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Combined Heat and Power
Witness: Jane E. Epperson
Sponsoring Party: Missouri Department of Economic
Development,
Division of Energy
Type of Exhibit: Rebuttal Testimony
Case Nos.: EO-2019-0132; EO-2019-0133

MISSOURI PUBLIC SERVICE COMMISSION

KANSAS CITY POWER & LIGHT COMPANY

AND

KCP&L GREATER MISSOURI OPERATIONS COMPANY

CASE NOS. EO-2019-0132 and EO-2019-0133

REBUTTAL TESTIMONY

OF

JANE E. EPPERSON

ON

BEHALF OF

MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT

DIVISION OF ENERGY

Jefferson City, Missouri
August 19, 2019

**BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI**

In the Matter of Kansas City Power & Light)
Company's Application for Authority to Establish a) **File No. EO-2019-0132**
Demand-Side Programs Investment Mechanism)

In the Matter of KCP&L Greater Missouri Operations)
Company's Application for Authority to Establish a) **File No. EO-2019-0133**
Demand-Side Programs Investment Mechanism)

AFFIDAVIT OF JANE E. EPPERSON

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

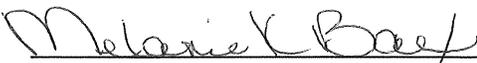
Jane E. Epperson, of lawful age, being duly sworn on her oath, deposes and states:

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 as the Senior Energy Policy Analyst, Division of Energy.
2. Attached hereto and made a part hereof for all purposes is my Rebuttal 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.



Jane E. Epperson

Subscribed and sworn to before me this 19th day of August, 2019.



Notary Public

My commission expires:

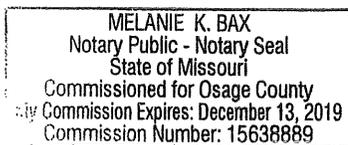


TABLE OF CONTENTS

I. INTRODUCTION 1

II. PURPOSE OF TESTIMONY 2

III. COMBINED HEAT AND POWER TECHNOLOGY AND BENEFITS.....2

IV. POSITIVE MOMENTUM FOR CHP IN MISSOURI..... 7

V. OVERVIEW OF UTILITY CHP PROGRAMS..... 10

VI. RECOMMENDATIONS AND CONCLUSION..... 12

LIST OF FIGURES

FIGURE 1. CHP System Schematic

**FIGURE 2. Energy Efficiency Comparison of CHP versus Separate Heat and Power
Production**

FIGURE 3. Independently Owned Utility-Administered CHP Programs

1 **I. INTRODUCTION**

2 **Q. Please state your name and business address.**

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

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

6 A. I am employed by the Missouri Department of Economic Development – Division
7 of Energy (DE) as the Senior Energy Policy Analyst.

8 **Q. Please describe your educational background and employment experience.**

9 A. I received my Masters of Science in Geology from the University of Missouri-
10 Columbia and my Bachelor of Arts degree in Geology from Stephens College,
11 Columbia, Missouri. Since joining DE, I have filed testimony before the Missouri
12 Public Service Commission (Commission) in Case Nos. ER-2014-0370, ER-2014-
13 0351, ER-2014-0258, WR-2015-0301, SR-2015-0302, ER-2016-0179, GR-2017-
14 0215, EO-2018-0211, and ER-2018-0145/0146. In addition to providing expert
15 testimony for DE, I contributed to the development of the 2015 Missouri
16 Comprehensive State Energy Plan, served as project manager for development of
17 Missouri's first statewide Technical Reference Manual, and participated in Missouri
18 Energy Efficiency Investment Act (MEEIA) rule revision dockets and electric
19 collaboratives. I currently chair the statewide natural gas collaborative. Prior to my
20 current position with DE, I served the Missouri Department of Conservation for 15
21 years in various positions, including supervisor of the Policy Coordination Unit,
22 which was responsible for statewide, regional, and area planning and policy,
23 statewide compliance with environmental and cultural resource laws, Missouri

1 River, Mississippi River and White River basin interstate coordination, and human
2 dimensions (surveys) research. Prior to my employment by the Department of
3 Conservation, I served as a Hydrologist for five years for the Missouri Department
4 of Natural Resources, focusing on interstate water law, policy, and management
5 issues.

6 **II. PURPOSE OF TESTIMONY**

7 **Q. What is the purpose of your Rebuttal Testimony in this proceeding?**

8 A. The purpose of my testimony is to a) describe combined heat and power (CHP)
9 technology and associated benefits to customers, b) recognize Kansas City Power
10 & Light Company (KC&L) and KCP&L Greater Missouri Operations Company
11 (GMO) (collectively, Companies) for their contributions to the positive momentum
12 for CHP in Missouri, c) provide an overview of CHP programs implemented by
13 other independently owned utilities and d) recommend actions to continue the
14 momentum and improve the depth and quality of the CHP option in the Companies'
15 Custom Business Rebate Program.

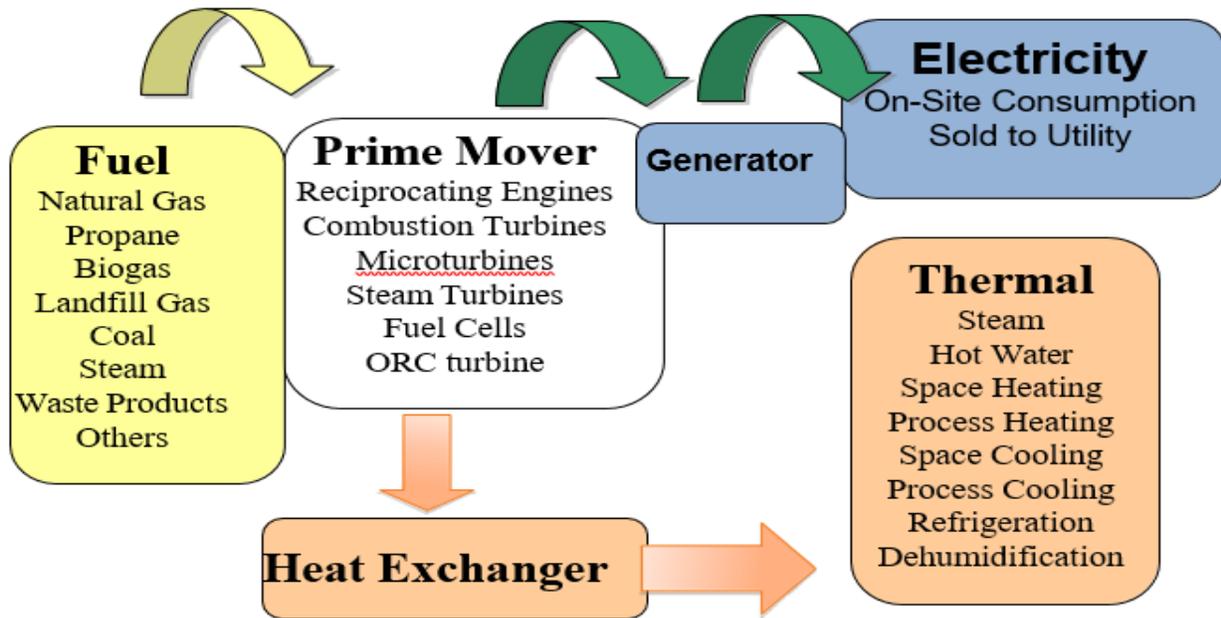
16 **III. COMBINED HEAT AND POWER TECHNOLOGY AND BENEFITS**

17 **Q. What is CHP?**

18 A. CHP is an array of proven, commercially available technologies that concurrently
19 generate electricity and useful thermal energy from the same fuel source. CHP
20 results in a significant increase in energy efficiency over separate heat and power
21 systems because the thermal energy that is normally wasted is utilized. Figure 1
22 is a schematic that summarizes the basic elements of a CHP system. The diversity

1 of fuel sources, prime movers, and thermal applications highlights the many
2 potential applications of CHP.

3 **Figure 1. CHP System Schematic.**¹



4 **Q. What type of KCPL and GMO customers might benefit from installation of a**
5 **CHP system?**

6 **A.** Small, medium and large commercial, industrial, and institutional customers with a
7 steady demand for both thermal and electrical energy are prime candidates for
8 utilization of CHP systems. Examples of commercial sector candidates include
9 data centers and hotels. Examples of industrial sector candidates include food and
10 beverage distributors and manufactures of chemical, wood, agricultural and

¹ U.S. Department of Energy Central CHP Technical Assistance Partnership, Cliff Haefke, June, 2018.

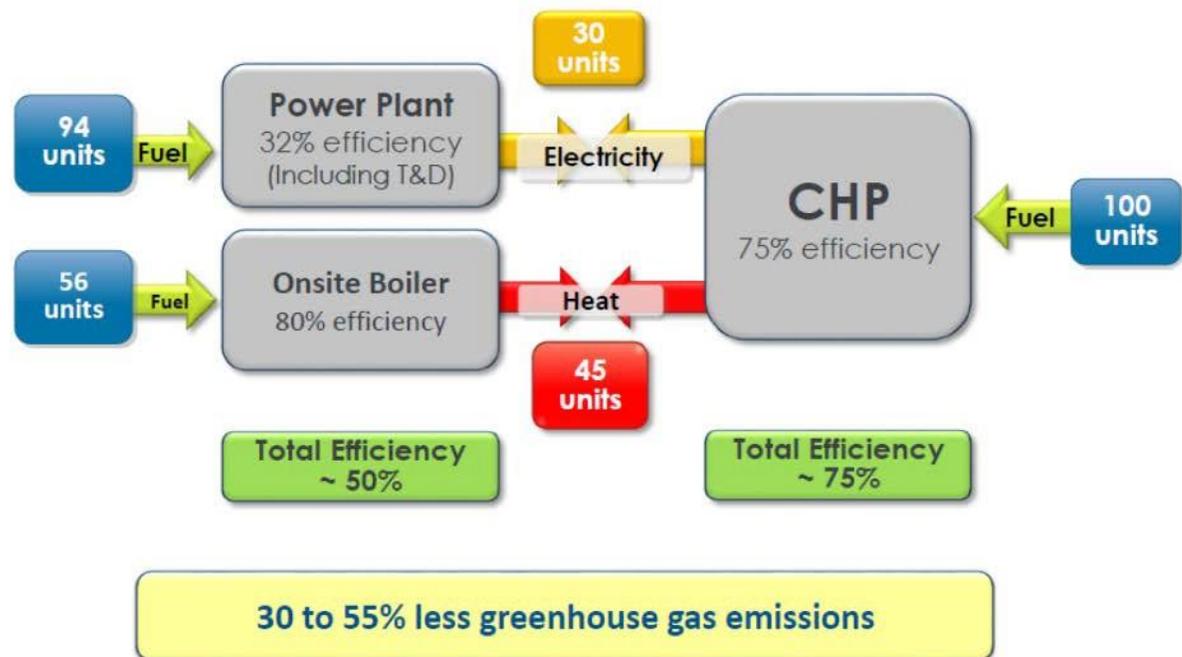
furniture products. Examples of institutional sector candidates include hospitals and nursing homes, public water and wastewater treatment facilities, universities and colleges, and municipal government emergency service facilities.

Q. How much energy does a CHP system save?

A. CHP systems produce both electricity and heat from a single fuel source, typically reducing by one-third the energy required to provide the same heat and power.

Figure 2. Energy Efficiency Comparison of CHP Versus Separate Heat and Power Production.²

CHP Recaptures Heat of Generation, Increasing Energy Efficiency, and Reducing GHGs



The left half of Figure 2 depicts separate heat and power production illustrated by two fuel inputs, resulting in an overall efficiency of 50 percent. An example of

² U.S. Department of Energy Central CHP Technical Assistance Partnership, 2018.

1 separate heat and power is a business owner that buys electricity from a utility and
2 has a boiler in the basement that provides hot water and space heating for the
3 facility. The right half of Figure 2 depicts CHP with the use of a single fuel input,
4 resulting in an overall efficiency of 75 percent. Depending on the specific customer
5 facility, energy fuel costs may constitute a significant and ongoing business
6 expense. The capital resulting from energy efficiency and reduced fuel costs can
7 be reinvested or otherwise applied by a business or community to improve its
8 services, competitiveness, and contribute to the local and state economy. A
9 business or community can also benefit from the capital created by the avoidance
10 of electric grid outages due to the reliability of CHP systems, thus increasing its
11 resiliency.

12 **Q. What are some examples of capital that a business or community customer**
13 **may save through the resiliency of a CHP installation?**

14 A. While there is currently no market mechanism for valuing resiliency, there are
15 many examples that address the cost of outages and thus the cost savings if those
16 outages are avoided. A Department of Defense national study reported
17 approximately 127 utility outages that lasted eight hours or longer in 2015, with a
18 financial impact estimated to be \$179,087 per day.³ A Ponemon Institute research
19 report estimated the average cost of unplanned outages for 67 data centers to be
20 \$690,204 per incident.⁴ The U.S. Department of Energy's Energy Sector Risk
21 Profile for the state of Missouri states that: a) Missouri electric transmission

³ Department of Defense Annual Energy Management Report Fiscal Year 2015, 2016. Office of the Assistant Secretary of Defense. Pages 45-57.

⁴ 2013 Cost of Data Center Outages, 2013. Ponemon Institute. Pages 7-9.

1 outages affect 1,600,305 customers 45 hours per year on average (2008-2013),
2 b) electric distribution outages caused by weather and falling trees affect 214,783
3 customers 45 hours per year annually, and c) severe weather causes average
4 property loss of \$58.9 million per year (1996-2014).⁵ The value of resiliency for
5 hospitals is particularly difficult to quantify as one considers the human and
6 monetary impacts of outages on ICU patients, surgeries, diagnostic testing,
7 laboratory results, patient safety, evacuation, lost revenue, and facility reputation.⁶
8 ⁷ In a presentation at the Western Missouri Combined Heat and Power Summit,
9 Jonathan Flannery estimated the value of resiliency in avoidance of a 2 hour
10 outage at an outpatient clinic to be \$93,750.⁸

11 **Q. How do CHP systems provide greater resiliency than the grid?**

12 A. CHP systems are proven to be highly reliable—not prone to outages—because of
13 their on-site location (which eliminates transmission and distribution outages) and
14 high performance, as measured by their “availability” parameter, which is the
15 percent of time in a year that a CHP system runs without an unplanned outage.
16 Depending on the specific prime mover of the CHP, systems are verified reliable
17 and available 70-99 percent of the time.⁹

⁵ https://www.energy.gov/sites/prod/files/2016/09/f33/MO_Energy%20Sector%20Risk%20Profile_2.pdf

⁶ Eric Cote and Jonathan Flannery, Roadmap to Resiliency, 2017. American Society for Healthcare Engineering.

⁷ Mark Mininberg, Thomas Mort, and Steve Jalowiec, Best Practices in Business Planning for Energy Resiliency, 2018. American Society for Healthcare Engineering.

⁸ https://energy.mo.gov/sites/energy/files/ValuingEnergyResiliencyFlanneryOct16.2018.pptx_.pdf

⁹ U.S. Environmental Protection Agency Combined Heat and Power Partnership, 2017. Catalog of CHP Technologies, p 1-6.

1 **IV. POSITIVE MOMENTUM FOR CHP IN MISSOURI**

2 **Q. Describe what progress been made toward increasing the awareness of CHP**
3 **solutions and potential benefits to Missouri businesses and communities.**

4 A. A CHP Summit for Resiliency of Critical Facilities was held in Kansas City April 16,
5 2018, to increase awareness of CHP technology. The participation of sponsors
6 and exhibitors with direct experience in CHP systems brought a breadth of
7 resources to the Summit, benefiting all participants. All Summit materials and
8 presentations are now available online to the public.¹⁰ DE continues to update its
9 public website with additional information about CHP technologies and hyperlinks
10 to reference resource.¹¹

11 The U.S. Department of Energy CHP Technical Assistance Partnership has
12 performed more than 20 confidential CHP qualification screenings in Missouri
13 within the last three years for organizations interested in CHP, many of which are
14 critical infrastructure facilities.¹²

15 **Q. Has progress been made toward reducing uncertainty regarding the**
16 **engineering and performance of CHP systems for businesses and**
17 **communities?**

18 A. Yes. Until recently, most CHP applications were individually designed and
19 engineered for the specific facility, followed by on-site assembly. The strength of
20 this approach is that the CHP system is the best combination of components to
21 maximize performance for that specific facility. There is a cost in both time and

¹⁰ <https://energy.mo.gov/chp-summit>

¹¹ <https://energy.mo.gov/clean-energy/combined-heat-power>

¹² <https://betterbuildingsolutioncenter.energy.gov/chp/central-chp-technical-assistance-partnership>

1 technical expertise associated with this approach that can be discouraging to a
2 business or community. Manufactures are now offering factory-built CHP systems
3 that eliminate many of the site-specific engineering requirements and associated
4 costs. The pre-packaged CHP systems reduce customer uncertainty regarding
5 performance, shorten installation time, streamline permitting, reduce design errors,
6 and reduce the overall cost. The U.S. Department of Energy (USDOE) identifies
7 CHP as “a commercially available clean energy solution that directly addresses a
8 number of national priorities including improving the competitiveness of U.S.
9 manufacturing, increasing energy efficiency, reducing emissions, enhancing our
10 energy infrastructure, improving energy security and growing our economy.”¹³
11 USDOE created the Packaged CHP Accelerator Program to a) develop a national
12 web-based catalog¹⁴ (currently functioning) of USDOE-vetted packaged CHP
13 suppliers, and b) validate that packaged system installation times and total project
14 costs can be reduced by 20 percent or more compared to individually engineered
15 systems.¹⁵ Due to the economic development and increased resiliency potential of
16 CHP to benefit Missouri businesses and communities, DE joined as an
17 Engagement Partner for the Packaged CHP Accelerator Program to share
18 information about the Energy Loan Program,^{16 17} and encourage packaged CHP

¹³ Combined Heat and Power: A Clean Energy Solution, U.S. DOE and U.S. EPA, August 2012,
https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/chp_clean_energy_solution.pdf

¹⁴ <https://chp.ecatalog.lbl.gov/search>

¹⁵ Packaged CHP Accelerator Fact Sheet, U.S. DOE, 2018,
<https://betterbuildingsinitiative.energy.gov/sites/default/files/attachments/Packaged-CHP-Accelerator-Fact-Sheet-FINAL.pdf>

¹⁶ <https://energy.mo.gov/assistance-programs/energy-loan-program>

¹⁷ <https://energy.mo.gov/sites/energy/files/emlp-fact-sheet.pdf>

1 suppliers to expand their service territories to include Missouri. DE recommends
2 that KCPL and GMO become Engagement Partners for the Packaged CHP
3 Accelerator Program to share information about the Companies' Custom Business
4 Rebates that include CHP. DE also recommends that the Companies invite the
5 growing number of packaged CHP solution providers to become registered
6 contractors ¹⁸ associated with Custom Business programs.

7 **Q. Are there other incentives available to KCP&L and GMO business and**
8 **community customers for CHP?**

9 A. Yes. The Federal Business Energy Investment Tax Credit was extended to 2021
10 and provides a 10 percent tax credit to the purchase of CHP projects with no
11 maximum limit on total cost stated.¹⁹

12 **Q. Has KCPL and GMO contributed to the positive momentum for CHP in**
13 **Missouri?**

14 Yes. DE acknowledges the efforts the Companies have made in the area of
15 standby service rates. Standby service rates are intended to reflect the costs the
16 Company incurs to be on "standby" for such time as a self-generating customer
17 requires energy. The Companies revised their standby service rider tariffs, to which
18 CHP customers are subject, in their recent rate cases (Case Nos. ER-2018-0145
19 and ER-2018-0146) by making the tariffs significantly more clear, user-friendly,
20 and cost-based.²⁰

¹⁸ <https://www.kcpl.com/contractors>

¹⁹ <http://programs.dsireusa.org/system/program/detail/658>

²⁰ https://www.kcpl.com/-/media/indexedmedia/my_bill/mo/detailed_tariffs_mo/modt_28standbyservicerider_1210_2018.pdf?la=en

1 The Companies are also working on a customer service tool associated with the
2 improved standby service rider that would enable a potential CHP customer to
3 input projected load profiles and generation assumptions to estimate the impact of
4 the Companies' standby service rider on their utility bill. This is significant because
5 one of the barriers to CHP deployment is the unknown and potentially prohibitive
6 charges associated with standby service. The completion of this tool would
7 contribute to the Companies' stated goal of reducing barriers to entry by
8 developing additional on line tools and streamlining processes.²¹

9 It is DE's understanding that the Companies will include cost-effective CHP
10 projects to be offered within their MEEIA Cycle 3 portfolios as a Business Custom
11 measure, as no changes have been proposed to the Business Custom measures,
12 and CHP was included in the MEEIA Cycle 2.²² DE recommends the explicit
13 reference to CHP as an eligible measure under the Custom Business Rebate
14 Program in future MEEIA filings.

15 **V. OVERVIEW OF UTILITY CHP PROGRAMS**

16 **Q. Do other investor-owned utilities (IOUs) administer CHP programs?**

17 A. Yes. A recent national review documented that about half of the 20 utility-led CHP
18 programs are offered as part of a business-custom energy efficiency program while
19 the other half are standalone programs, which may more fully address the specifics
20 of CHP systems²³. The various IOU CHP programs offer a wide range and

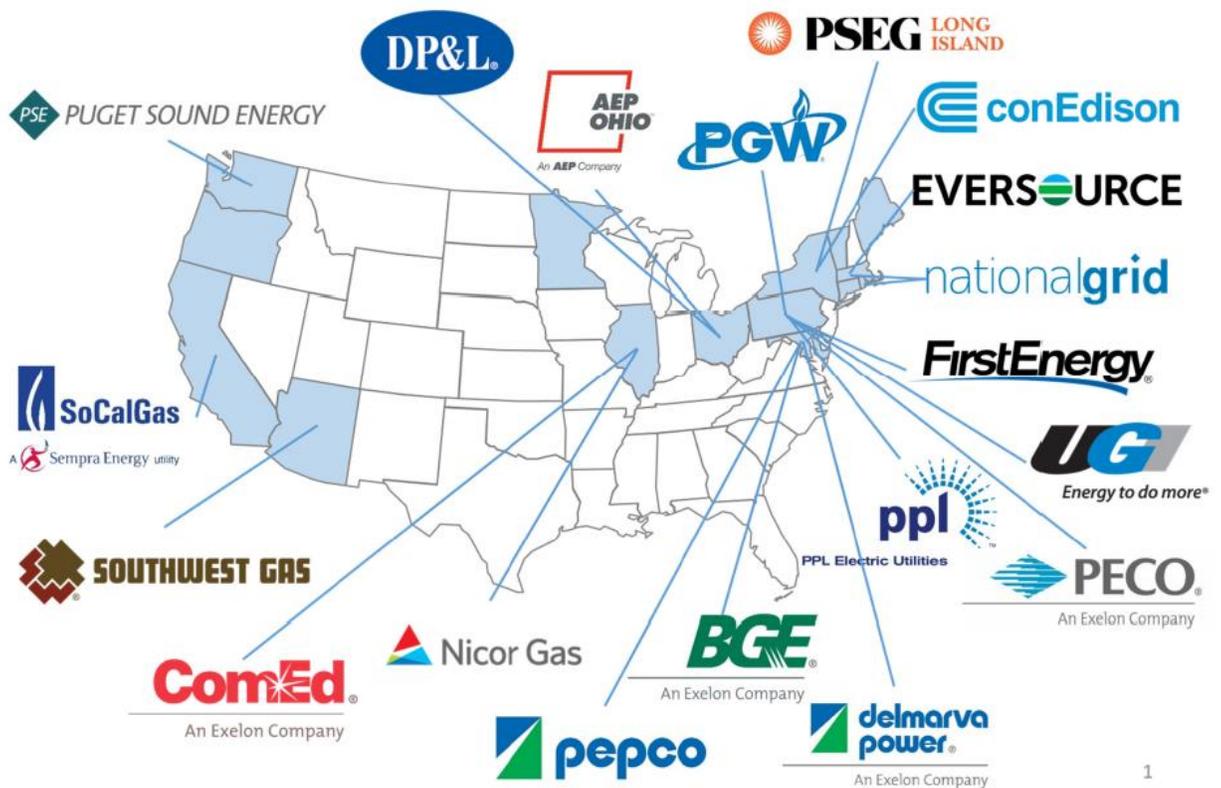
²¹ November 29, 2018 MEEIA Cycle 3 2019-2022 Filing, page 35.

²² E-mail communication from Brian A. File to Jane E. Epperson, December 18, 2018.

²³ Kelly, M. and A. Hampson. 2018. A National Review of Combined Heat and Power Programs in Utility Energy Efficiency Portfolios. Proceedings of the 2016 ACEEE Summer Study on Energy Efficiency in Buildings. Washington, DC: ACEEE. <https://aceee.org/files/proceedings/2018/#/paper/event-data/p113>

1 combination of incentives, including: capacity incentives from \$75-\$1,800 per kW;
2 production incentives from 2-30 cents per kWh for 12-18 months; up to 50-70
3 percent of total project cost; and 25-50 percent of feasibility assessment costs.²⁴
4 For example, in Illinois, ComEd and Nicor Gas jointly offer 75 percent of the
5 feasibility assessment cost (up to \$37,000) for a CHP system. In addition, ComEd
6 provides 7 cents per kWh without a cap, while Nicor Gas provides \$1 per therm
7 savings (capped at \$500,000).²⁵

8 **Figure 3. Independently Owned Utility-Administered CHP Programs** ²⁶



24 ibid
25 ibid
26 ibid

1 There is no shortage of existing IOU CHP programs that can be used as
2 frameworks from which to build program guidance for potential KCPL and GMO
3 CHP customers. DE recommends that KCPL and GMO complete collaboratively-
4 developed CHP-specific program guidance within one year of case conclusion;
5 provide the CHP-specific guidance to customers via the website and through
6 registered contractors and business development representatives; and adopt the
7 goal of successfully assisting one customer to complete a CHP installation within
8 the three years of case conclusion. Built upon the experience of other IOU CHP
9 programs, DE recommends these steps for elevating the awareness of CHP as an
10 eligible measure for the custom business rebate program.

11 **VI. RECOMMENDATIONS AND CONCLUSION**

12 **Q. Please summarize your recommendations.**

13 A. DE recommends the Companies continue their momentum and improve the depth
14 and quality of the CHP option in the Custom Business Rebate Program by a)
15 completing collaboratively-developed CHP-specific program guidance within one
16 year of case completion, which DE would be pleased to assist the Company in this
17 effort and provide support, and, b) providing collaboratively-developed CHP-
18 specific program guidance to registered contractors, business development
19 representatives, and customers (via website), c) including specific reference to
20 CHP in future MEEIA filings, and d) adopting the goal of successfully assisting one
21 customer to complete a CHP installation within three years of case completion.

22 **Q. Does this conclude your Rebuttal Testimony?**

23 A. Yes.