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July 12, 2013

Via Electronic Mail and Hand Delivery
Ms. Elizabeth Ackerman
Director, Division of Economic Development and Energy Policy
New Jersey Board of Public Utilities
44 South Clinton Avenue, 9th Floor
P.O. Box 350
Trenton, New Jersey 08625-0350

Re: Combined Heat and Power (CHP) Cost Benefit Analysis Assumptions and Inputs: Request for Comments by the Center for Energy, Economic and Environmental Policy

Dear Ms. Ackerman:

Per the request of Frank Felder, PhD, of the Rutgers Center for Energy, Economic and Environmental Policy ("CEEEP") at the June 19, 2013 Combined Heat and Power/Fuel Cell Working Group, attached please find input submitted on behalf of the New Jersey Division of Rate Counsel ("Rate Counsel") concerning key assumptions to be developed for the above-referenced cost benefit analysis ("CBA"). Rate Counsel reserves its right to submit additional comments as more material becomes available for review.

Thank you for the opportunity to assist in the development of this CBA. Please contact me should you have any questions or comments.

Very truly yours,

STEFANIE A. BRAND
Director, Division of Rate Counsel

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Combined Heat and Power (CHP) Cost Benefit Analysis
Assumptions and Inputs:
Request for Comments by the Center for Energy, Economic and Environmental Policy

Comments of the New Jersey Division of Rate Counsel

July 12, 2013

The Division of Rate Counsel ("Rate Counsel") would like to thank the Center for Energy, Economic and Environmental Policy ("CEEEP") for the opportunity to present comments on the June 19, 2013 request for comments on the methodology, assumptions and other inputs outlined in "Costs and Benefits of Combined Heat and Power: Draft v.2." The proposed analysis was presented by CEEEP and discussed at the June 19, 2013 meeting of the Office of Clean Energy's ("OCE") Combined Heat and Power ("CHP")/Fuel Cell Working Group ("Working Group"). Rate Counsel's comments on the proposed analysis and CEEEP's data request are presented below.

Introduction

CEEEP is developing a cost-benefit analysis ("CBA") model to analyze the economics of CHP from the perspective of society and the CHP owner. It appears that this model will be used to assess the economics of individual CHP projects. References used by CEEEP are stored on-line at http://policy.rutgers.edu/ceeep/chp. However, CEEEP is also asking for input from stakeholders in order to develop various key assumptions needed for the analysis. Comments are sought on key assumptions including, but not limited to, the following:

- standby rates,
- discount rate,
- debt/equity ratio,
- cost of equity,

- cost of debt,
- loan repayment period,
- depreciation schedule,
- construction period,
- monthly gas and electric peak and usage,
- capital cost of black start equipment,
- value of loss load ($/MWh), and
- outage frequency (no. of days / year).

After OCE and CEEEP staff receive input from stakeholders on these key assumptions, they plan to distribute a draft CBA model with preliminary results to stakeholders for comment.

Rate Counsel's comments first address these key assumptions. Second, Rate Counsel presents its concerns with some aspects of the currently proposed CBA model. Finally, Rate Counsel provides additional, general sources of CHP CBA methodology and inputs.

Key Assumptions

Below, Rate Counsel provides additional sources for CEEEP's consideration. Rate Counsel cautions against reliance on any one source. Instead, Rate Counsel offers studies or reports that contain values that CEEEP can use as a reference to hone in on a single value (as appropriate) that reflects both experience with CHP installations on the ground in New Jersey and the findings of national studies or comparisons from other states.

Financial Assumptions

CEEEP should consult with various stakeholders such as CHP project developers, lenders, and investors to learn NJ-specific financial data, including the debt/equity ratio, equity rates, loan rates, loan repayment, depreciation schedule, and construction period. To do this,

CEEEP should first verify that the input it receives in response to this request for comments is provided by a range of interests, including CHP project developers, lenders, and investors, who have experience with a range of CHP technologies and fuels (gas-fired engines and turbines, fuel cells, waste heat recovery, etc.). To the extent that the comments CEEEP receives do not represent a range of interests and technologies, CEEEP should employ a different channel (e.g., conducting telephone interviews) for obtaining feedback on NJ-specific financial assumptions from other CHP project developers, lenders, and investors.

Standby Rates

As discussed at the June 19, 2013 meeting, CEEEP is planning to meet with utility staff to receive input on utility standby rates. Rate Counsel supports this approach as a way to develop standby rate assumptions for CEEEP's CBA model, but also suggests that CEEEP consult with Rate Counsel before finalizing standby rate assumptions.

Monthly Gas and Electric Peak and Usage

CEEEP requested that stakeholders provide monthly gas and electric usage data to develop user consumption assumptions for the cost benefit model. For monthly gas and electric usage data for large nonutility power producers, including CHP, Rate Counsel suggests CEEEP investigate U.S. EIA's 923 data, as this database is publicly available and contains data on CHP facilities in New Jersey. The database is accessible at http://www.eia.gov/electricity/data/eia923/. This database does not provide peak usage data. Rate Counsel does not have any data source for monthly peak usage data, but notes that monthly peak data as well as time of use and seasonal usage data (e.g., winter off-peak and peak, summer peak and off-peak) would be useful to estimate more accurate avoided costs and emissions for certain applications calling for a higher level of granularity.

Capital Cost of Black Start Equipment

CEEEP requested that stakeholders provide information on the capital cost of black start equipment for its calculation of reliability costs for input into its cost benefit analysis model. The U.S. EPA has compiled data on capital costs of equipment for black start capability. A summary of equipment cost from this database is provided below.

Control Costs for Generator Back-Up Capability

Control Level	Time to Pick Up Load	Equipment Required	Capital Cost
Manual	Up to an hour	• Engine start • Manual transfer switch • Distribution switchgear	$20–$60 per kW
Automatic	5 to 10 cycles when running	• Engine start • Open transition automatic transfer switch • Distribution switchgear	$25–$105 per kW
Seamless	¼ to ½ cycle when running	• Engine start • Closed transition automatic transfer switch with bypass isolation • Distribution switchgear	$45–$170 per kW
Reconfiguring for Load Shedding	Not applicable	As needed by the site: • Design Engineering • Distribution switchgear • Rewiring • Added electrical panels, breakers, controls	$100–$500 per kW

Note: Cost range figures represent estimates for a 500 kW CHP system at the high end and a 3,000 kW CHP system at the low end. Cost estimates do not include recircuiting costs, which depend on site needs.
Source: U.S. Environmental Protection Agency Combined Heat and Power Partnership. January 2007. Valuing the Reliability of Combined Heat and Power. http://www.epa.gov/chp/documents/calculating_reliability_benefits.pdf

Value of Loss Load ($/MWh)

CEEEP requested that stakeholders provide information on the value of loss of load for its calculation of reliability benefits for input into its cost benefit analysis model. Loss of load value varies widely by type of customer. For example, Pacific Gas & Electric Company (PG&E) researched the estimated direct costs of outages to their customers and found that the value of service can vary widely by customer class, as shown in the table below.

Estimated Direct Costs of Outages for PG&E Customers Unserved

Customer Class	$/kWh
Industrial	$12.70 – $424.80
Commercial	$40.60 – $68.20
Agricultural	$11.50 – $11.70
Residential	$5.10 – $8.50

Source: U.S. Environmental Protection Agency Combined Heat and Power Partnership. January 2007. Valuing the Reliability of Combined Heat and Power. http://www.epa.gov/chp/documents/calculating_reliability_benefits.pdf.

Accordingly, Rate Counsel does not recommend that CEEEP use a single value for the value of loss of load in its analysis. An analysis similar to PG&E's should be performed based on New Jersey data. CEEEP should recognize the variation in this value based on type of business or sector within its CBA, which could then be extrapolated to a state-wide basis based on CHP market potential by SIC code.

Comments on Additional Issues

CBA perspective

The current proposal misses the utility/ratepayer perspective, which means that the model cannot calculate the economics of CHP as a utility investment of ratepayer funds. A test with this perspective is often called the utility cost test or program administrator cost test and is used extensively in EE program evaluation. The results of the test from the societal perspective will not change based on changes in incentive levels, because the societal perspective only cares about the total incremental cost of alternative measures. The societal perspective considers incentives to be economic transfers within society rather than a loss or gain to society as a whole.

To assess what level of incentives provides the best return on utility/ratepayer investments, the utility perspective is necessary in the CBA model.

Standby charge

As discussed at the July 19, 2013 Working Group meeting, standby charges are currently incorporated in the private perspective in the CBA model, but not in the societal perspective. However, to the extent that standby charges represent true costs to the utility, they should be counted as costs from the societal perspective, which will essentially reduce the amount of avoided transmission and distribution costs. This is a complex issue. Thus, we encourage CEEEP and CEP staff to have discussions with utility staff and consult with Rate Counsel on this subject.

Avoided Emissions

As discussed at the July 19, 2013 Working Group meeting and presented on page 7 through 9 of CEEEP's presentation, CEEEP has proposed to use avoided emissions calculated based on (a) U.S. average emission rates and (b) % marginal run of different resources reported by PJM. Rate Counsel is concerned with this method as it may not accurately estimate avoided emissions, and potentially over-estimates avoided emissions, because it assumes that CHP can displace all of marginal coal generation. The issue is that coal generation has very high emission rates and accounts for 59% of the marginal generation, but the majority of the coal plant operation may be at night when not all CHP units are operating. In addition, CEEEP's current approach uses US average emission rates for each fuel type. Emission rates within the PJM territory should be readily available. In general, CEEEP should use or develop temporally and geographically differentiated avoided emission data. There are two approaches Rate Counsel suggests that CEEEP consider:

- One approach would be to identify CHP generation profiles by CHP type and match those with PJM marginal generation profiles differentiated by time-of-use and season. This approach could be simplified depending on the initial findings on CHP generation and grid marginal generation profiles. For example, if CEEEP's research finds that CHP load profiles can be adequately characterized as either high load CHP (which operates even during night hours) and low load CHP (which does not operate during night hours), and avoided emissions do not differ much by season, CEEEP may consider developing two types of avoided emission profiles: one for CHP that runs during the day and stops operating at night, and another for CHP that operates 24/7. To do this, CEEEP needs to identify what type of generation is on the margin during the day and night and to what extent.
- Another approach would be to investigate the use of a US EPA draft methodology/tool called "AVERT" (or Avoided Emissions and Generation Tool) for estimating avoided emission impacts from clean energy resources. This tool is currently being developed and tested under US EPA's EE/RE Roadmap Manual initiative.[1] The tool estimates temporal and location-specific avoided emissions for energy efficiency and renewable energy projects.

Lastly, Rate Counsel recommends that CEEEP investigate if wind resources are appropriate to be used for marginal emissions rates. (Refer to page 7 of the "Costs and Benefits of Combined Heat and Power: Draft v.2." presentation, which shows wind with 4.2% of the marginal run in PJM.)

[1] For further information, please contact Robyn DeYoung (DeYoung.Robyn@epa.gov) at U.S. EPA.

Additional Resources

Rate Counsel suggests for CEEEP's consideration the following reports as sources of CHP-specific CBA key assumptions, inputs, and methodology.

- KEMA 2008. Market Potential of Combined Heat and Power in Massachusetts, prepared for Massachusetts Technology Collaborative. The report evaluated the economic potential of CHP and provided CHP-specific data such as size, capacity factor, and thermal load utilization rate by specific industry and business type. As it appears that the report is no longer available on-line, Rate Counsel has provided a PDF copy of this report attached to these comments.
- EPRI 2008. Creating Incentives for Electricity Providers to Integrate Distributed Energy Resources, prepared for California Energy Commission, available at http://www.energy.ca.gov/2008publications/CEC-500-2008-028/CEC-500-2008-028.pdf. The report introduced a comprehensive benefit cost model for distributed energy resources developed through an extensive stakeholder collaboration process. The model analyzed both customer- and utility-owned distributed energy resources from various perspectives. The model incorporated numerous types of costs and benefits of DG and CHP, such as maintenance costs, thermal payment, standby charges, transmission and distribution capacity, backup value, and renewable energy credits. The report included costs and benefits for customer owned and utility-owned combined cooling, heating and power (CCHP). Appendix D of this report provides some key financial parameters, such as a debt/equity ratio, debt cost, equity cost, and financing term. As EPRI's model

may be very useful for improving CEEEP's CBA, Rate Counsel recommends CEEEP investigate and obtain this DG/CHP economic model.