Consumer Power Advocates

Continuum Health Partners
Fordham University
Luthin Associates, Inc.
Memorial Sloan Kettering Cancer Center
Mount Sinai Medical Center
New York University
NYU Langone Medical Center
Montefiore Medical Center

July 31, 2009

Hon. Jaclyn Brilling
Secretary
State of New York Public Service Commission
Three Empire State Plaza, 14th Floor
Albany, New York 12223-1350

Re: Case 09-S-0029 – Proceeding on Motion of the Commission to Consider Steam Resource Plan and East River Re-Powering Project Cost Allocation Study, and Steam Energy Efficiency Programs for Consolidated Edison Company of New York, Inc.

Dear Secretary Brilling:

Please find Consumer Power Advocates Proposal for Customer Sited Supply for filing in the above-captioned proceeding. This proposal is supported by the Pace Energy and Climate Center. Copies of the aforementioned proposal are being served via e-mail on all active parties.

Thank you for the opportunity to provide this for consideration.

Very truly yours,
Catherine Luthin

Catherine M. Luthin
Executive Director

Encl.

cc: ALJ Rudy Stegemoeller by E-mail
Active Parties by E-mail.

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State of New York
Public Service Commission

Proceeding on Motion of the Commission to Consider Steam Resource Plan and East River Re-powering Project Cost Allocation Study, and Steam Energy Efficiency Programs for Consolidated Edison Company of New York, Inc.	**Case 09-S-0029**

Proposal for Customer Sited Supply of Consumer Power Advocates

Dated: July 31, 2009

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Alternatives for Customer Sited Supply

I. Introduction

New York State and the City of New York have both recognized that increased penetration of combined heat and power (CHP) is necessary to improve air quality and reduce the economic risk of high energy prices on the City's economy. Development of customer-sited combined heat and power (CHP) plants in New York City's largest buildings is essential to meet the New York State Energy Plan and PlaNYC CHP goals [1]and the New York State goal of reducing electricity consumption 15% by 2015 though energy efficiency, particularly if the Commission permits Con Edison to install replacement boilers rather than a new CHP plant at Hudson Avenue. The Commission's decision in this proceeding will determine whether it is possible to meet the goals.

CHP has the potential to provide the following benefits for the building operator:

- Decreased overall energy costs through efficient on-site generation of electricity and production of up to 100% of large building steam requirements.
- Reduction in electricity costs vs. Con Edison delivery and retail energy supply.
- Reduced reliance on Con Edison electricity.

CHP economics are largely determined by the price of energy used to fuel the plants and wholesale energy prices determined hourly in NYISO markets. In almost all hours, the wholesale price is set by a natural gas fired generator. In peak hours, that generator typically has a higher heat rate than a CHP plant. According to a recent Gas Technology Institute (GTI) [2]report net heat rates for typical CHP plants are approximately 9000 BTU, while the average heat rate of NYC wholesale generator is above 10000 during off-peak hours, and above 15000 during peak hours. Because both price-setting wholesale generators and CHP plants burn natural gas, no additional price risk need be assumed by the CHP operator, and the economic savings and environmental improvements are proportional to the improvement in thermal efficiency. Therefore, CHP plants maximize the benefits of fuel efficiency when they are operated on peak, when the difference in efficiency between the CHP plant and the marginal wholesale generator is the greatest.

Efficient CHP generation is limited by the amount of heat recovery as steam. Therefore, to maximize the benefits of CHP, a use for that thermal energy must be found. The Con Edison steam system, with its high and fairly constant thermal losses, could absorb this energy in an efficient way. Steam from customer-sited CHP plants could displace steam from Con Edison boilers and new steam capacity being considered for Hudson Avenue could be scaled back.

[1] PlaNYC, Energy Initiative 9:"We will increase the amount of Clean DG by 800 MW" available at: http://www.nyc.gov/html/PlaNYC2030/html/plan/energy_clean-generation.shtml

[2] Opportunities for the Development of Distributed Generation / Combined Heat and Power Systems in New York City Commercial Buildings, Gas Technology Institute, prepared by Redwood Power Company, figure 2, p.11.

II. Environmental and Economic Benefits

CHP's environmental and economic benefits are well documented. CHP recovers the thermal energy that is generally wasted when electricity is generated and provides far greater efficiency than separate generation of electricity and steam. The greater efficiency translates into less energy used and less emissions of various pollutants. The benefits include:

1. Reduced NOx, SO_2 particulate and carbon emissions
2. Reduced peak demand on the electric and steam system systems
3. Reduced condensate dumping
4. Reduced use of City water for generation and for diluting condensate to reduce the temperature for dumping
5. Reduced need for steam system capacity
6. Reduced natural gas prices fuel prices because of demand reductions related to generation efficiencies
7. Reduced electricity capacity and energy prices due to increased supply

If 114 MW potential identified below were developed and achieved a heat rate of 9000 BTU/kWh to displace energy from a 12500 BTU/kWh machine, the energy equivalent of 3.25 million dekatherms would be saved, resulting in reduced emissions of 190,000 tons of carbon, 245 tons of NOx and 1 ton of SO_2 annually. [3]

Converting boilers burning No. 6 fuel oil to CHP units burning natural gas will produce tremendous environmental and health benefits for two related reasons. First, burning natural gas produces significantly less emissions than No. 6 fuel oil. SO_2 emissions are more than 99% lower; $PM_{2.5}$ emissions are reduced by approximately 96% and NO_x by approximately 75%. [4] In addition, No. 6 fuel oil has far greater concentration of heavy metals such as nickel than natural gas and emissions of such heavy metals are correspondingly higher. Second, because CHP is far more efficient than the separate generation of electricity and thermal energy, less energy is used to create electricity and thermal energy resulting and emissions are corresponding lower.

Emissions impose environmental and other societal costs that are not incorporated in the price of energy paid by consumers; hence they are referred to as environmental externalities. Those costs are real and must be considered by the Commission when it determines whether to facilitate greater penetration of customer-sited CHP plants. The costs range from the well-documented health costs that result from emissions of

[3] According to the Siemens Building Technologies Environmental Impact Calculator, available at http://siemens.greentouchscreen.com/calculator2009/SiemensCalculator2009Web.html

[4] Draft version of *The Bottom of the Barrel, How the Dirtiest Heating Oil Pollutes Our Air and Harms Our Health*, Environmental Defense Fund and U.S. Green Building Council New York (June 16, 2009)

nickel[5] and $PM_{2.5}$ [6] to the far reaching environmental and health costs of NO_x, SO_2 and CO_2.

Various public service commissions that have reviewed externality costs have come up with a wide variety of values for each pollutant. For example, the City of New York, in its July 28, 2009 letter to Secretary Brilling submitting additional comments in response to Scoping Questions, noted that "[w]hile the projected future value of carbon reductions has been subject to a wide range of projections, it is noteworthy that some recent estimates project a cost of up to $30 per ton in 2015."[7]

A full analysis of the range of externality values is beyond the scope of these comments. The key point is that there are substantial costs that should be explored in this proceeding, with the values then multiplied by the emissions reductions which would result from expanded penetration of customer-cited CHP. We are eager to participate in that process.

III. Market Potential

There are numerous sites on the steam system that have the potential for relatively large CHP installations. These include facilities with large thermal loads and electric loads in excess of 1.5 MW, particularly those adjacent to the steam and gas systems and those in need of renovation or redevelopment. According to a recent GTI report[8], there are 22 commercial sites in the City that could potentially add as much as 95 MW of efficient electric generation capacity. These do not include institutional hosts surveyed by Luthin Associates, which sum to approximately 25 MW at three sites on the steam system between 39th St and 75th St, or the 2 largest projects included in an analysis by Endurant that alone could add 10 MW. While this is not an exhaustive list, it is 114 MW of efficient generation that could be developed.

This capacity will not be developed unless there is an efficient use for a significant percentage of the steam generated in excess of building thermal loads. If Con Edison's steam tariff were amended to allow customers to inject steam into the Con Edison system at reasonable rates, CHP plants could be developed with sufficient thermal loads to economically meet a larger portion of the entire electric load of the building. We believe, based on correspondence with NYSERDA, that such CHP

[5] See *Public Health Statement for Nickel*, Agency for Toxic Substances & Disease Registry, http://www.atsdr.cdc.gov/toxicprofiles/phs15.html#bookmark05 (August 25, 2005)

[6] See *State of the Air 2009*, American Lung Association, http://www.stateoftheair.org/ (2009)

[7] The City cited to *A Master Electrical Transmission Plan for New York City*, Charles River Associates International 225 (May 2009).

[8] Opportunities for the Development of Distributed Generation / Combined Heat and Power Systems in New York City Commercial Buildings, , Gas Technology Institute, prepared by Redwood Power Company, figure 11, p.26

systems, with all or some of the steam energy injected into the Con Edison system, would meet the definitions and requirements of efficient distributed generation.

With the exception of the purchase of excess steam from CHP plants, the rates and tariff requirements for this type of service already exist. There are electric and steam standby tariffs, as well as gas tariffs. Technical specifications for the quality, purity and pressure of injected steam already exist as part of a purchase agreement between Con Edison and a steam supplier.[9] What remains to be developed are metering solutions, tariffs and operating agreements that allow potential CHP operators to inject excess steam into the Con Edison system. Analogous arrangements are in place on the electric system, and there appears to be no technical reason why these cannot be developed for the steam system.

IV. Methodology

We started with the assumption that many CHP projects in NY are constrained in their operations by a lack of consistent thermal load. The majority of customers that are candidates for CHP systems have a typical on-peak electric load profile, with loads rising beginning at 8AM, peaking sometime in the afternoon and then falling off as evening falls. However, the thermal load is typically not as consistent which makes sizing systems for optimal electric and thermal coincidental performance difficult. Systems are typically designed to throttle back electric production when the thermal load drops, in order to maintain efficiency (with 60% HHV efficiency being the magic number for both NYSERDA and DOE funding of CHP systems). The lack of consistent thermal load is one of the biggest hurdles to overcome in developing economic CHP systems in New York City. Making the Con Edison steam system available as a practically unlimited thermal sink, the practical effect of allowing customers to feed steam into the system would remove this hurdle and represent a complete game changer for cogeneration economics.

To determine how providing a thermal sink would positively affect CHP economics, Endurant Energy conducted an analysis of 5 sites on the steam system between 39th St. and 68th St., beginning with the baseline energy model that modulates electric production to match thermal load. The base case was then adjusted to allow the system to follow the electric load. This increased the annual electricity production available from the system without reducing the system's efficiency, because excess thermal energy could be used to meet the steam requirements of the Con Edison system. The resulting additional electric production (the delta between the thermal load constrained and non-constrained numbers) provides additional savings for a particular project. Endurant then backed out the increased fuel costs for running the system at higher loads as well as the increased maintenance costs (on a $/kWh basis) to provide an "increased savings" number. Finally, the incremental cost of the extra equipment necessary to feed steam back into the system was added (this analysis was performed by Van Zelm Engineers, Section VI.). The difference between the base

[9] Long Term Con Edison Steam Production Options Study-Phase I Final Report, WorleyParsons, October 2006, P.6

case and the adjusted case is the incremental economic benefit from allowing customer supplied steam.

Based on the analysis shown in Section VI., it appears that even if the steam entering the system is considered to have minor economic value, the additional production available from removing the thermal load constraint will still contribute significant value to the projects.

The goal is to provide the increased individual economic savings on the five projects below. Because these vary in size and in the relative value of thermal energy, the sum of the five was used to develop an average increased savings and the increased steam supplied to the Con Edison system per MW of installed CHP. Those averages are applied to the stated goal of 800MW of DG in New York City by 2030 (PlaNYC 2030 goal) to provide the additional economic benefit as well as the additional steam supplied into the system. According to our analyses, the use of injection of steam into the Con Edison system increases the average economic benefit by 31%, but in the case of Example 1, that increase is almost 100%, changing a marginal project into an economically viable cogen system.

V. Customer sited steam supply case studies

The following tables were prepared by Endurant Energy, LLC and summarize analyses of five projects ranging from 1.6 MW to 6 MW. The tables show the improvement in electric peak reduction, annual electric production and steam production that is possible when there is sufficient thermal load to absorb all the steam production required to maintain high efficiencies. In correspondence, NYSERDA has accepted that customer sited steam supply is an efficient use of steam from CHP plants, and thus injection of steam into the Con Edison system allows these plants to meet the definition of efficient CHP. The operation of these plants with steam sales to Con Edison increases the overall efficiencies of the plants by an average of 23%, and for one 2 MW plant it nearly doubles the cash savings available to the operator.

Example 1: Eastside, 2 MW.

	Standard Dispatch	Dispatch with Customer Sited Steam Supply	Delta
Total Capital Cost ($)	$ 8,771,540	$ 8,771,540	**0%**
Additional Equipment Costs for Net Metering ($)	$ -	$ 180,000	**-**
Annual Electricity Produced (kWh)	5,137,928	7,578,829	**48%**
Annual Electricity Produced (MMBTU)	17,536	25,867	**48%**
July Peak Demand Reduction (kW)	586	1,553	**165%**
Annual Electricity Dollars Saved ($)	$ 812,545	$ 1,370,121	**69%**
Annual Thermal Produced (Used by Bldg-MMBTU)	18,570	20,617	**11%**
Annual Thermal Produced (Used by Bldg-Mlbs)	17,210	19,107	**11%**
Excess Thermal Produced (Unused by Bldg-MMBTU)	7,438	17,758	**139%**
Excess Thermal Produced (Unused by Bldg-Mlbs)	6,893	16,458	**139%**
Annual Thermal Dollars Saved ($)	$ 191,450	$ 229,482	**20%**
Annual Natural Gas Used (MMBTU)	59,408	87,713	**48%**
Annual Natural Gas Used Cost ($)	458,320	674,879	**47%**
Annual Maintenance Cost ($)	$ 128,448	$ 189,471	**48%**
Total Run Hours	2,946	4,301	**46%**
System Efficiency (HHV)	60.8%	73.2%	**21%**
$ per Excess Mlbs	$ -	$ 5.54	**-**
Steam Sales back to Con Ed ($)		$ 91,176	**-**
			-
Net Annual Revenue	**$ 417,227**	**$ 826,430**	**98%**

Steam Savings Calculation	Standard Dispatch	Dispatch with Customer Sited Steam Supply
Pre-CHP Annual MLB Use	29,637.00	29,637.00
Post-CHP Annual MLB Use	18,517.00	16,894.00
Pre-CHP Maximum MLB Demand	16.00	16.00
Post-CHP Contract Demand	16.00	16.00
Pre-CHP Annual On-Peak Steam Cost	$ 242,738.00	$ 242,738.00
Pre-CHP Annual Off-Peak Steam Cost	$ 564,349.00	$ 564,349.00
Pre-CHP Annual Steam Demand Cost	$ 47,481.00	$ 47,481.00
Post-CHP Annual On-Peak Steam Cost	$ 113,675.00	$ 98,729.00
Post-CHP Annual Off-Peak Steam Cost	$ 304,205.00	$ 281,119.00
Post-CHP Annual Contract Demand Cost	$ 245,238.00	$ 245,238.00
Post-CHP Steam Cost	$ 191,450.00	$ 229,482.00

Example 2: Eastside, 1.6 MW.

	Standard Dispatch	Dispatch with Customer Sited Steam Supply	Delta
Total Capital Cost ($)	$ 8,905,540	$ 8,905,540	**0%**
Additional Equipment Costs for Net Metering ($)	$ -	$ 180,000	**-**
Annual Electricity Produced (kWh)	3,442,019	5,297,310	**54%**
Annual Electricity Produced (MMBTU)	11,748	18,080	**54%**
July Peak Demand Reduction (kW)	224	1,544	**589%**
Annual Electricity Dollars Saved ($)	$ 760,172	$ 1,005,964	**32%**
Annual Thermal Produced (Used by Bldg-MMBTU)	12,944	14,517	**12%**
Annual Thermal Produced (Used by Bldg-Mlbs)	11,996	13,454	**12%**
Excess Thermal Produced (Unused by Bldg-MMBTU)	2,559	9,680	**278%**
Excess Thermal Produced (Unused by Bldg-Mlbs)	2,372	8,971	**278%**
Annual Thermal Dollars Saved ($)	$ 264,932	$ 303,576	**15%**
Annual Natural Gas Used (MMBTU)	39,870	61,761	**55%**
Annual Natural Gas Used Cost ($)	309,105	475,954	**54%**
Annual Maintenance Cost ($)	$ 86,050	$ 132,433	**54%**
Total Run Hours	2,300	3,763	**64%**
System Efficiency (HHV)	61.9%	68.5%	**11%**
$ per Excess Mlbs	$ -	$ 5.54	**-**
Steam Sales back to Con Ed ($)		$ 49,701	**-**
			-
Net Annual Revenue	**$ 629,949**	**$ 750,854**	**19%**

Steam Savings Calculation	Standard Dispatch	Dispatch with Customer Sited Steam Supply
Pre-CHP Annual MLB Use	28,117.00	28,117.00
Post-CHP Annual MLB Use	15,405.00	13,700.00
Pre-CHP Maximum MLB Demand	13.80	13.80
Post-CHP Contract Demand	13.20	13.20
Pre-CHP Annual On-Peak Steam Cost	$ 270,567.00	$ 270,567.00
Pre-CHP Annual Off-Peak Steam Cost	$ 507,352.00	$ 507,352.00
Pre-CHP Annual Steam Demand Cost	$ 46,844.00	$ 46,844.00
Post-CHP Annual On-Peak Steam Cost	$ 119,797.00	$ 111,504.00
Post-CHP Annual Off-Peak Steam Cost	$ 237,664.00	$ 207,312.00
Post-CHP Annual Contract Demand Cost	$ 202,370.00	$ 202,370.00
Post-CHP Steam Cost	$ 264,932.00	$ 303,577.00

Example 3: Westside, 2 MW.

		Standard Dispatch		Dispatch with Customer Sited Steam Supply	Delta
Total Capital Cost ($)	$	8,771,540	$	8,771,540	**0%**
Additional Equipment Costs for Net Metering ($)	$	-	$	180,000	**-**
Annual Electricity Produced (kWh)		6,267,321		7,499,004	**20%**
Annual Electricity Produced (MMBTU)		21,390		25,594	**20%**
July Peak Demand Reduction (kW)		438		1,889	**331%**
Annual Electricity Dollars Saved ($)	$	1,260,937	$	1,428,679	**13%**
Annual Thermal Produced (Used by Bldg-MMBTU)		23,253		24,487	**5%**
Annual Thermal Produced (Used by Bldg-Mlbs)		21,551		22,694	**5%**
Excess Thermal Produced (Unused by Bldg-MMBTU)		11,520		22,105	**92%**
Excess Thermal Produced (Unused by Bldg-Mlbs)		10,677		20,487	**92%**
Annual Thermal Dollars Saved ($)	$	491,296	$	510,100	**4%**
Annual Natural Gas Used (MMBTU)		72,913		87,371	**20%**
Annual Natural Gas Used Cost ($)		562,471		672,101	**19%**
Annual Maintenance Cost ($)	$	156,683	$	187,475	**20%**
Total Run Hours		3,303		4,000	**21%**
System Efficiency (HHV)		61.2%		82.6%	**35%**
$ per Excess Mlbs	$	-	$	5.54	**-**
Steam Sales back to Con Ed ($)			$	113,496	**-**
					-
Net Annual Revenue	**$**	**1,033,078**	**$**	**1,192,699**	**15%**

Steam Savings Calculation	**Standard Dispatch**	**Dispatch with Customer Sited Steam Supply**
Pre-CHP Annual MLB Use	45,152.00	45,152.00
Post-CHP Annual MLB Use	21,297.00	20,408.00
Pre-CHP Maximum MLB Demand	24.00	24.00
Post-CHP Contract Demand	23.50	23.50
Pre-CHP Annual On-Peak Steam Cost	$ 431,187.00	$ 431,187.00
Pre-CHP Annual Off-Peak Steam Cost	$ 824,406.00	$ 824,406.00
Pre-CHP Annual Steam Demand Cost	$ 85,687.00	$ 85,687.00
Post-CHP Annual On-Peak Steam Cost	$ 125,252.00	$ 125,252.00
Post-CHP Annual Off-Peak Steam Cost	$ 363,534.00	$ 344,730.00
Post-CHP Annual Contract Demand Cost	$ 361,198.00	$ 361,198.00
Post-CHP Steam Cost	$ 491,296.00	$ 510,100.00

Example 4: Midtown, 4 MW.

	Standard Dispatch	Dispatch with Customer Sited Steam Supply	Delta
Total Capital Cost ($)	$ 16,100,000	$ 16,100,000	**0%**
Additional Equipment Costs for Net Metering ($)	$ -	$ 180,000	**-**
Annual Electricity Produced (kWh)	11,653,835	15,552,569	**33%**
Annual Electricity Produced (MMBTU)	39,775	53,081	**33%**
July Peak Demand Reduction (kW)	450	1,816	**304%**
Annual Electricity Dollars Saved ($)	$ 2,463,431	$ 2,986,049	**21%**
Annual Thermal Produced (Used by Bldg-MMBTU)	41,880	52,444	**25%**
Annual Thermal Produced (Used by Bldg-Mlbs)	38,813	48,604	**25%**
Excess Thermal Produced (Unused by Bldg-MMBTU)	14,191	22,371	**58%**
Excess Thermal Produced (Unused by Bldg-Mlbs)	13,152	20,733	**58%**
Annual Thermal Dollars Saved ($)	$ 827,882	$ 1,001,229	**21%**
Annual Natural Gas Used (MMBTU)	132,690	177,062	**33%**
Annual Natural Gas Used Cost ($)	1,018,978	1,358,534	**33%**
Annual Maintenance Cost ($)	$ 291,346	$ 388,814	**33%**
Total Run Hours	3,000	4,000	**33%**
System Efficiency (HHV)	61.5%	72.2%	**17%**
$ per Excess Mlbs	$ -	$ 5.54	**-**
Steam Sales back to Con Ed ($)		$ 114,861	**-**
			-
Net Annual Revenue	**$ 1,980,989**	**$ 2,354,791**	**19%**

Steam Savings Calculation	Standard Dispatch	Dispatch with Customer Sited Steam Supply
Pre-CHP Annual MLB Use	107,850.00	107,850.00
Post-CHP Annual MLB Use	71,320.00	62,265.00
Pre-CHP Maximum MLB Demand	35.00	35.00
Post-CHP Contract Demand	34.40	34.40
Pre-CHP Annual On-Peak Steam Cost	$ 621,215.00	$ 621,215.00
Pre-CHP Annual Off-Peak Steam Cost	$ 1,923,436.00	$ 1,923,435.00
Pre-CHP Annual Steam Demand Cost	$ 113,308.00	$ 113,308.00
Post-CHP Annual On-Peak Steam Cost	$ 177,134.00	$ 177,134.00
Post-CHP Annual Off-Peak Steam Cost	$ 1,124,600.00	$ 951,254.00
Post-CHP Annual Contract Demand Cost	$ 528,342.00	$ 528,342.00
Post-CHP Steam Cost	$ 827,883.00	$ 1,001,228.00

Example 5: Westside, 6 MW.

		Standard Dispatch		Dispatch with Customer Sited Steam Supply	Delta
Total Capital Cost ($)	$	20,250,000	$	20,250,000	**0%**
Additional Equipment Costs for Net Metering ($)	$	-	$	180,000	**-**
Annual Electricity Produced (kWh)		18,113,067		22,001,071	**21%**
Annual Electricity Produced (MMBTU)		61,820		75,090	**21%**
July Peak Demand Reduction (kW)		1,742		3,026	**74%**
Annual Electricity Dollars Saved ($)	$	3,151,715	$	4,122,306	**31%**
Annual Thermal Produced (Used by Bldg-MMBTU)		61,667		63,749	**3%**
Annual Thermal Produced (Used by Bldg-Mlbs)		57,152		59,081	**3%**
Excess Thermal Produced (Unused by Bldg-MMBTU)		33,101		49,702	**50%**
Excess Thermal Produced (Unused by Bldg-Mlbs)		30,677		46,063	**50%**
Annual Thermal Dollars Saved ($)	$	1,024,853	$	1,035,077	**1%**
Annual Natural Gas Used (MMBTU)		201,358		243,879	**21%**
Annual Natural Gas Used Cost ($)		1,547,133		1,871,416	**21%**
Annual Maintenance Cost ($)	$	452,827	$	550,027	**21%**
Total Run Hours		3,668		4,047	**10%**
System Efficiency (HHV)		61.3%		77.3%	**26%**
$ per Excess Mlbs	$	-	$	5.54	**-**
Steam Sales back to Con Ed ($)			$	255,189	**-**
					-
Net Annual Revenue	**$**	**2,176,608**	**$**	**2,811,129**	**29%**

Steam Savings Calculation		**Standard Dispatch**		**Dispatch with Customer Sited Steam Supply**
Pre-CHP Annual MLB Use		117,765.00		117,765.00
Post-CHP Annual MLB Use		72,231.00		71,669.00
Pre-CHP Maximum MLB Demand		40.30		40.30
Post-CHP Contract Demand		40.30		40.30
Pre-CHP Annual On-Peak Steam Cost	$	702,511.00	$	702,511.00
Pre-CHP Annual Off-Peak Steam Cost	$	2,244,446.00	$	2,244,446.00
Pre-CHP Annual Steam Demand Cost	$	144,839.00	$	144,839.00
Post-CHP Annual On-Peak Steam Cost	$	250,632.00	$	248,223.00
Post-CHP Annual Off-Peak Steam Cost	$	1,197,493.00	$	1,189,677.00
Post-CHP Annual Contract Demand Cost	$	618,818.00	$	618,818.00
Post-CHP Steam Cost	$	1,024,853.00	$	1,035,078.00

In these cases, the electric plants can be efficiently operated more hours, and in particular they can increase their efficient peak electric output, because the volume of usable steam is essentially unlimited if steam can be injected into the Con Edison system. In addition to the benefits of more annual production and greater peak electric load reduction, the overall efficiency of the plants improve as well. Because both steam fuel costs and the electric market price follow the cost of natural gas, this analysis is not sensitive to changes in the price of natural gas. The peak rate of excess steam generation is approximately 16 Mlbs/hr, an amount that the Con Edison system should be able to accept in all hours of the year.

Total of five projects:

	Standard Dispatch	Dispatch with Customer Sited Steam Supply	Delta
Total Capital Cost ($)	$ 53,893,080	$ 53,893,080	**0%**
Additional Equipment Costs for Net Metering ($)	$ -	$ 900,000	
Annual Electricity Produced (kWh)	41,172,151	52,631,473	**28%**
Annual Electricity Produced (MMBTU)	140,521	179,631	**28%**
July Peak Demand Reduction (kW)	3,216	8,284	**158%**
Annual Electricity Dollars Saved ($)	$ 7,688,627	$ 9,907,154	**29%**
Annual Thermal Produced (Used by Bldg-MMBTU)	145,370	161,297	**11%**
Annual Thermal Produced (Used by Bldg-Mlbs)	134,726	149,487	**11%**
Excess Thermal Produced (Unused by Bldg-MMBTU)	66,250	111,936	**69%**
Excess Thermal Produced (Unused by Bldg-Mlbs)	61,400	103,741	**69%**
Annual Thermal Dollars Saved ($)	$ 2,535,481	$ 2,775,888	**9%**
Annual Natural Gas Used (MMBTU)	466,369	596,025	**28%**
Annual Natural Gas Used Cost ($)	3,586,902	4,576,929	**28%**
Annual Maintenance Cost ($)	$ 1,029,304	$ 1,315,787	**28%**
Total Run Hours	12,917	16,348	**27%**
System Efficiency (HHV)	61.3%	75.2%	**23%**
$ per Excess Mlbs	$ -	$ 5.54	
Steam Sales back to Con Ed ($)	$ -	$ 574,722	
	$ -	$ -	
Net Annual Revenue	**$ 5,607,903**	**$ 7,365,049**	**31%**

	Standard Dispatch	**Dispatch with Customer Sited Steam Supply**
Steam Savings Calculation		
Pre-CHP Annual MLB Use	328,521.00	328,521.00
Post-CHP Annual MLB Use	198,770.00	184,936.00
Pre-CHP Maximum MLB Demand	129.10	129.10
Post-CHP Contract Demand	127.40	127.40
Pre-CHP Annual On-Peak Steam Cost	$ 2,268,218.00	$ 2,268,218.00
Pre-CHP Annual Off-Peak Steam Cost	$ 6,063,989.00	$ 6,063,988.00
Pre-CHP Annual Steam Demand Cost	$ 438,159.00	$ 438,159.00
Post-CHP Annual On-Peak Steam Cost	$ 786,490.00	$ 760,842.00
Post-CHP Annual Off-Peak Steam Cost	$ 3,227,496.00	$ 2,974,092.00
Post-CHP Annual Contract Demand Cost	$ 1,955,966.00	$ 1,955,966.00
Post-CHP Steam Cost	$ 2,800,414.00	$ 3,079,465.00

The avoided fuel cost for steam system boiler fuel was estimated by applying the average rate of excess steam energy per MW of as determined in the above analyses, and multiplying that by the City's goal of 800 MW. That number was divided by the estimated boiler efficiency to determine the volume of fuel displaced. That fuel was priced at $4.11/dth, based on the price of natural gas for electric generation as reported by the NYISO.

Displaced steam generation (Mlbs)		758,100
Displaced steam generation (MMBTU)		817,993
Boiler efficiency		80%
Displaced boiler fuel (dekatherms)		1,022,491
Natural gas price ($/dt)	$	6.00
Avoided fuel cost	$	6,134,948
Avoided cost per Mlbs	$	8.09

Note that the value of excess steam includes only the incremental fuel cost, and that cost is priced at the estimated cost of natural gas for steam generation. This estimate does not include any decrease in steam distribution losses, or decreases in water or chemicals related to reduced condensate disposal by Con Edison.

VI. Technical Issues

The technical requirements for customer sited steam supply were analyzed by Van Zelm Engineers. The full report is attached as Appendix I. Their conclusion was that all the technical problems may be resolved. Their major findings included:

1. **Steam Metering**

   Metering of steam is a mature technology, and meter station equipment is available for a wide range of steam flow and turn down. Though a typical building steam metering station can include multiple staged metering elements to accommodate accurate metering for a wide range of steam flow, the magnitude of steam flow for CHP produced steam from an engine-generator CHP system is easily accomplished using a single metering element. The proposed approach is to employ a vortex type meter selected to afford accuracy and turndown. This metering station would input to the Buyer's metering PLC system and allow accounting of the export flow separate from steam separately delivered to the building by Buyer, thereby providing a calculated net metering of import and export steam.

2. **Steam Quality – Monitoring**

   Continuous monitoring of steam conductivity, sodium ion concentration, and pH must be provided to Con Edison.

VII. Effect on Steam System

If all of the above examples of CHP were developed with customer-sited steam, there would be approximately 103,000 Mlbs of customer-sited steam to be injected into the

Con Edison system. That number would be about 9 times larger, or about 1 million Mlbs, if all of the 95 MW identified in the GTI study were developed as well. According to workpapers filed in the 2007 steam rate case (07-S-1315), Con Edison's steam generation, excluding cogeneration and purchases, was 14 million Mlbs for the year ending June 2007, and at least 497,000 Mlbs in every month of that year. If oil powered generation were reduced to accommodate customer sited supply, both the economic value to Con Edison and the environmental benefits of this steam would be greater. For example, according to the Worley-Parsons Phase I final report, beginning at p.55, the Company's 74th St oil-fired cogeneration plant is dispatched for both steam and electric production. When it is dispatched for steam production, efficient CHP could replace fuel oil at that plant. In any event, the steam-only boiler production far exceeds the volume of customer-sited steam potential.

VIII. Rates

CHP plants are eligible for electric standby service, and that will not change if customer sited steam supply is available. The current analysis includes a steam standby rate in the steam saving calculation, which was originally developed to be revenue neutral to the Company in the case of steam customers who install their own boilers. It is not clear that this tariff is appropriate for CHP plants that provide steam to the system. There is currently no tariff for the sale of steam to Con Edison.

APPENDIX I.

CHP Steam Net Metering
System Description
Endurant Energy, LLC.

VANZELM ENGINEERS

Endurant Energy, LLC
CHP Steam Net Metering
System Description

General

Combined Heat and Power (CHP) deployed in proximity to electric and steam loads affords the highest efficiency of energy delivery as there are no electric or steam transmission losses. Additionally, the CHP electric and steam production assets, as are typically sized to provide peak capacity for a given building application, are available to operate during off peak periods subject to availability of a steam load. It is proposed that CHP applications for buildings receiving service from a district steam system offer economic and environmental benefits when export of steam can be a part of the operating regimen.

Steam Metering

Metering of steam is a mature technology, and meter station equipment is available for a wide range of steam flow and turn down. Though a typical building steam metering station can include multiple staged metering elements to accommodate accurate metering for a wide range of steam flow, the magnitude of steam flow for CHP produced steam from an engine-generator CHP system is easily accomplished using a single metering element. The proposed approach is to employ a vortex type meter selected to afford accuracy and turndown. This metering station would input to the Buyer's metering PLC system and allow accounting of the export flow separate from steam separately delivered to the building by Buyer, thereby providing a calculated net metering of import and export steam.

Steam Generation and Control

Customer steam generation equipment provides steam production at steam conditions such that the steam pressure and temperature is regulated and exportable to the distribution system to suit the Buyer's real time steam condition requirements. This can be remotely set and communicated from the Buyer's Energy Dispatcher. Steam export can be controlled by the Buyer's in-building PLC, by regulation of a control valve that will be in series configuration with a positive shutoff trip valve such that the Buyer's Energy Dispatcher has immediate capability to isolate in the event that a shut down is necessary for system protection.

Steam Quality – Water Treatment

Steam quality will provide a steam product that meets FDA purity requirements. Seller will employ water treatment and water chemistry that includes pretreatment by reverse osmosis and electrodionization system. All water treatment chemicals shall confirm to the requirements of the Code of Federal Regulations, Food and Drugs, Title 21, Part 173, Section 310, Boiler Water Additives, including the special requirements for steam used in milk production. All treatment Chemicals will be FDA approved.

VANZELM ENGINEERS

Endurant Energy, LLC
CHP Steam Net Metering
System Description

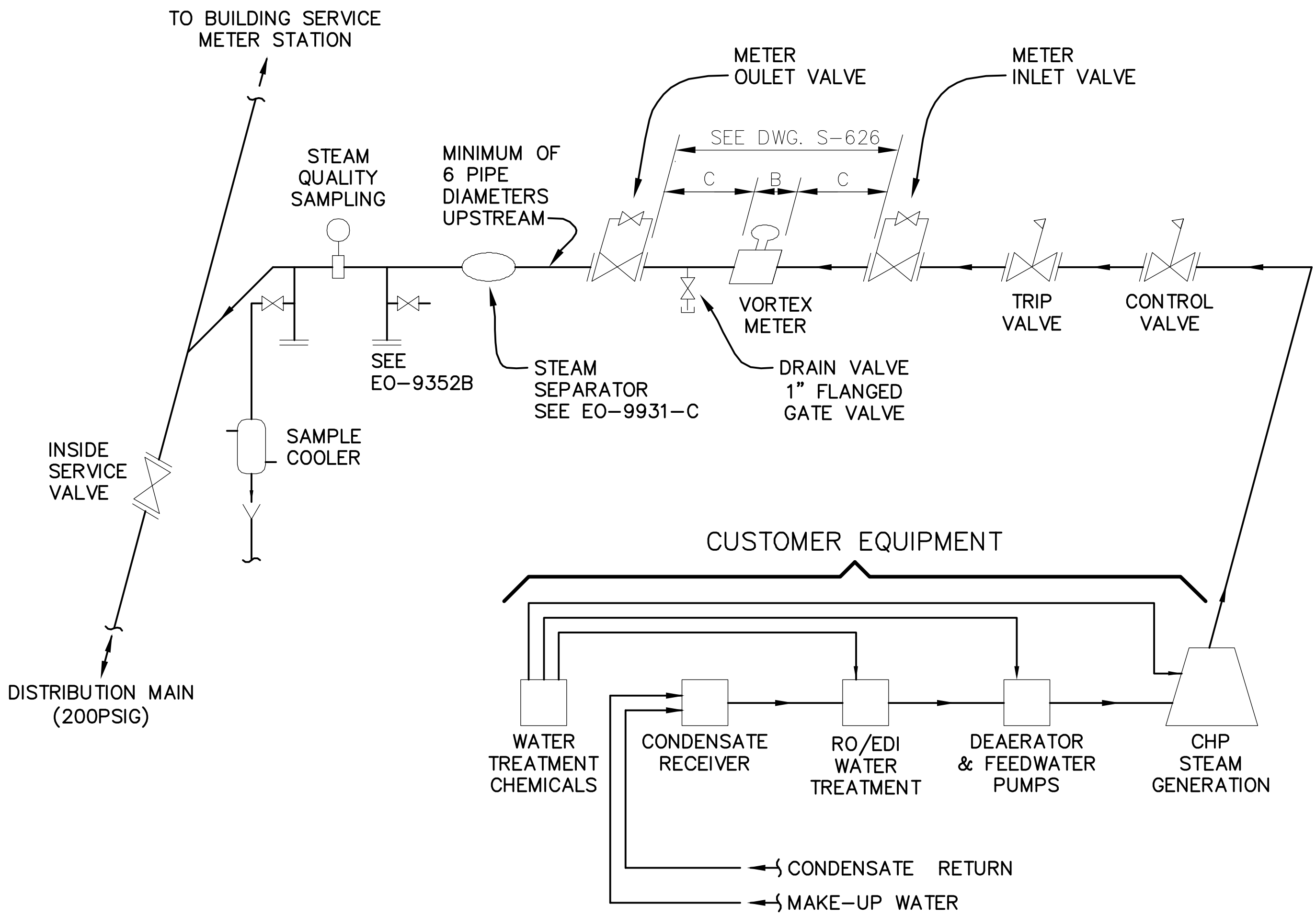
Steam Quality – Monitoring

Continuous monitoring of steam conductivity, sodium ion concentration, and pH will be provided and available to the Buyer as real time digital signals. Steam sampling will be taken from the horizontal center of the steam export main using an isokinetic probe conforming to ASTM 1066. A steam sampling provision will be provided at a drip pot immediately upstream of the delivery point. All steam monitoring equipment will be accessible by the Buyer.

System Configuration

A System Diagram is attached.

APPENDIX I



NOTES

1. COMPONENT REFERENCES ARE TO CON ED STEAM DISTRIBUTION ENGINEERING SPECIFICATIONS.
2. METERING, TRIP VALVE AND CONTROL VALVE CONTROLLED BY CON ED PLC SYSTEM.
3. STEAM QUALITY SAMPLING AS PER ASTM 1066
4. WATER TREATMENT CHEMICALS AS PER CFR FOOD & DRUG TITLE 21 PART 173 SECTION 310.

PROJECT NAME	DRAWING TITLE
ENDURANT ENERGY, LLC	CHP STEAM NET METERING SYSTEM DIAGRAM

VANZELM ENGINEERS, LLC
MECHANICAL AND ELECTRICAL ENGINEERS
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(860) 284-5064 FAX (860) 284-5098

PROJECT NO.: 2008009.05
REVISION TO: – REV.: –
SCALE: NTS DATE: 7/30/09
SK-1
DWG. NO.
REMARKS: