



## **Operations Monitoring Report**

**Second Quarter FY16**

**Prepared by:**

**Thermal Engineering Group, Inc.  
105 Hazel Path Court, Ste 2  
Hendersonville, TN 37075**

**January 29, 2016**

## **I. Executive Summary**

A review of the fiscal year 2016 (FY16) Second Quarter performance and contract obligations between Constellation New Energy (CNE) and the Metropolitan Government of Nashville and Davidson County (Metro) is presented in this report by Thermal Engineering Group, Inc (TEG). The status of the available funds for all active capital construction and repair and improvement projects are also presented. For the fiscal year 2016 to date, CNE has satisfactorily met all of the contract obligations to Metro and has had no contract violations.

For the Second Quarter FY16, the chilled water sales increased 14.3% over the previous Second Quarter (FY15). The chilled water sendout was also up 6.9% over the previous Second Quarter. However, the system losses were down approximately 56.7%. The Second Quarter FY16 saw a 16.1% increase in cooling degree days. The peak chilled water demand for the current quarter was 14,083 tons, which is 3.0% lower than the previous Second.

Steam sendout for the current quarter decreased by approximately 25.1% over the previous Second Quarter with a 45.2% decrease in heating degree days. Likewise, steam sales also decreased by approximately 30.4% over the previous Second Quarter. Steam system losses, as a percentage of sendout, increased, and the total losses increased approximately 23.7% over the previous Second Quarter. The peak steam demand for the current quarter was 103,094 pounds per hour, which represents a decrease in the Second Quarter demand by approximately 24.3%.

The Energy Generating Facility (EGF) performance continues to surpass the System Performance Guarantee (Guaranteed Maximum Quantity or GMQ) levels. The chilled water plant electric consumption continues to perform lower than the guaranteed levels and has decreased in the Second Quarter due to operational changes implemented by CNE. The steam plant electric consumption decreased significantly over the previous Second Quarter, and the amount of electricity per unit of sales of steam increased by approximately 4.1%. The steam plant fuel efficiency has typically remained consistent with previous years and quarters, but a significant decrease in plant fuel efficiency is noted for December. The total water consumption for the steam and chilled water plants increased 6.5% from the previous Second Quarter marked by a 21.1% increase in the EDS make-up for the chilled water system and a 42.6% decrease in the steam plant usage.

Work continued on DES Capital and Repair & Improvement Projects during the Second Quarter of FY16. Repair and Improvements to the EDS continue as scheduled. Construction was completed on DES117 during the Second Quarter FY16. DES112 is awaiting confirmation of redline drawing dimensions. Once these are received and confirmed, the record drawings will be completed and this project will be closed. DES107 was closed during the Second Quarter FY16.

The current fiscal year system operating costs to date are \$10,424,620. This value represents approximately 47.8% of the total budgeted operating cost for FY16. The customer revenues from the sales of steam and chilled water for FY16 (to date) are \$9,526,789 which is approximately 47.6% of the budgeted amount. The difference between the operating costs and customer revenue is the Metro funding amount (MFA), which represents the shortfall in cash

flow for the system. The MFA transferred to date for FY16 is \$897,000 (50% of budget). However, the actual MFA required cannot be accurately calculated due to outstanding invoices.

---

## Table of Contents

Section	Description	Page
I.	Executive Summary .....	i
II.	Energy Distribution System Sales and Performance .....	1
	A. Chilled Water .....	1
	1. Sales and Sendout .....	1
	2. Losses.....	2
	3. Performance .....	3
	B. Steam.....	4
	1. Sales and Sendout .....	4
	2. Losses.....	5
	3. Performance .....	6
	C. Contract Guarantee Performance .....	8
	D. Operating Costs.....	10
III.	EGF Operations .....	12
	A. Reliability.....	12
	B. Efficiency .....	12
	C. Environment, Health and Safety .....	12
	D. Personnel.....	13
	E. Training.....	13
	F. Water Treatment .....	13
	G. Maintenance and EGF Repairs .....	14
	H. EGF Walk-through.....	14
IV.	Capital Projects .....	15
	A. Second Quarter FY16 Open Projects .....	15
	B. Second Quarter FY16 Closed Projects .....	17
	C. Capital Projects Budget.....	17
V.	Energy Distribution System Repair, Improvements, PM and Emergencies....	18
	A. Repairs and Improvements .....	18
	B. Preventive Maintenance.....	19
	C. Emergencies.....	20
	D. EDS Walk-through.....	20
VI.	Customer Relations .....	20
	A. Marketing.....	20
	B. Customer Interaction.....	20
VII.	Recommendations.....	21

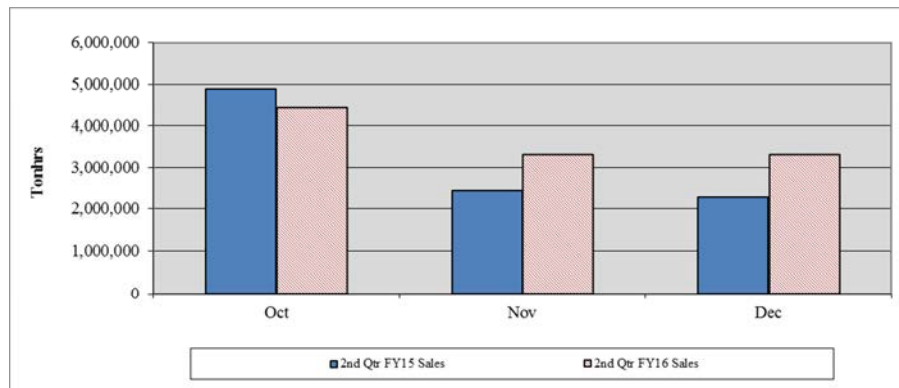
## II. Energy Distribution Sales and Performance

### A. Chilled Water

This section of the report discusses and presents performance information regarding the operation of the EGF for the periods described. Charts and tabular data are also presented to provide a more detailed description of the actual EGF performance.

#### 1. Sales and Sendout

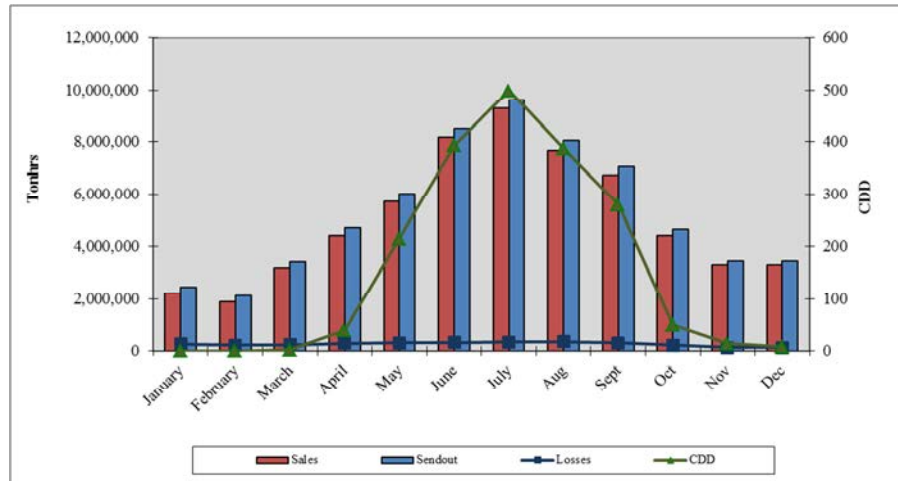
A comparison for the Second Quarter chilled water sales is shown in Figure 1. This data reflects a 14.3% increase in sales for the current quarter over the same quarter of the previous fiscal year. The increase in chilled water sales is largely due to a warmer than normal November and December.



**Figure 1. Chilled Water Sales Comparison**

The peak chilled water demand for the current quarter was 14,083 tons, which represents an approximate 3.0% decrease over the previous Second Quarter and the highest recorded EGF peak.

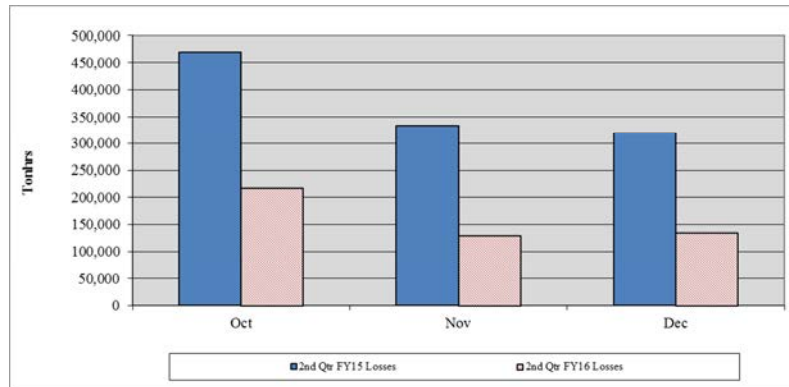
Figure 2 shows the chilled water sales, sendout and losses for the previous twelve months. The losses on this figure are defined as the difference in tonhrs per month between the recorded sendout and sales values and represent the total energy loss for chilled water in the EDS. The number of cooling degree days per month are also tracked for comparison.



**Figure 2. Chilled Water Sales, Sendout, Losses and CDD for the Previous Twelve Months**

2. Losses

A comparison of the total, chilled water energy losses in the EDS for the Second Quarter is shown in Figure 3. These losses are the difference in chilled water sendout and sales.

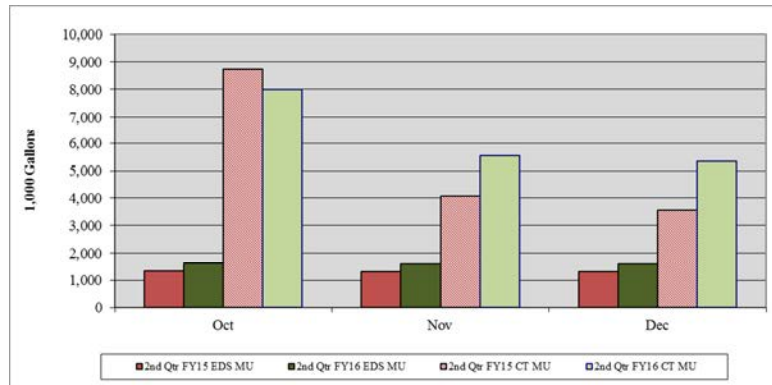


**Figure 3. Chilled Water System Loss Comparison**

The EDS make-up increased by approximately 21.1% over the previous Second Quarter. CNE is continuing to investigate the sources of the chilled water leaks that cause the increase in EDS make-up. A new project is anticipated to begin in the Third Quarter that may assist CNE in finding these sources. The total EDS water usage represents only a small part of the total EGF water usage for the quarter, but the percentage is increasing.

The total energy losses have decreased by approximately 56.7% over the previous Second Quarter. The make-up to the cooling towers increased 15.4% during the quarter due largely to an increase in chilled water sales. The number of cycles of

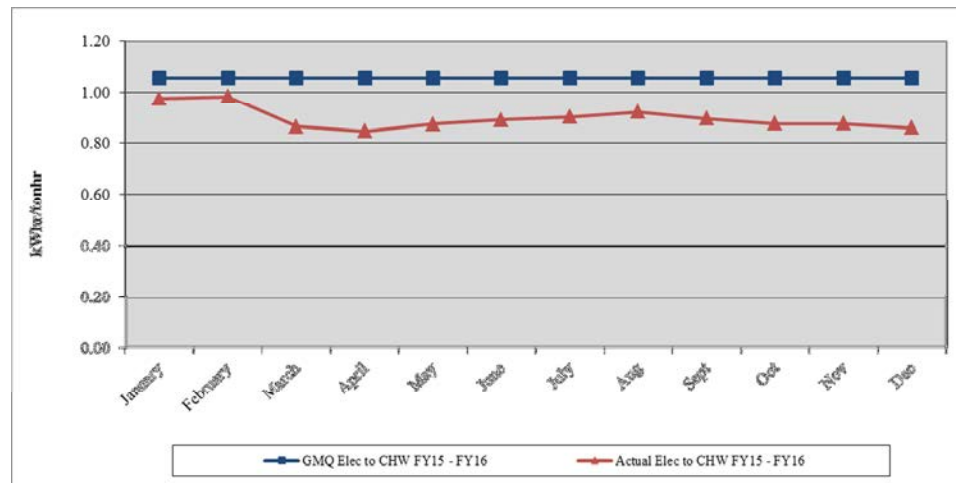
concentration in the condensing water circuit experienced a 18.6% increase during the current. The overall city water make-up comparison for the chilled water system is shown in Figure 4.



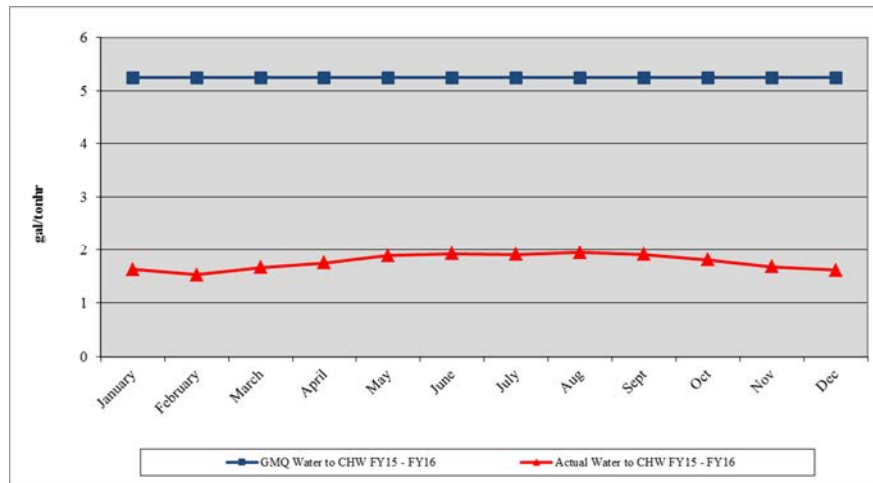
**Figure 4. Chilled Water System City Water Usage Comparison**

### 3. Performance

The performance of the chilled water aspect of the EGF is presented by the following two charts, Figures 5 and 6, for the previous twelve months. Under the management of CNE, the System Performance Guarantee levels as described in the ARMA are being achieved quite satisfactorily.



**Figure 5. Chiller Plant Electric Performance Guarantee Comparison for the Previous Twelve Months**



**Figure 6. Chiller Plant Water Consumption Performance Guarantee Comparison for the Previous Twelve Months**

The chilled water allocation of the electric consumption falls under the GMQ limit of 1.055 kWhr per tonhr for the current quarter, and no excursion is reported for the current fiscal year. However, the chiller plant electric usage continued to show a steady increase over previous years until March 2015. CNE made some operational changes in the First Quarter FY15 that led to an increase in electric use during the Second and Third Quarters. Additional changes were made in March that appears to have led to a subsequent reduction in electric use. The electric usage per unit of sales decreased approximately 8.2% over the Second Quarter for FY15 (Figure 5) and continues to show improvement. TEG and CNE continue to work together to improve the efficiency of the chiller plant.

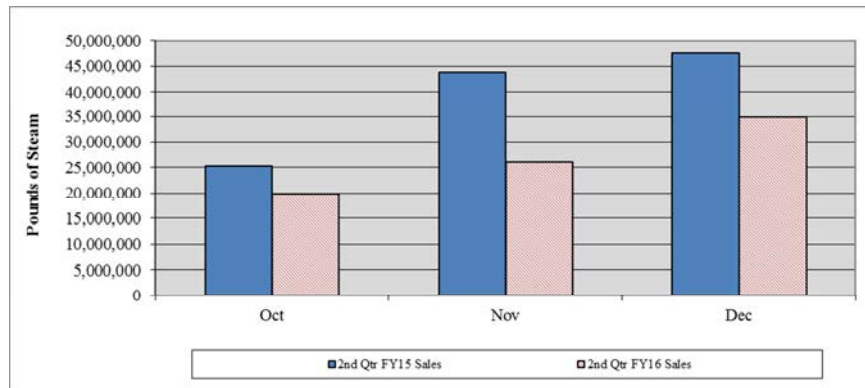
The actual chilled water plant water conversion factor increased approximately 1.9% over the previous Second Quarter. However, the total consumption of city water for the chiller plant for the current quarter increased 16.5% due largely to an increase in chilled water sales.

## B. Steam

### 1. Sales and Sendout

The steam sendout decreased by approximately 25.1% over the previous Second Quarter (FY15), and the sales also decreased by approximately 30.4%. The Quarter experienced a significant decrease in the number of heating degree days (45.2%) due to a warmer than normal November and December. The steam system losses increased 23.7% over the previous Second Quarter. A comparison for the Second Quarter steam sales is shown in Figure 7.

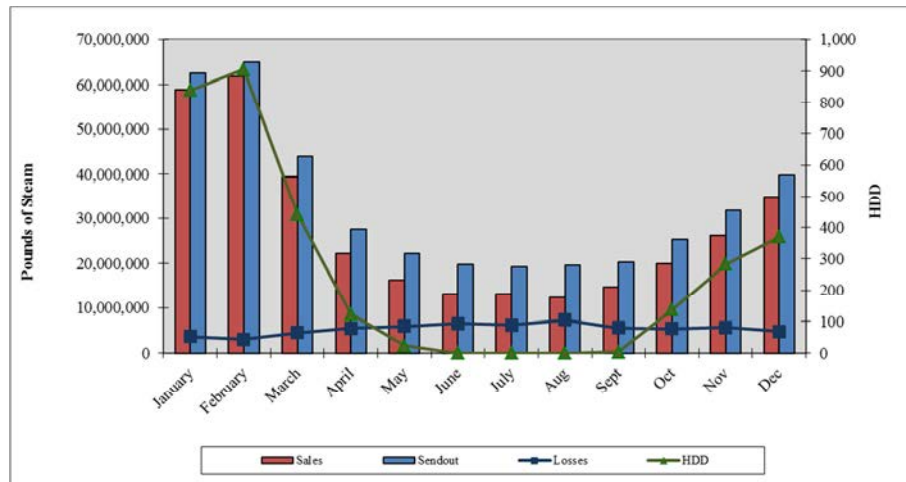




**Figure 7. Steam Sales Comparison**

The peak steam demand for the current quarter was 103,094 pph, which reflects an approximate 24.3% decrease in the peak steam production over the previous Second Quarter.

Figure 8 shows the steam sales, sendout and losses for the previous twelve months. The losses on this figure are defined as the difference in pounds per month between the recorded sendout and sales values and represent the total mass loss in the EDS between the EGF and the customer meters.

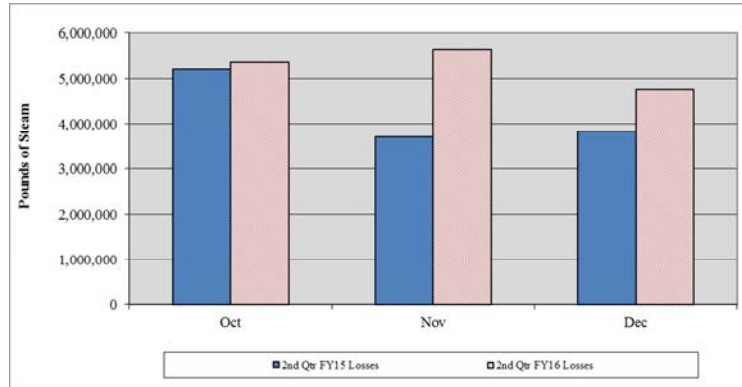


**Figure 8. Steam Sales, Sendout, Losses and HDD for the Previous Twelve Months**

## 2. Losses

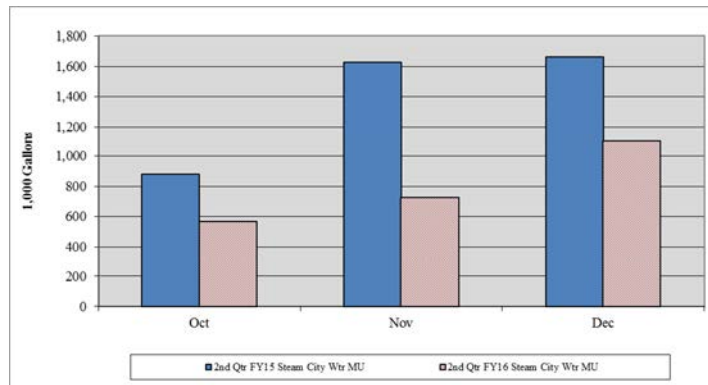
A comparison of the total steam mass losses in the EDS for the Second Quarter is shown in Figure 9. The mass loss is caused by the heat loss in the EDS between the EGF and the customer meters, resulting in a mass loss at steam traps. Faulty traps, steam leaks or meter error could also be a contributing cause of these losses. Whenever steam sales decrease from the previous quarter, the percent of system

losses can be expected to increase since the majority of these losses are based on a near constant heat loss of the system.



**Figure 9. Steam System Losses**

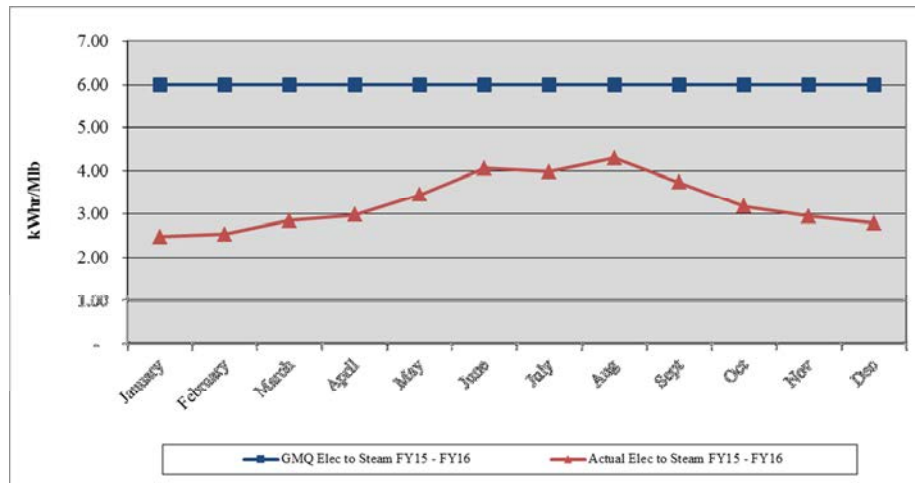
The amount of city water make-up (MU) to the steam system consists of the loss in mass between the EGF and the customers, in the condensate return from the customers to the EGF and losses at the EGF. This data is shown in the comparison of Second Quarter data in Figure 10.



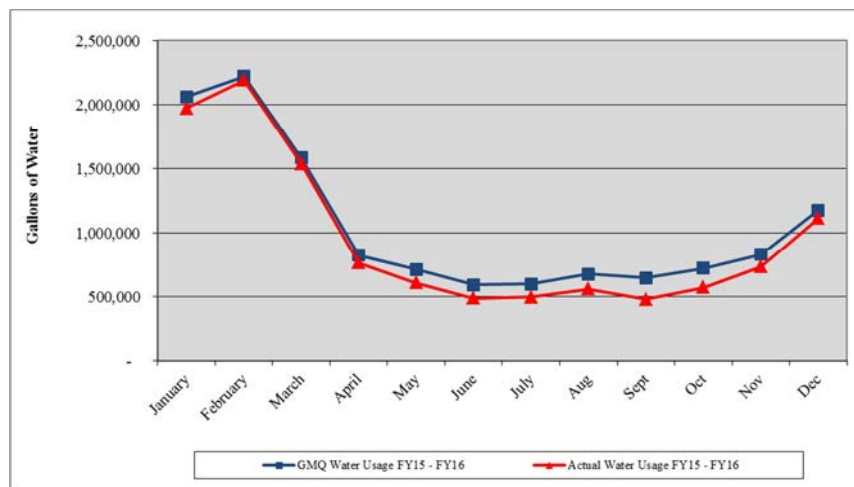
**Figure 10. Steam System City Water Make-up Comparison**

### 3. Performance

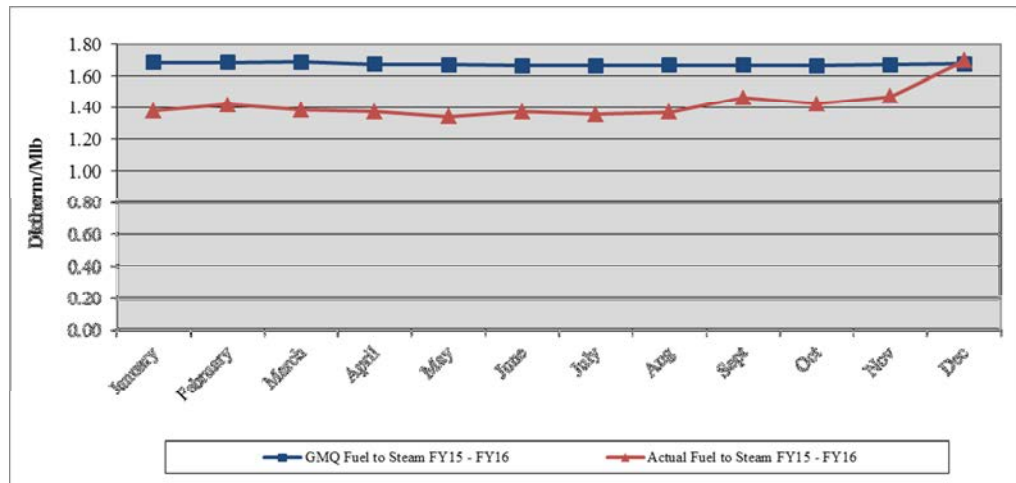
The performance of the steam system aspect of the EGF is presented by the following three charts, Figures 11, 12 and 13. Under the management of CNE, the System Performance Guarantee levels as described in the ARMA are being achieved satisfactorily.



**Figure 11. Steam Plant Electric Performance Guarantee for the Previous Twelve Months**



**Figure 12. Steam Plant Water Performance Guarantee for the Previous Twelve Months**



**Figure 13. Steam Plant Fuel Performance Guarantee for the Previous Twelve Months**

The current quarter experienced a 27.6% decrease in the steam plant electric consumption while experiencing a 4.3% increase in the electric conversion factor due to a decrease in sales. The water consumption for the steam plant decreased 42.6% this quarter as compared to the previous Second Quarter. The fuel consumption per unit of steam sales has been relatively constant throughout the historic data. However, the boiler plant fuel efficiency decreased significantly for the current quarter due to a significant increase in the fuel consumption for December. For the first time, the fuel consumption for December exceeded the guaranteed value.

C. Contract Guarantee Performance

The production and sales performance for the EGF and EDS are summarized in Table 1 for the current quarter. Additional parameters, such as cooling tower blow-down and peak demands are listed in this table, as well. Table 2 presents the Second Quarter comparisons of the Guaranteed Maximum Quantities (GMQ) of the criteria commodities (fuel, water and electricity).

**Table 1. Second Quarter FY16 Production, Sales and Consumption Summary**

Item	Unit	Second Quarter FY16	Second Quarter FY15	*Percent Difference
	days	92	92	0.00%
<b>Total Electric Use</b>	kWhrs	9,853,022	9,492,895	3.79%
Chilled Water	kWhrs	9,615,831	9,165,469	4.91%
Steam	kWhrs	237,191	327,426	-27.56%
<b>Total Water Use</b>	kgal	26,114	24,532	6.45%
Total Chilled Water	kgal	23,720	20,359	16.51%
EDS Make-up	kgal	4,839	3,997	21.07%
Cooling Towers	kgal	18,881	16,362	15.40%
Calc CT Evaporation	kgal	15,946	13,431	18.73%
CT Blowdown	kgal	2,935	2,931	0.14%
Calc # Cycles		5.43	4.58	18.56%
Steam	kgal	2,394	4,173	-42.63%
<b>Total Fuel Use</b>	mmBTU	150,447	179,301	-16.09%
Natural Gas	mmBTU	150,439	179,203	-16.05%
Propane	mmBTU	8	98	-91.84%
<b>Condensate Return</b>	kgal	9,507	12,021	-20.92%
	lbs	77,534,404	98,040,657	-20.92%
Avg Temp	°F	176.3	170.0	3.73%
<b>Sendout</b>				
Chilled Water	tonhrs	11,528,700	10,783,700	6.91%
Steam	lbs	96,873,000	129,340,000	-25.10%
Peak CHW Demand	tons	14,083	14,515	-2.98%
Peak Steam Demand	lb/hr	103,094	136,218	-24.32%
CHW LF		37.08%	33.65%	10.19%
Steam LF		42.56%	43.00%	-1.04%
<b>Sales</b>				
Chilled Water	tonhrs	11,042,844	9,661,191	14.30%
Steam	lbs	81,114,853	116,600,782	-30.43%
<b>Losses</b>				
Chilled Water	tonhrs	485,856	1,122,509	-56.72%
Steam	lbs	15,758,147	12,739,218	23.70%
		16.27%	9.85%	65.16%
<b>Degree Days</b>				
CDD		72	62	16.13%
HDD		790	1,442	-45.21%

\*positive percent difference values imply an increase from FY15 to FY16

**Table 2. Second Quarter FY16 Performance Guarantee Comparison for Steam and Chilled Water**

GMQ Calculations	Unit	Second Quarter FY16	Second Quarter FY15	*Percent Difference
<b>Steam</b>				
GMQ Elec Conversion	kWhr/Mlb	6.00	6.00	
Electric Conversion	kWhr/Mlb	2.92	2.81	4.13%
GMQ Plant Efficiency	Dth/Mlb	1.672	1.687	
Plant Efficiency	Dth/Mlb	1.553	1.386	12.03%
Actual %CR		80.04%	75.80%	5.59%
Avg CR Temp	°F	176	170	3.73%
GMQ Water Conversion	gal	2,726,802	4,413,304	
Water Conversion	gal	2,417,940	4,214,730	-42.63%
<b>Chilled Water</b>				
GMQ Elec Conversion	kWhr/tonhr	1.055	1.055	
Electric Conversion	kWhr/tonhr	0.871	0.949	-8.21%
GMQ Water Conversion	gal/tonhr	5.25	5.25	
Water Conversion	gal/tonhr	2.15	2.11	1.93%

\*positive percent difference values imply an increase from FY15 to FY16

#### D. Operating Costs

The fixed operating costs for the DES include the management fee to CNE, debt service payments on the bonds and engineering and administration costs and are charged to the customers relative to their contract demand. The variable costs are dependent on the amounts of steam and chilled water produced and sold to the customers. These latter costs include the utility and chemical treatment costs. The vast majority of the costs incurred for the operation of the DES are passed onto the customers in the form of the demand charges (fixed costs) and energy charges (variable costs). A summary of the total operating costs for the fiscal year to date are shown in Table 3.

The revenues shown reflect the charges to the customers for their respective steam and chilled water service. The difference between the total costs and revenues from the customers is the shortfall that must be paid by Metro. The shortfall exists due to the remaining capacity at the EGF that was included in the original construction and remains unsold and the debt service for bonds to which the customers do not directly contribute.

The system operating costs for FY16 to date are \$10,424,620. This value represents approximately 47.8% of the total budgeted operating cost for FY16 and includes expenses to date that have been invoiced but were not paid at the time of this report. Additional invoices that would be charged to the Second Quarter have not been issued or

paid at the time of this report. The customer revenues from the sales of steam and chilled water for FY16 are \$9,526,789 which is approximately 47.6% of the budgeted amount. The MFA transferred to date is \$897,000 (50% of budget). However, the actual MFA required cannot be accurately calculated due to the outstanding invoices.

**Table 3. DES Expenses and Revenues to Date**

Item	FY16 Budget	First Quarter Expenses	Second Quarter Expenses	Third Quarter Expenses	Fourth Quarter Expenses	Total Spending to Date	% of Budget
<b>Operating Management Fee</b>							
<b>FOC: Basic</b>	\$ 4,433,800	\$ 1,076,159	\$ 1,076,159	\$ -	\$ -	\$ 2,152,317	48.54%
9th Chiller	\$ 41,600	\$ 10,084	\$ 10,084	\$ -	\$ -	\$ 20,168	48.48%
C/O 6A	\$ 82,000	\$ 19,908	\$ 19,908	\$ -	\$ -	\$ 39,816	48.56%
C/O 6B	\$ 71,800	\$ 17,429	\$ 17,429	\$ -	\$ -	\$ 34,858	48.55%
C/O 7	\$ 27,100	\$ 6,566	\$ 6,566	\$ -	\$ -	\$ 13,132	48.46%
C/O 8	\$ 11,900	\$ 2,873	\$ 2,873	\$ -	\$ -	\$ 5,747	48.29%
<b>Pass-thru Charges:</b>	\$ 139,500	\$ 42,247	\$ 47,778	\$ -	\$ -	\$ 90,025	64.53%
Insurance	\$ 32,100	\$ 2,675	\$ -	\$ -	\$ -	\$ 2,675	8.33%
<b>Marketing:</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
CNE Sales Activity	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
Incentive Payments	\$ 12,800	\$ 3,139	\$ 3,139	\$ -	\$ -	\$ 6,279	49.05%
<b>FEA:</b>	\$ -	\$ 13,900	\$ 10,873	\$ -	\$ -	\$ 24,773	n.a.
Steam	\$ -	\$ 144,264	\$ 76,510	\$ -	\$ -	\$ 220,774	n.a.
Chilled Water	\$ -	\$ (226,605)	\$ (123,280)	\$ -	\$ -	\$ (349,885)	n.a.
<b>Misc:</b>	\$ -	\$ 15,630	\$ 15,630	\$ -	\$ -	\$ 31,259	n.a.
ARFA	\$ -	\$ -	\$ (7,016)	\$ -	\$ -	\$ (7,016)	n.a.
Deferral	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
<b>Subtotal - Man Fee =</b>	<b>\$ 4,852,600</b>	<b>\$ 1,354,873</b>	<b>\$ 1,279,932</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 2,634,806</b>	<b>54.30%</b>
<b>Reimbursed Management Fee + Chem Treatment</b>		\$ 1,352,198	\$ 454,123	\$ -	\$ -	\$ 1,806,321	0.00%
<b>Metro Costs</b>							
<b>Pass-thru Charges:</b>	\$ 9,000	\$ 33,421	\$ 7,198	\$ -	\$ -	\$ 40,619	451.32%
EDS R&I Transfers	\$ 282,100	\$ 70,525	\$ 70,525	\$ -	\$ -	\$ 141,050	50.00%
Metro Marketing	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
Project Administration	\$ 54,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
Metro Incremental Cost	\$ 529,600	\$ 143,244	\$ 121,775	\$ 8,121	\$ -	\$ 273,140	51.57%
<b>Utility Costs:</b>	\$ 745,400	\$ 210,481	\$ 109,117	\$ -	\$ -	\$ 319,599	42.88%
Water/Sewer	\$ -	\$ 40	\$ 40	\$ -	\$ -	\$ 80	n.a.
EDS Water/Sewer	\$ -	\$ 16,124	\$ 14,163	\$ -	\$ -	\$ 30,286	n.a.
EDS Electricity	\$ 6,545,700	\$ 2,336,989	\$ 1,018,806	\$ -	\$ -	\$ 3,355,795	51.27%
Electricity	\$ 100,900	\$ 1,893	\$ 2,480	\$ -	\$ -	\$ 4,373	4.33%
Natural Gas Consultant	\$ -	\$ 48,964	\$ 75,416	\$ -	\$ -	\$ 124,380	n.a.
Natural Gas Transport	\$ 3,287,100	\$ 269,087	\$ 459,057	\$ -	\$ -	\$ 728,144	22.15%
Natural Gas Fuel	\$ -	\$ -	\$ 89,658	\$ -	\$ -	\$ 89,658	n.a.
Propane	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
<b>Subtotal - Metro Costs =</b>	<b>\$ 11,564,200</b>	<b>\$ 3,130,767</b>	<b>\$ 1,968,235</b>	<b>\$ 8,121</b>	<b>\$ -</b>	<b>\$ 5,107,122</b>	<b>44.16%</b>
<b>Subtotal - Operations =</b>	<b>\$ 16,416,800</b>	<b>\$ 4,485,640</b>	<b>\$ 3,248,167</b>	<b>\$ 8,121</b>	<b>\$ -</b>	<b>\$ 7,741,928</b>	<b>47.16%</b>
<b>Debt Service</b>							
2012 Bonds	\$ 3,479,500	\$ 878,313	\$ 870,075	\$ -	\$ -	\$ 1,748,388	50.25%
2005 Bonds -Self Funded	\$ 762,200	\$ -	\$ -	\$ 291,687	\$ -	\$ 291,687	38.27%
2007 Bonds -Self Funded	\$ 204,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
2008 Bonds -Self Funded	\$ 203,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
2010 Bonds -Self Funded	\$ 202,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
MCCC Fund -Self Funded	\$ 714,000	\$ -	\$ 662,100	\$ -	\$ -	\$ 662,100	92.73%
Interest & Misc Revenue	\$ (156,900)	\$ (6,747)	\$ (12,737)	\$ -	\$ -	\$ (19,483)	12.42%
MIP	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
Oper. Reserve Fund	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
<b>Subtotal - Capital =</b>	<b>\$ 5,409,000</b>	<b>\$ 871,566</b>	<b>\$ 1,519,438</b>	<b>\$ 291,687</b>	<b>\$ -</b>	<b>\$ 2,682,691</b>	<b>49.60%</b>
<b>Total =</b>	<b>\$ 21,825,800</b>	<b>\$ 5,357,206</b>	<b>\$ 4,767,606</b>	<b>\$ 299,808</b>	<b>\$ -</b>	<b>\$ 10,424,620</b>	<b>47.76%</b>
<b>Customer Revenues</b>							
Taxes Collected		\$ 113,667	\$ 84,311	\$ -	\$ -	\$ 197,978	n.a.
Taxes Paid		\$ 113,666	\$ 84,312	\$ -	\$ -	\$ 197,978	n.a.
Penalty Revenues/Credits		\$ (38,116)	\$ 7,910	\$ -	\$ -	\$ (30,206)	n.a.
Energy Revenues Collected		\$ 5,444,128	\$ 4,112,868	\$ -	\$ -	\$ 9,556,995	n.a.
<b>Revenues =</b>	<b>\$ 20,031,300</b>	<b>\$ 5,406,013</b>	<b>\$ 4,120,777</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 9,526,789</b>	<b>47.56%</b>
<b>Metro Funding Amount =</b>	<b>\$ 1,794,500</b>	<b>\$ (48,806)</b>	<b>\$ 646,829</b>	<b>\$ 299,808</b>	<b>\$ -</b>	<b>\$ 897,830</b>	<b>50.03%</b>

The DES serves 28 customers and 41 buildings in downtown Nashville. These customers are divided into three categories: 1) Private customers who privately own their buildings, 2) State of TN owned buildings and 3) Metro owned buildings. A summary of the annual costs for each of these three categories is presented in Table 4. These values include late fees and penalties and any unpaid balances.

**Table 4. Customer Revenue Summary to Date**

Building	Chilled Water			Steam		
	Total Cost	Consumption (tonhrs/yr)	Unit Cost (\$/tonhr)	Total Cost	Consumption (Mlb/yr)	Unit Cost (\$/Mlb)
Private Customers	\$ 2,084,500	10,723,065	\$ 0.1944	\$ 690,708	34,585	\$ 19.9710
State Government	\$ 1,844,126	8,099,259	\$ 0.2277	\$ 812,406	33,168	\$ 24.4938
Metro Government	\$ 3,114,043	15,919,031	\$ 0.1956	\$ 1,011,212	53,561	\$ 18.8797
New Customers	\$ 1,901,926	9,676,387	\$ 0.1966	\$ 533,972	35,969	\$ 14.8454
<b>Total</b>	<b>\$ 7,042,669</b>	<b>34,741,355</b>	<b>\$ 0.2027</b>	<b>\$ 2,514,327</b>	<b>121,314</b>	<b>\$ 20.7258</b>

Total Revenue	\$	9,556,995
True-up and Adjustments (Net)	\$	(30,206)
Net Revenue	\$	9,526,789

### III. EGF Operations

Items relating to the facility operations presented herein are derived from the monthly reports issued by CNE for FY16. Communication between TEG and CNE continues to be excellent, and CNE has reported and managed all EGF operations satisfactorily and according to the ARMA with no contract violations.

#### A. Reliability

The principle issues surrounding the reliable operation of the EGF relates to the ability to operate without significant interruption, exclusive of planned outages, and disruption of service to the customers. The following disruptions in service occurred during the quarter.

- Switchgear 3A was tripped accidentally while performing electrical maintenance causing an excursion in the chilled water supply temperature on a day in November for approximately forty-two minutes.
- Excursions and disruptions in operations that have occurred throughout the year are included in the individual Monthly Operational Reports from CNE.

#### B. Efficiency

The operation of the EGF satisfied the guaranteed levels for all commodity usage during the quarter. There were no significant excursions above the guaranteed levels for the current quarter. A more detailed discussion of the contract guarantee performance was presented previously in this report.

#### C. Environment, Health and Safety

No environmental violations were reported during the quarter.



Monthly safety meetings were held on Storm Water Pollution Prevention and Spill Prevention, Controls and Countermeasures, Blood-borne Pathogens, Heat and Cold Stress and Steam and Refrigerant Safety.

CNE continues cross-training its maintenance employees to fill in as relief operators.

#### D. Personnel

The EGF currently has twenty-five full time employees. Of the current number of employees, seventeen were previously employed by Nashville Thermal Transfer Corporation.

#### E. Training

Staff training for this quarter consisted of the Health and Safety training discussed previously. CNE continues cross training maintenance personnel to perform the tasks of the operators at the EGF in case of emergency or need.

#### F. Water Treatment

The water treatment program consists of regular testing and monitoring of the water chemistry in the steam, chilled water and condensing water systems. Chemicals are added to control the water hardness, chlorine levels and biologicals. Remote testing of the condensate at the AA Birch, Tennessee Tower and the Andrew Jackson also occurs regularly to monitor the concentration and distribution of the steam system chemicals.

- Steam System
  - The condensate return averaged approximately 80.0% of the steam sendout during the quarter which represents a 5.6% increase over the previous Second Quarter.
- Condensing Water System
  - The conductivity of the condensing water continues normal with only a few excursions resulting in high cycles of concentration and low blowdown rates.
- Chilled Water System
  - CNE continues to monitor and test for the presence of bacteria in the system and has installed the continuous biocide feed equipment. It is also believed that the presence of the bacteria is reducing the heat transfer abilities of several of the customer heat exchangers. As a result of this ongoing issue, DES119 was created as an attempt at reducing the impact the presence the bacteria may have on the heat transfer of customer heat exchangers.

#### G. Maintenance and EGF Repairs

CNE continues to report on the numerous routine maintenance and preventive maintenance activities performed on the EGF primary and ancillary equipment. The principle items are discussed herein as they relate to the repair, maintenance or replacement of equipment or devices at the facility and are not considered extraordinary. The cost for these items is included as part of the FOCs.

- The new equipment for the continuous feed for the chilled water biocide feed was installed during the quarter.
- The flame scanner on boiler #1 was replaced.
- The belts on cooling towers 3, 11 and 12 were replaced. Belts on cooling towers 3, 10, 14 and 15 were adjusted.
- The oil heater on chiller 7B was replaced.
- The leak in the propane system was found to be in a portion of the buried piping. This portion of the piping was excavated, replaced and backfilled in October. The propane system has not experienced any additional leaks since the repair.
- Hand rails were installed around a portion of the cooling tower deck.
- Other minor repairs and maintenance were made during the quarter and are listed in the monthly reports issued by CNE.

#### H. EGF Walk-through

A quarterly Walk-through of the EGF was performed on January 5, 2016, by Kevin Jacobs, P.E. with TEG. This review involved a tour of the facility with the primary points of interest and concern noted herein.

- Many of the housekeeping items noted in the previous walk-through have been repaired or resolved.
- Some of the riser pipes in the cooling towers have been painted, but some repairs remain. CNE has dedicated itself to repaint these riser pipes as the tower basins are repaired and the fill is replaced. They estimate a complete restoration of these components over the next couple of winters.
- Bricks supporting the water meter lids along KVB are missing. Since this area is prone to unauthorized pedestrian traffic now due to the new Ascend Amphitheater, CNE was instructed to make repairs to the meter box lids and prevent people from being in this area until repairs could be made in the previous quarter. The repairs have not been made, but the area was barricaded by CNE to prevent people from accessing the area.
- Cobwebs have reformed in various places throughout the plant and on motor control center #4 located near the boilers; these should be removed. However, progress has been made in removing some of these cobwebs.
- CNE previously installed “No Trespassing” signs at an area on the western wall of the EGF at the instruction of Metro Police so that they could assist in removing

unauthorized people from camping in the area under the trees. The unauthorized people have been removed, but this issue has been a recurring problem in warmer months.

#### **IV. Capital Projects**

The Capital Projects discussed in this section are those projects funded through the issuance of bonds by Metro. Costs for these projects will be paid from funds already appropriated. The statuses of the projects are discussed, and the project cost-to-date and bond balances are also presented.

##### **A. Second Quarter FY16 Open Projects**

The following projects remained open at the end of the Second Quarter FY16.

##### **1. DES033 – Manhole Lid and Ring Replacement/Restoration**

This project relates to the repair and replacement of manhole lids and rings whenever Metro Public Works performs Street re-paving. This project will remain open and on-going.

##### **2. DES090 – Manhole & Tunnel Insulation Repair (Revised from DES060)**

Work associated with this project will be on-going as required.

##### **3. DES104 –NES Time of Use Rates**

CNE is progressing in the development of the programming and procedural changes in order to implement the TOU charges. CNE anticipates the final implementation of the programming changes during the Fourth Quarter FY16 and in time for the customer invoices beginning in FY17.

##### **4. DES110 – EGF Alternative Fuel**

The preliminary design for the second propane storage tank was issued in December by IC Thomasson and Associates (CNE's engineer). The final design is anticipated during the Third Quarter FY16 along with the pre-bid meeting.

CNE has furnished Metro with their revised propane purchasing plan and have pre-purchased propane for the FY16 heating season.

5. DES111 – DES Combined Heat and Power

TEG developed a preliminary design, operating cost estimate and a capital cost estimate in FY15 in order to determine the feasibility of a combined heat and power (CHP) system at the EGF. Initially, this project was associated with providing stand-by and emergency electricity to the flood prevention system proposed to be located along the Cumberland River on 1<sup>st</sup> Avenue South near the EGF. When the capital funding for the flood prevention system was not approved, DES modified the CHP project to solely provide electricity and waste heat to serve its own needs.

A combined heat and power project entails the installation of a new combustion turbine generator that produces electricity. The high temperature turbine exhaust gases are ducted into a heat recovery boiler to produce steam. Since the turbine exhaust contains a relatively high concentration of oxygen, additional fuel can be burned in the heat recovery boiler to produce additional steam. In the case of the DES, the total steam production will offset the current production of steam sent to the DES customers and the electricity produced by the combustion turbine will offset electricity purchased from the local utility. At this point in the evaluation, the project may save the DES approximately \$3,000,000 in energy costs annually, have a simple return less than ten years and increase the capacity of the DES.

A Request for Qualifications was issued by the DES through the Metro Procurement Department to solicit proposals from qualified engineering firms. Based on the responses, the DES selected I.C. Thomasson and Associates (ICT) to continue with the design development. The funding for the CHP project was approved by Metro through the issuance of a bond for \$26,000,000 (fund 49116).

The DES is currently in negotiations with ICT to finalize their contract to perform the necessary engineering for this project. The completion of the design is anticipated in early FY17 and the construction of the new equipment and modifications to the EGF are anticipated to be completed in late FY18 or early FY19.

6. DES112 – Condensate Return Piping Replacement  
at the Cordell Hull Building

Construction was completed on this project during the First Quarter FY16. Once questions related to redline drawing dimensions are answered, this project will be closed.

7. DES117 - Manhole S5 Rebuild

Construction was completed during the Second Quarter FY16. It is anticipated that this project will be closed out during the Third Quarter FY16.

8. DES119 - Chilled Water System Delta T Issue

The Hydroflow device for addressing the potential fouling of a heat exchanger has been purchased by CNE. The installation of this device is anticipated during the Third Quarter FY16 at the Metro Courthouse. A base line test of the heat exchanger performance will be performed in the Third or Fourth Quarter and the device will be left to operate for approximately six months at which time a second test will be performed to determine the impact the device has had on the heat exchanger approach temperature. An improvement in the approach temperature under similar loads and flows will be the metric that demonstrates the products effectiveness. If the product is effective, the DES may install the device at other customer buildings. If it is not effective, the product will be returned to Hydroflow for a refund.

B. Second Quarter FY16 Closed Projects

DES107 was closed during the First Quarter FY16.

C. Capital Projects Budget

The following table summarizes the costs and remaining balance of the DES capital projects based on reported expenditures to date. Open projects or completed projects that require some additional management are shown. Total costs for projects that are closed are shown with a gray highlight. Only the funds currently available are shown.

For FY16, a new bond fund, 49116, was established for the DES to fund DES111 and other future projects. Previous payments from the fund 49109 were transferred to this bond in the Second Quarter.

**Table 5. Capital Projects Expense Summary**

DES Project #	Description	Total Budget	FY16 Spending to Date	Total Spent to Date	Remaining Balance
<b>2010 Bond Projects-49109</b>					
DES070	MH 6 to 23 Cond Line	\$ 20,000	\$ -	\$ 527	\$ 19,473
DES071	Hermitage Hotel Ser Modifications	\$ 20,000	\$ -	\$ 1,119	\$ 18,881
DES072	Sheraton Stm & Cond Line	\$ 11,000	\$ -	\$ 10,462	\$ 538
DES091	NES Time of Use Electric Rate	\$ 65,000	\$ -	\$ 64,616	\$ 384
DES089	AA Birch Tunnel Repairs	\$ 175,000	\$ 117	\$ 172,849	\$ 2,151
DES105	Suntrust Shaft Repairs	\$ 160,000	\$ 117	\$ 159,010	\$ 990
DES111	DES CHP	\$ 78,000	\$ (69,898)	\$ (0)	\$ 78,000
DES119	DES Delta T Issue	\$ 100,000	\$ 2,569	\$ 2,569	\$ 97,431
DES117	Manhole S5 Modifications	\$ 160,000	\$ 157,575	\$ 157,575	\$ 2,425
<b>Total Closed Projects</b>		<b>\$ 1,834,533</b>	<b>\$ -</b>	<b>\$ 1,834,533</b>	<b>\$ -</b>
	Metro Project Admin	\$ -	\$ -	\$ -	\$ -
	Project Man, Development, etc	\$ 22,383	\$ -	\$ -	\$ 22,383
<b>Total 2010 Bond</b>		<b>\$ 2,645,916</b>	<b>\$ 90,480</b>	<b>\$ 2,403,259</b>	<b>\$ 242,656</b>
<b>Customer Connection Fund-49107</b>					
DES104	Time of Use/ Customer Billing	\$ 30,000	\$ 1,659	\$ 8,012	\$ 21,988
DES106	Courthouse CHW Heat Exchanger	\$ 72,000	\$ 1,697	\$ 71,276	\$ 724
DES110	Alternative Fuel Source for EGF	\$ 50,000	\$ -	\$ 19,242	\$ 30,758
<b>Sub-Total Closed Projects</b>		<b>\$ 7,161,827</b>	<b>\$ -</b>	<b>\$ 6,559,502</b>	<b>\$ 602,325</b>
	Metro Project Admin	\$ 80,000	\$ 14,389	\$ 71,334	\$ 8,666
	Project Man, Development, etc	\$ 1,115,173	\$ -	\$ -	\$ 1,115,173
<b>Customer Connection Fund</b>		<b>\$ 8,509,000</b>	<b>\$ 17,745</b>	<b>\$ 6,729,366</b>	<b>\$ 1,779,634</b>
<b>CHP and EDS Repairs-49116</b>					
DES111	DES CHP	\$ 30,000,000	\$ 81,802	\$ 81,802	\$ 29,918,198
<b>Sub-Total Closed Projects</b>		<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
	Metro Project Admin	\$ 305,000	\$ -	\$ -	\$ 305,000
	Project Man, Development, etc	\$ 470,000	\$ -	\$ -	\$ 470,000
<b>CHP and EDS Repairs</b>		<b>\$ 30,775,000</b>	<b>\$ 81,802</b>	<b>\$ 81,802</b>	<b>\$ 30,693,198</b>

## V. Energy Distribution System Repairs, Improvements, PM and Emergencies

Several EDS repairs and improvements were made during the Second Quarter. The principle items for discussion are presented in the following sections.

### A. Repairs and Improvements

Several repairs were made to the EDS and at customer buildings during the quarter. The remaining value of the R&I budget at the end of the current quarter is \$31,161. Table 6 provides a summary of the FY16 expenditures and revenues to date associated with the R&I budget.

**Table 6. Repair and Improvement Expenditure and Revenue Summary**

Description	Date	Tracking #	Vendor	Expenditure	Transfers	Net Market Adjustment	Market Value	Balance	paid from Trustee Date
Value at end of FY15						\$ -	\$ 46,884.53	\$ 46,884.53	
Reimbursement for Symphony Line Damage	7/29/2015	N/A	N/A	\$ (23,197.62)					7/29/2015
Reimbursement for MCC Line Damage	7/29/2015	N/A	N/A	\$ (31,628.93)					7/29/2015
Reimbursement for MCC Line Damage	7/29/2015	N/A	N/A	\$ (22,294.00)					7/29/2015
CNE June R&I	8/13/2015	DES-1938	CNE	\$ 1,820.59					8/17/2015
DES-107 MH A&B Mech	8/6/2015	DES-2038	TEG	\$ 1,366.75					8/6/2015
DES-112 Cordell Hall	8/6/2015	DES-2038	TEG	\$ 1,565.60					8/6/2015
DES-113 Malley Bridge	8/6/2015	DES-2038	TEG	\$ 85.50					8/6/2015
DES-117 M/H S5 Modification	8/6/2015	DES-2038	TEG	\$ 4,607.90					8/6/2015
DES-118 2015 Steam Outage	8/6/2015	DES-2038	TEG	\$ 1,039.45					8/6/2015
DES-107 MH A&B Mech Rebuild	9/17/2015	DES-2050	TEG	\$ 3,229.50					9/23/2015
DES-112 Cordell Hall Condens	9/17/2015	DES-2050	TEG	\$ 3,214.40					9/23/2015
DES-113 Malloy Bridgestone C	9/17/2015	DES-2050	TEG	\$ 213.75					9/23/2015
DES-117 M/H S5 Modification	9/17/2015	DES-2050	TEG	\$ 2,561.15					9/23/2015
DES-118 2015 Steam Outage	9/17/2015	DES-2050	TEG	\$ 156.20					9/23/2015
DES 106.2 Metro Courthouse CHW	6/30/2015	N/A	CNE	\$ (2,164.16)					N/A
DES 106.2 Metro Courthouse CHW	6/30/2015	N/A	CNE	\$ (55,340.67)					N/A
DES 106.2 Metro Courthouse CHW	6/30/2015	N/A	CNE	\$ 2,164.16					N/A
DES 106.2 Metro Courthouse CHW	6/30/2015	N/A	CNE	\$ 55,340.67					N/A
DES-107 MH M, B & 2	9/30/2015	DES-2060	CNE	\$ 12,766.11					9/30/2015
CNE July R&I	9/30/2015	DES-2061	CNE	\$ 3,027.55					9/30/2015
DES-118 2015 Steam Outage	9/30/2015	DES-2062	CNE	\$ 7,643.86					9/30/2015
DES-118 2015 Steam Outage	9/30/2015	DES-2063	CNE	\$ 105,923.70					9/30/2015
DES-107 MH M, B & 2	9/30/2015	DES-2064	CNE	\$ 28,360.11					9/30/2015
<b>Sub-Total First Quarter</b>				<b>\$ 100,461.57</b>	<b>\$ 70,524.99</b>	<b>\$ -</b>	<b>\$ (29,936.58)</b>	<b>\$ (29,936.58)</b>	
DES-107 MH M, B & 2	10/2/2015	DES-2068	TEG	\$ 1,063.40					10/8/2015
DES-109 Indigo Hotel	10/2/2015	DES-2068	TEG	\$ 117.15					10/8/2015
DES-112 Cordell Hull Condensate	10/2/2015	DES-2068	TEG	\$ 2,152.65					10/8/2015
DES-117 M/H S5 Modificaton	10/2/2015	DES-2068	TEG	\$ 7,910.65					10/8/2015
DES-118 2015 Steam Outage	10/2/2015	DES-2068	TEG	\$ 334.60					10/8/2015
DES-107 MH M, B & 2	10/13/2015	DES-2072	TEG	\$ 546.70					10/14/2015
DES-109 Indigo Hotel	10/13/2015	DES-2072	TEG	\$ 312.40					10/14/2015
DES-112 Cordell Hull Condensate	10/13/2015	DES-2072	TEG	\$ 2,310.47					10/14/2015
DES-117 M/H S5 Modificaton	10/13/2015	DES-2072	TEG	\$ 8,610.40					10/14/2015
CNE Aug R&I	10/23/2015	DES-2083	CNE	\$ 5,393.98					11/4/2015
DES-107 MH M, B & 2	11/10/2015	DES-2089	TEG	\$ 195.25					11/25/2015
DES-109 Indigo Hotel	11/10/2015	DES-2089	TEG	\$ 117.15					11/25/2015
DES-112 Cordell Hull Condensate	11/10/2015	DES-2089	TEG	\$ 1,169.45					11/25/2015
DES-117 M/H S5 Modificaton	11/10/2015	DES-2089	TEG	\$ 7,071.35					11/25/2015
DES-112 Cordell Hull Condensate	11/30/2015	DES-2097	CNE	\$ 36,064.80					12/8/2015
CNE Sept R&I	11/30/2015	DES-2094	CNE	\$ 3,720.98					12/8/2015
CNE Oct R&I	12/18/2015	DES-2109	CNE	\$ 481.25					12/22/2015
DES-112 Cordell Hull Condensate	12/18/2015	DES-2110	TEG	\$ 771.55					12/22/2015
DES-117 M/H S5 Modificaton	12/18/2015	DES-2110	TEG	\$ 1,475.95					12/22/2015
<b>Sub-Total Second Quarter</b>				<b>\$ 79,820.13</b>	<b>\$ 70,524.99</b>	<b>\$ -</b>	<b>\$ (9,295.14)</b>	<b>\$ (9,295.14)</b>	
<b>Sub-Total Third Quarter</b>				<b>\$ -</b>	<b>\$ 23,508.33</b>	<b>\$ -</b>	<b>\$ 23,508.33</b>	<b>\$ 23,508.33</b>	
<b>Sub-Total Fourth Quarter</b>				<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	
<b>FY16 Year to Date</b>				<b>\$ 180,281.70</b>	<b>\$ 164,558.31</b>	<b>\$ -</b>	<b>\$ 31,161.14</b>	<b>\$ 31,161.14</b>	

## B. Preventive Maintenance

Preventive maintenance, tunnel and manhole inspections and reviews of customers' mechanical rooms were performed during the quarter. The principle items for discussion are presented.

1. EDS Manhole Inspections
  - a. Some traps were found not to be functioning properly; CNE is continuing to repair or replace traps in the system.
  - b. Structural metal in the vaults and tunnels need to be cleaned and painted.
  - c. Spalled concrete needs to be repaired in some manholes.
  - d. Some minor insulation repairs are needed in some vaults.
  - e. Mud and debris needs to be removed from some manholes.



2. Other EDS Inspections
  - a. Minor items are included in the CNE monthly reports.

C. Emergencies

No emergencies were reported during the quarter.

D. EDS Walk-through

Due to the holidays and schedule conflicts, a Second Quarter FY16 walkthrough was not completed. The manholes scheduled for review during the Second Quarter FY16 will be reviewed during the Third Quarter FY16.

## **VI. Customer Relations**

This section contains descriptions of the marketing efforts made by the DES Team during the quarter. The topics of interactions, meetings and training seminars with the customers are also discussed. There are currently 28 customers, comprised of 41 different buildings, connected to the EDS. Service to each of these buildings continues to prove satisfactory, and the responsiveness to customer issues is handled by CNE in an excellent and professional manner.

A. Marketing

The DES has placed a temporary hold on active marketing at this time due to the uncertainty of the actual steam and chilled water loads on the MCC and due to the higher than normal system temperature differences that may be related to the chilled water chemistry. TEG will continue to monitor this issue and make recommendations to Metro regarding the availability of any additional capacity.

The potential service to the new Lifeway building, intended to be constructed adjacent to the EGF, has been cancelled. Lifeway is not moving forward with the purchase of the property at this time.

TEG met with the engineers and developers of the re-development of the “old” Convention Center during the quarter. TEG discussed with them the potential for continued DES service and alternatives to standard service were also discussed.

B. Customer Interaction

The CNE customer service representative (CSR) continues to respond to customer issues as they arise. Much of the communication involves minor problems with the customers’ heating and cooling systems that are unrelated to DES service. Other more significant issues are summarized herein.



- CNE contacted the building managers at the State Supreme Court, TSU and the Library and Archives buildings to inform them that steam service to their buildings would be restored on October 16 following the completion of the MH-S5 project.
- The steam service to several customers was restored after the buildings' normal steam service isolation during the summer months.
- A few steam leaks were noted by customers occurring at or near metering or PRV devices during the month. CNE responded promptly to each of these issues and made the necessary repairs.
- The State notified CNE of their intentions to demolish the Central Services building in February 2016. The steam and chilled water service to the building will be terminated at that time and the DES metering equipment will be removed.
- Other minor issues and customer interactions are noted in the monthly CNE reports.

## **VII. Recommendations**

Based on the review of the Second Quarter EGF and EDS operations, the following recommendations are made.

- Corroded structural steel within the vaults and tunnels should be cleaned and painted or replaced; TEG will continue to coordinate this effort with CNE.
- Insulation which is absent, or in disrepair, in the vaults should be addressed through either additional capital projects, which include work within these vaults, or through DES090.
- Steam traps which need repair or replacement should be addressed as soon as possible.
- Concrete repairs need to be made in some manholes. TEG will continue to coordinate this effort with CNE.
- Mud and debris needs to be cleaned from some manholes.
- Additional monitoring is required to determine the effectiveness of the biocide agent added to the chilled water system.