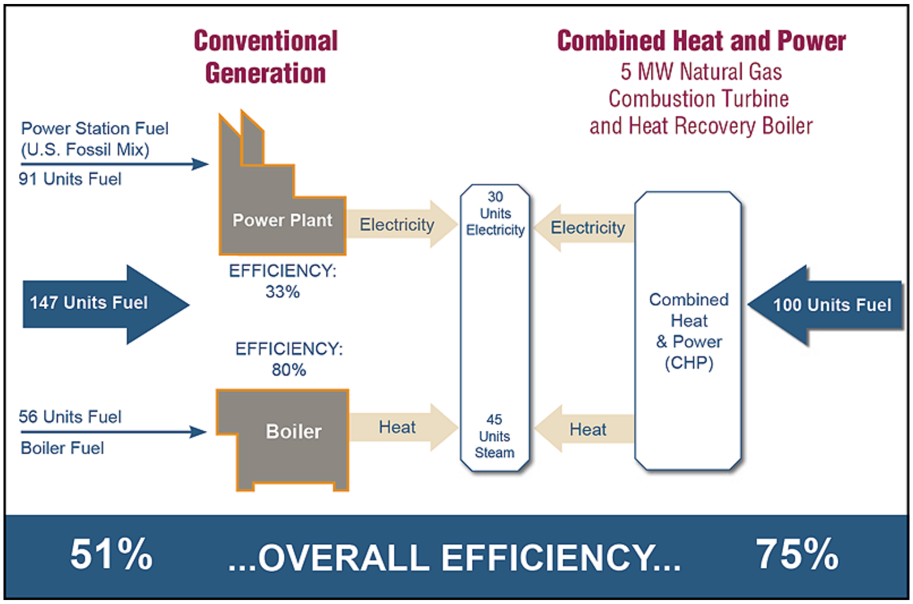
the 45 percent efficiency of SHP.[4] This greater efficiency of CHP stems from two factors: 1) CHP installations capture and make use of waste heat, and 2) CHP units are located near the point at which the energy is consumed, thereby limiting losses associated with the transmission and distribution of power.[5] Note here that efficiency is calculated by dividing units of energy output by units of energy input.

Figure 1 below provides an illustration of CHP's efficiency relative to SHP. In this particular example, assuming the existence of a power plant operating at 33 percent efficiency and a boiler operating at 80 percent efficiency, 147 units of energy would be the necessary input to yield 75 units of output with SHP. By comparison, the efficiency advantage of CHP makes it possible to obtain the same energy output for approximately two-thirds (i.e., 100 units) of the fuel input.

[4] The forgoing draws on: 1) EPA, "Combined Heat and Power Partnership, Combined Heat and Power: Frequently Asked Questions". (http://www.epa.gov/chp/documents/faq.pdf). Accessed November 20th, 2014; and
2) Center for Sustainable Energy, "Combined Heat and Power". (http://energycenter.org/self-generation-incentive-program/business/technologies/chp). Accessed November 20th, 2014.

[5] International Energy Agency, "Combined Heat and Power: Evaluating the Benefits of Greater Global Investment". (http://www.iea.org/publications/freepublications/publication/chp_report.pdf). Accessed November 20th, 2014.

Figure 1: Efficiency Comparison Between CHP and SHP[6]



According to the EPA, the two most common types of CHP configurations are a gas turbine/engine with a heat recovery unit and a steam boiler with a steam turbine.[7] Figures 2 and 3 below illustrate how each of these configurations operates.

[6] EPA, "Combined Heat and Power Partnership: Efficiency Benefits". (http://www.epa.gov/chp/basic/efficiency.html) Accessed December 4th, 2014.
[7] EPA, "Combined Heat and Power Partnership: Basic Information". (http://www.epa.gov/chp/basic/index.html). Accessed December 5th, 2014.

Figure 2: Gas Turbine or Engine with Heat Recovery Unit[8]

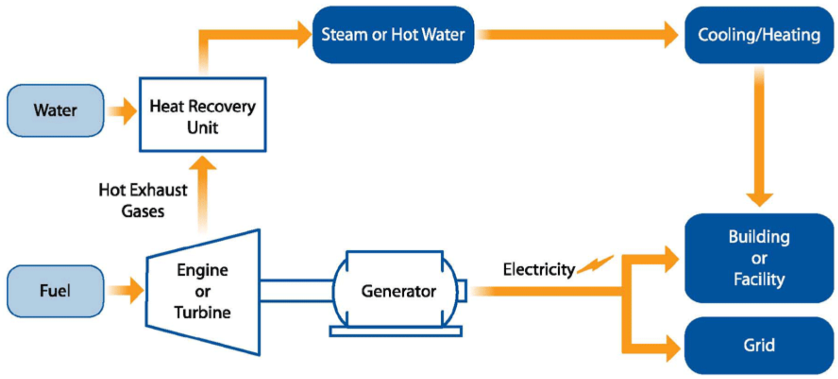
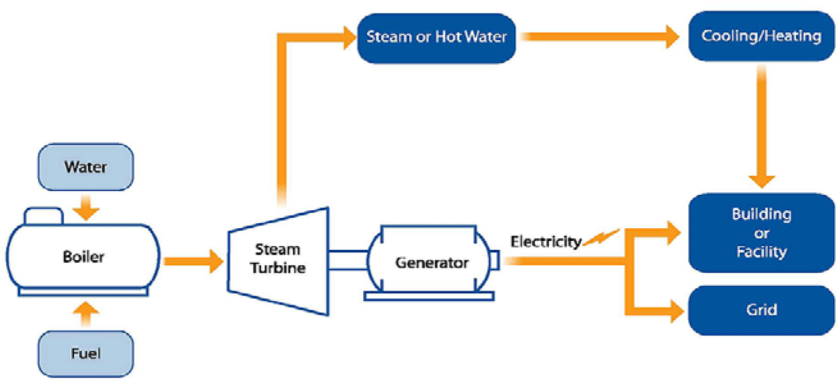


Figure 3: Steam Boiler with Steam Turbine[9]



There are in reality a variety of CHP technologies[10]; the forgoing figures are included here to simply provide readers with concrete examples of how CHP systems could function.

Q. Are there any benefits associated with CHP systems?

A. Yes. There are a number of benefits that make CHP an attractive option to satisfy Missouri's energy needs. These can be broadly categorized as economic benefits,

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[8] Ibid.
[9] Ibid.
[10] EPA, "Combined Heat and Power Partnership: CHP Technologies, Catalog of CHP Technologies". (http://www.epa.gov/chp/technologies.html). Accessed December 9th, 2014.

environmental benefits, and security benefits. While these benefits can be placed into different categories, many of them are interrelated and they all stem from the status of CHP as an efficient and decentralized means of energy production. In recognition of these benefits, a number of states have policies to encourage the uptake of CHP. The American Council for an Energy-Efficient Economy (ACEEE), as part of its State Energy Efficiency Scorecard, calculates an annual index to capture each state's policies toward CHP (at present, Massachusetts and Connecticut have the highest CHP scores at 4.5/5).[11] At the federal level, CHP's myriad benefits motivated President Obama's Executive Order - Accelerating Investment in Industrial Energy Efficiency - that set a national goal to increase industrial CHP capacity by 40 gigawatts (GW) before 2021.[12] This Executive Order represented the most high-profile of policymakers' recent efforts to promote the uptake of CHP.

Q. What are the economic benefits?

A. One of the key economic benefits of CHP is a direct result of greater efficiency, which translates into less energy use and expenditures. The savings associated with reduced energy consumption represents the creation of real wealth; that is, resources previously spent on energy are now freed up for other purposes. The precise level of savings will be a function of a variety of factors, including prevailing prices for "on-grid" electricity and/or thermal energy, the cost of the fuel that is used to power the CHP unit, and the capital, operating, and maintenance costs associated with the unit. Apart from energy

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[11] ACEEE, "The State Energy Efficiency Scorecard". (http://aceee.org/state-policy/scorecard). Accessed December 10th, 2014. Missouri's score was 0/5.

[12] White House, "Executive Order - Accelerating Investment in Industrial Energy Efficiency", August 30th, 2012. (http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency). Accessed December 5th, 2014.

savings for the entity with the CHP unit, the technology also has the potential to be a cost-competitive means of new electricity generation, though the specifics here are, as above, contingent on a number of time- and location-specific variables.[13] Further, because CHP constitutes stand-alone, decentralized energy production, entities with CHP units are to some extent insulated from power outages that result from natural disasters, human error, cyber-attack[14], or other causes. This provides a degree of stability and enables the CHP-using entity to continue operating as before. In recent history, this benefit was perhaps most evident during Hurricane Sandy, where a number of facilities in the impacted area were able to maintain power with their CHP systems (e.g., Danbury Hospital, South Oaks Hospital, the College of New Jersey, Princeton University, and New York University, among others), while 8.5 million customers had none.[15] [16] To offer just a few concrete examples of CHP's resiliency, during Hurricane Sandy the Public Interest Data Center in New York City remained fully operational with its CHP unit, the installation of which was prompted by the 2003 blackouts in New York. The Sikorsky Aircraft Corporation's CHP system (in Stratford, Connecticut) also remained in operation during the Storm. With its CHP system, Louisiana State University in Baton

[13] EPA, "Combined Heat and Power: A Clean Energy Solution", August 2012. (http://www.epa.gov/chp/documents/clean_energy_solution.pdf). Accessed December 2nd, 2014.

[14] The recent high-profile cyber-attack allegedly conducted by North Korea may have been a forerunner to attacks on the American energy grid: Reuters, "For North Korea's Cyber Army, Long-Term Target may be Telecoms, Utility Grids", December 19th, 2014. Article authored by Ju-Min Mark and Jack Kim. (http://www.reuters.com/article/2014/12/19/us-sony-cybersecurity-northkorea-idUSKBN0JX0JW20141219). Accessed December 19th, 2014.

[15] American Counsel for an Energy-Efficient Economy, "How CHP Stepped Up When the Power Went Out During Hurricane Sandy", December 6th, 2012. Article authored by Anna Chittum. (http://www.aceee.org/blog/2012/12/how-chp-stepped-when-power-went-out-d). Accessed December 1st, 2014.

[16] ICF International, "Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities", March, 2013. Report authored by Anne Hampson, Tom Bourgeois, Gavin Dillingham, and Isaac Panzarella. (http://energy.gov/sites/prod/files/2013/11/f4/chp_critical_facilities.pdf). Accessed December 5th, 2014.

Rouge, Louisiana was able to maintain power supply to critical areas of campus during Hurricane Gustav in 2008. And the Twentynine Palms Marine Corps Air Ground Combat Center in Twentynine Palms, California has weathered numerous grid outages while maintaining power to four critical load circuits with its CHP system.[17]

While an uninterrupted power supply made possible by CHP clearly offers economic benefits, it should be borne in mind that these benefits are not solely economic. There are other, non-economic reasons (e.g., security, health) associated with a resilient power supply. Which of these are more pronounced in a given instance will depend on the nature of the facility in question.

CHP utilization also protects one from the vicissitudes of electricity prices and/or the prices of fuel needed to produce thermal energy. By insulating itself from unpredictable variations in energy costs, a business or industrial concern, hospital, university, or the like can better plan for the future. This is not an insignificant consideration. In certain contexts, unforeseen fluctuations in energy costs can be just as disruptive as absolute levels of such costs. Because a CHP unit must be powered by some type of fuel, absent some form of hedging mechanism, there is a certain degree of risk associated with fuel price volatility. However, it bears mentioning that CHP also affords the host a degree of flexibility on what kind of fuel can be used: "Certain CHP technologies and applications are well equipped to provide a flexible response to changing local fuel opportunities,

[17] Ibid.

enabling CHP owners to respond more directly to changing price signals in fuel markets."[18]

In essence, the economic benefits of CHP can essentially be summed up as *savings* and *stability*.[19]

Q. What are the environmental benefits?

A. The environmental benefits of CHP units result directly from their greater efficiency vis-à-vis SHP. This enhanced efficiency renders it possible to obtain the same energy output for less input. And as a consequence of less fuel input, potentially noxious emissions such as carbon dioxide, nitrogen oxides, and sulfur dioxide, are reduced.[20] While the environmental benefits are not necessarily distinct from those associated with energy efficiency programs and renewables, they are significant and are often cited as a key reason to adopt the technology.

The scale of its energy- and emission-saving potential is considerable: According to the U.S. Department of Energy (DOE), increasing CHP capacity by 40 GW by 2020 will save one quadrillion Btu of energy (1 percent of all U.S. energy use) and reduce carbon dioxide emissions by 150 million metric tons annually.[21] In another DOE publication, it is calculated that providing a fifth of U.S. electricity via CHP by 2030 will save approximately 5.3 quadrillion Btu of fuel each year, which is equivalent to half of all

[18] American Council for an Energy-Efficient Economy, "How Electric Utilities Can Find Value in CHP", July 18th, 2013. White Paper authored by Anna Chittum. (http://www.aceee.org/white-paper/electric-utilities-and-chp). Accessed December 4th, 2014. (Quotation from page 8).
[19] Benefits listed under this section derived from EPA, "Combined Heat and Power Partnership: Economic Benefits". (http://www.epa.gov/chp/basic/economics.html). Accessed December 1st, 2014.
[20] EPA, "Combined Heat and Power Partnership: Environmental Benefits". (http://www.epa.gov/chp/basic/environmental.html). Accessed December 2nd, 2014.
[21] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Benefits of Combined Heat and Power". (http://www.energy.gov/eere/amo/benefits-combined-heat-and-power). Accessed December 3rd, 2014.

energy currently used by American households each year. Further, achieving this goal is estimated to reduce annual carbon dioxide emissions over 800 million metric tons.[22] As concrete examples, consider ExxonMobil's 470 megawatt (MW) CHP system in Beaumont, Texas. This system operates at 88 percent efficiency, and as a result uses 37 percent less fuel than what would be required with SHP. This greater efficiency, in turn, reduces carbon dioxide emissions by approximately 2.4 million tons annually.[23] Consider also the CHP unit at the Sikorsky Aircraft Corporation referenced above; this system reduces greenhouse gas emissions by over 8,900 tons annually, which is equivalent to removing 1,600 passenger vehicles from the roads each year.[24]

Reduced emissions are rightly viewed as a positive end in itself: The benefits of such to the environment and human health are palpable and well-documented. However, these environmental considerations are particularly important in the current regulatory context. It has been demonstrated that CHP can play an integral role in achieving cost-effective compliance with the EPA's forthcoming 111(d) standards.[25] [26] Moreover, some have recognized that CHP has the potential to play a role in achieving compliance with the

[22] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Combined Heat and Power: A Decade of Progress, A Vision for the Future". (http://www.energy.gov/sites/prod/files/2013/11/f4/chp_accomplishments_booklet.pdf). Accessed December 5th, 2014.

[23] EPA, "Combined Heat and Power Partnership: Efficiency Benefits". (http://www.epa.gov/chp/basic/efficiency.html). Accessed December 4th, 2014.

[24] Cogeneration and On-Site Power Production, "Sikorsky Powers Up CHP System in Connecticut", October 19th, 2011. By Dr. HeatherJohnstone. (http://www.cospp.com/articles/2011/10/sikorsky-powers-up-chp-system-in-connecticut.html). Accessed December 5th, 2014.

[25] Center for Clean Air Policy, "Report: Expanding the Solution Set: How Combined Heat and Power can Support Compliance with 111(d) Standards for Existing Power Plants", May 2014. Report authored by Stacey Davis and Thomas Simchak. (http://ccap.org/assets/CCAP-Expanding-the-Solution-Set-How-Combined-Heat-and-Power-Can-Support-Compliance-with-111d-Standards-for-Existing-Power-Plants-May-2014.pdf). Accessed December 2nd, 2014.

[26] American Council for an Energy-Efficient Economy, "How Electric Utilities Can Find Value in CHP", July 18th, 2013. White Paper authored by Anna Chittum. (http://www.aceee.org/white-paper/electric-utilities-and-chp). Accessed December 4th, 2014.

EPA's Boiler Maximum Achievable Control Technology regulations.[27] Therefore, CHP should not only be viewed as an important means to directly protect the environment, natural and human. It also achieves the corollary purpose of facilitating compliance with salient environmental regulations.

Q. What are the security benefits?

A. Whereas CHP's environmental benefits primarily stem from its relative efficiency, its security benefits are more related to its decentralized nature. There are certain weaknesses inherent in centralized power production that can be overcome with CHP. In the context of a large, centralized generation facility, damage to that single facility (whether man-caused, as in a terrorist attack or cyber-attack, or natural, as in a hurricane, tornado, earthquake, etc.) can have a widespread negative impact. Such an event has the potential to disrupt service to all customers who rely on that particular facility. CHP systems, in contrast, are comparatively small and less centralized and are therefore not susceptible to this degree of risk. Further, CHP units are located at or near the facility at which the energy is consumed, thereby eliminating potential risks associated with damage to transmission and distribution infrastructure. While they are not invulnerable, damage to a CHP system will typically not have the diffuse knock-on effects of damage to a centralized generation facility. Note also that the relative efficiency of CHP is not merely an economic and environmental benefit, but also brings additional security

[27] ICF International, "From Threat to Asset - How CHP Can Benefit Utilities", July 23rd, 2014. White paper authored by Anne Hampson and Jessica Rackley. (http://www.icfi.com/insights/white-papers/2014/how-chp-can-benefit-utilities). Accessed December 5th, 2014.

benefits. Namely, disruptions in fuel input markets are less problematic to CHP systems to the extent that such systems require less fuel. [28]

The security benefits of this resiliency are thoroughgoing. The EPA has recognized a number of "power sensitive customers", which include digital communication facilities, military operations, wastewater treatment facilities, and hospitals/healthcare facilities.[29] Some of these types of facilities were among those that maintained power during Hurricane Sandy (e.g., Bergen County Utilities Wastewater Treatment Plant, Greenwich Hospital in Greenwich, Connecticut).[30] It is telling that in the aftermath of Hurricane Sandy, New York, New Jersey, and Connecticut all adopted CHP incentive programs.[31] To highlight one such program, the New York State Energy Research and Development Authority (NYSERDA) CHP Acceleration Program, which aims to "leverage $90 million in private capital and reduce peak electric load by 37.5 MW", provides "support for installation of approved modules, support services, technical assistance, system performance data collection, and other activities."[32]

[28] This paragraph draws on CHP Association, "Benefits". (http://chpassociation.org/benefits/). Accessed December 3rd, 2014.
[29] EPA, "Combined Heat and Power Partnership: Calculating Reliability Benefits". (http://www.epa.gov/chp/basic/benefits.html). Accessed December 3rd, 2014.
[30] ICF International, "Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities", March 2013. Report authored by Anne Hampson, Tom Bourgeois, Gavin Dillingham, and Isaac Panzarella. (http://energy.gov/sites/prod/files/2013/11/f4/chp_critical_facilities.pdf). Accessed December 5th, 2014.
[31] ICF International, "From Threat to Asset - How CHP Can Benefit Utilities", July 23rd, 2014. White paper authored by Anne Hampson and Jessica Rackley. (http://www.icfi.com/insights/white-papers/2014/how-chp-can-benefit-utilities). Accessed December 5th, 2014.
[32] Clean Energy States Alliance, "State Leadership in Clean Energy Awards: Outstanding Programs Found Here", November, 2014. (http://www.cesa.org/assets/2014-Files/SLICE-2014/CESA-SLICE-2014-Report-LR.pdf). Accessed December 9th, 2014. (Quotation from page 16).

The fact is that human safety, health, and welfare depend in part on the continuous operation of certain facilities, and CHP can play an important role here by ensuring consistent and reliable energy delivery for these facilities when outages occur.

Q. What are standby rates?

A. Before turning to the status of CHP in Empire's Missouri service territory, it is necessary to define standby rates. In the context of CHP, standby rates are rates charged by a utility for the services it provides to a CHP customer (henceforth used interchangeably with "cogenerator"). These services may include power supplied during temporary generator outages (which can be planned, as in the case of maintenance, or unplanned), supplemental power (which is necessary when the CHP unit is not meeting the energy needs of its host), power that is cheaper than that which can be generated on-site, and the delivery associated with all of the forgoing. Standby rates typically include a charge for the capacity necessary to provide service to customers when CHP outages (planned or unplanned) occur, a charge for the electricity supplied by the utility during an outage, and associated distribution costs.[33] The structure of standby rates is one of the key determinants of the economic viability of CHP.

III. EMPIRE AND CHP

Q. How extensive is CHP in Empire's Missouri territory?

A. According to Empire's response to data request DED-DE 001, there are currently no CHP customers in its Missouri service territory.

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[33] Regulatory Assistance Project, "Standby Rates for Combined Heat and Power Systems: Economic Analysis and Recommendations for Five States", February 2014. Report authored by James Selecky, Kathryn Iverson, and Ali Al-Jabir (Foreword authored by Richard Sedano). (www.raponline.org/document/download/id/7020). Accessed December 3rd, 2014.

Q. Does Empire have a framework in place to allow for the integration of CHP into its system?

A. No. In data request DED-DE 003, DE asked Empire to "[p]lease provide a detailed explanation of the process a CHP customer follows to interconnect with Empire's system." The company responded by directing DE to its response to DED-DE 001, which simply stated that there are no CHP customers in its Missouri service territory.

Further, in data request DED-DE 022, DE asked "How would a CHP customer requiring standby service (i.e., backup service when the unit is down, service on a regular basis to supplement onsite generation, or some combination of the two) be charged for such service under Empire's current tariffs?" The company responded that "Empire does not have any 'Combined Heat and Power' customers nor does it currently have a tariff to provide 'back-up' service to such customers."

Q. Should Empire have an interconnection protocol and standby rates, even if there are presently no CHP customers in its Missouri service territory?

A. Absolutely. Before a potential CHP customer can determine whether it makes economic sense to adopt CHP, it needs to know the costs associated with doing so. And to a large extent, these costs are a function of the interconnection process and the standby rate framework.

IV. PROPOSED STANDBY RATE FRAMEWORK

Q. Why is sound standby rate design important?

A. Ensuring the prudent design of standby rates is important because their structure is a key determinant of how attractive CHP would be from an economic perspective: "Electric rate structures, particularly standby and backup rates, can have a significant impact on

CHP economics by affecting the amount of actual savings resulting from reduced electricity purchases from the grid."[34] Standby rates are particularly important in Missouri, which scored a 0/5 on ACEEE's 2014 CHP policy index.[35] Policy incentives and standby rates are two major channels through which CHP can be encouraged or discouraged. The lack of policy incentives for CHP in Missouri makes the structure of standby rates even more consequential, as there is no policy framework to counterbalance poorly-structured rates.[36]

Empire does not currently have a standby rate framework in place, so there are no rates to analyze. However, their absence can be viewed as a form of discrimination against cogeneration, which is prohibited by 4 CSR 240-20.060(5)(A).[37] Whereas other potential Empire customers can quickly consult the company's tariffs to ascertain the terms of electric service offered, entities considering CHP cannot do the same. The absence of tariffed rates for standby service makes it impossible for potential cogenerators to determine if CHP would be economically viable in Empire's service territory. But no such barrier applies to other potential customers considering the terms of Empire's electric service. This lack of a tariffed standby rate framework could conceivably

[34] EPA, "Standby Rates for Customer-Sited Resources: Issues, Considerations, and the Elements of Model Tariffs," December 2009. Report prepared by the Regulatory Assistance Project and ICF International. (http://www.epa.gov/chp/documents/standby_rates.pdf). Accessed December 3rd, 2014. (Quotation from page 2).

[35] ACEEE, "The State Energy Efficiency Scorecard". (http://aceee.org/state-policy/scorecard). Accessed December 10th, 2014.

[36] The purpose of this testimony is not to argue for policy incentives for CHP, and these sentences should not be read as such.

[37] "Rates for sales shall be just and reasonable and in the public interest and *shall not discriminate* against any qualifying facility in comparison to rates for sales to other customers served by the electric utility." (Italics added)

function as a barrier to CHP adoption, and may be one reason there are no CHP customers in Empire's Missouri service territory.

Though Empire does not currently have cogenerators in its service territory, it needs to be prepared to integrate them into its system if the need arises. At present, it is not clear how the Company would handle an inquiry from a potential CHP customer, even though the Company is required, as per 4 CSR 240-20.060(5)(B)1, to provide standby service "[u]pon the request of a qualifying facility."

Q. What principles should govern Empire's standby rates?

A. The guiding principles for designing economically sound and regulatorily consistent standby rates can be found in 4 CSR 240-20.060(5). In the paragraphs that follow, I will briefly outline the three types of standby service: supplemental, maintenance, and backup, as well as offer general comments on how they should be charged for by Empire.

Supplemental power can be conceptualized as that which a cogenerator regularly purchases in order to supplement onsite generation. This portion of a cogenerator's electricity purchases is no different from the purchases of firm service customers that do not self-generate. According to the Regulatory Assistance Project (RAP),

> [s]upplemental power is electric capacity and energy supplied by an electric utility that is regularly used by a self-generating customer in addition to capacity and energy from on-site generation. Because this service usually is available "around the clock" and on a "firm" basis, supplemental power is the same as full requirements service for non-generating customers. Supplemental power is typically charged at the otherwise applicable full-requirements tariff rates.[38]

[38] Regulatory Assistance Project, "Standby Rates for Combined Heat and Power Systems: Economic Analysis and Recommendations for Five States", February 2014. Report authored by James Selecky, Kathryn Iverson, and Ali Al-Jabir (Foreword authored by Richard Sedano). (www.raponline.org/document/download/id/7020). (Quotation from page 10).

The rates for supplemental power should therefore be no different than those for firm service.

Maintenance power is that which a cogenerator must purchase from the utility when the CHP unit must be shut down for *planned* maintenance. (If the unit must be immediately shut down for unplanned, emergency maintenance, the power purchased would qualify as backup power, which is discussed below.) Maintenance power is different from supplemental power in that it is purchased intermittently. However, maintenance could be scheduled for the times of year - and during off-peak hours - when the utility has sufficient generating resources available to sell additional power at minimal additional cost.[39]

Maintenance power should be provided in accordance with otherwise applicable firm service rate schedules, though some additional provision would need to stipulate that maintenance is to be scheduled around peak hours to the extent possible.

Again, according to RAP,

> [p]roperly scheduled maintenance power service rates should reflect both the lower cost and the off-peak nature of this service. It is a lower cost service than firm backup power because utilities generally require maintenance service to be scheduled in advance, and service may be refused if adequate resources are not available to accommodate a planned outage. This lower quality of service should be reflected in the form of a price discount for maintenance power relative to backup power service.[40]

[39] Regulatory Assistance Project, "Standby Rates for Combined Heat and Power Systems: Economic Analysis and Recommendations for Five States", February 2014. Report authored by James Selecky, Kathryn Iverson, and Ali Al-Jabir (Foreword authored by Richard Sedano). (www.raponline.org/document/download/id/7020).
[40] Ibid. (Quotation from page 12).

Backup power is that which must be provided to cogenerators when their CHP units fail or must be shut down unexpectedly. The utility must be ready to serve these unexpected needs of cogenerators, which cannot be planned or predicted in advance.

The amount of backup power a cogenerator will need in the event of a CHP failure will either be the capacity of the CHP unit (if it is operated at capacity) or whatever fraction thereof is relied upon for onsite generation. Alternatively, if a cogenerator agrees to only requiring a set amount of backup power in the event of CHP shutdown, that is the amount that would be needed.

The reliability of a CHP unit affects the cost of reserving backup capacity for cogenerators:

> The reliability of self-generators affects the cost of providing backup service. The fundamental economic principle underlying the design of backup power rates is that a utility providing backup service is incurring the costs associated with the reserve capacity, which in conjunction with the self-generating capacity, assures a reliable supply of electricity to the customer. Highly reliable self-generators will require small reserve levels; less reliable self generators [sic] will require larger reserve levels.[41]

Note that the reservation charge for backup power is distinct from the charge for electricity actually purchased in a given month. Actual electricity used could be charged for in accordance with otherwise applicable rates.

Q. Please summarize your recommendations.

A. Empire should have an interconnection framework in place, as well as tariffed standby rates. While DE is not advocating any particular standby rate design, they should be consistent with the parameters set forth in Missouri's PURPA regulations pertaining to rates for sales to cogenerators (4 CSR 240-20.060(5)). DE also believes it prudent to

[41] Ibid. (Quotation from page 13).

recognize the differences between supplemental, maintenance, and backup service, and the rates for each should take account of these differences.

Until a cost study can be conducted to determine a reasonable standby rate framework, Empire should simply charge for supplemental, maintenance, and backup power actually used in accordance with otherwise applicable[42] rates. Regarding maintenance power, cogenerators should be required to schedule maintenance in advance outside of peak hours. And for backup power, a monthly reservation charge is necessary for Empire to keep capacity available to provide backup power. This charge could be calculated by taking the product of a) contract demand (i.e., the marginal demand a cogenerator would place on Empire's system in the event of an unscheduled CHP outage), b) a "per kW" demand charge, which could simply be the demand charge in the otherwise applicable rate, and c) the CHP unit's "forced outage rate", or the percentage of time said unit will fail over a given time period.

The RAP study referenced above contains a theoretical portion that details best practices in standby rate design, as well as sample standby rates from five utilities (in Arkansas, Colorado, New Jersey, Ohio, and Utah) and recommendations for strengthening them. This study could offer Empire valuable guidance in designing sound standby rates. DE also urges Empire to review standby service tariffs in other jurisdictions to gain a clearer understanding of the technical provisions that should accompany a standby service tariff. Whatever the ultimate framework, it is essential that the rates and terms of standby service be in the Company's tariffs.

[42] "Otherwise applicable" here means those rates that would apply to a CHP customer if that customer did not self-generate.

Q. Does this conclude your direct testimony?

A. Yes.