Metro Nashville
DISTRICT ENERGY SYSTEM

DES Customer Meeting

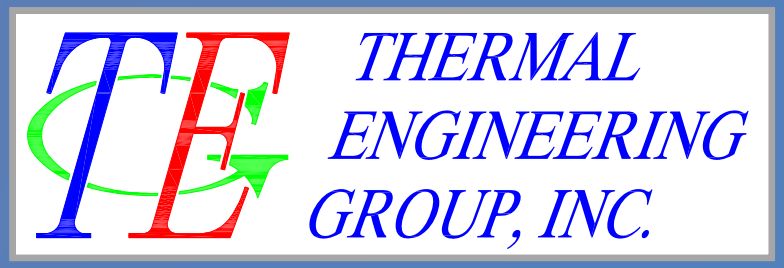
Spring FY15

May 14, 2015

Agenda

1. Welcome!
2. Historic Customer Expenses
3. Historic Customer Consumption
4. Historic System Efficiency
5. Natural Gas Pricing
6. DES FY15 and FY16 Budgets
7. Chilled Water Delta T Review & How It Affects You!
8. Building Side Water Chemistry
9. DES Combined Heat and Power Project
10. Questions and Answers
11. Adjourn

1. Welcome DES Customers!

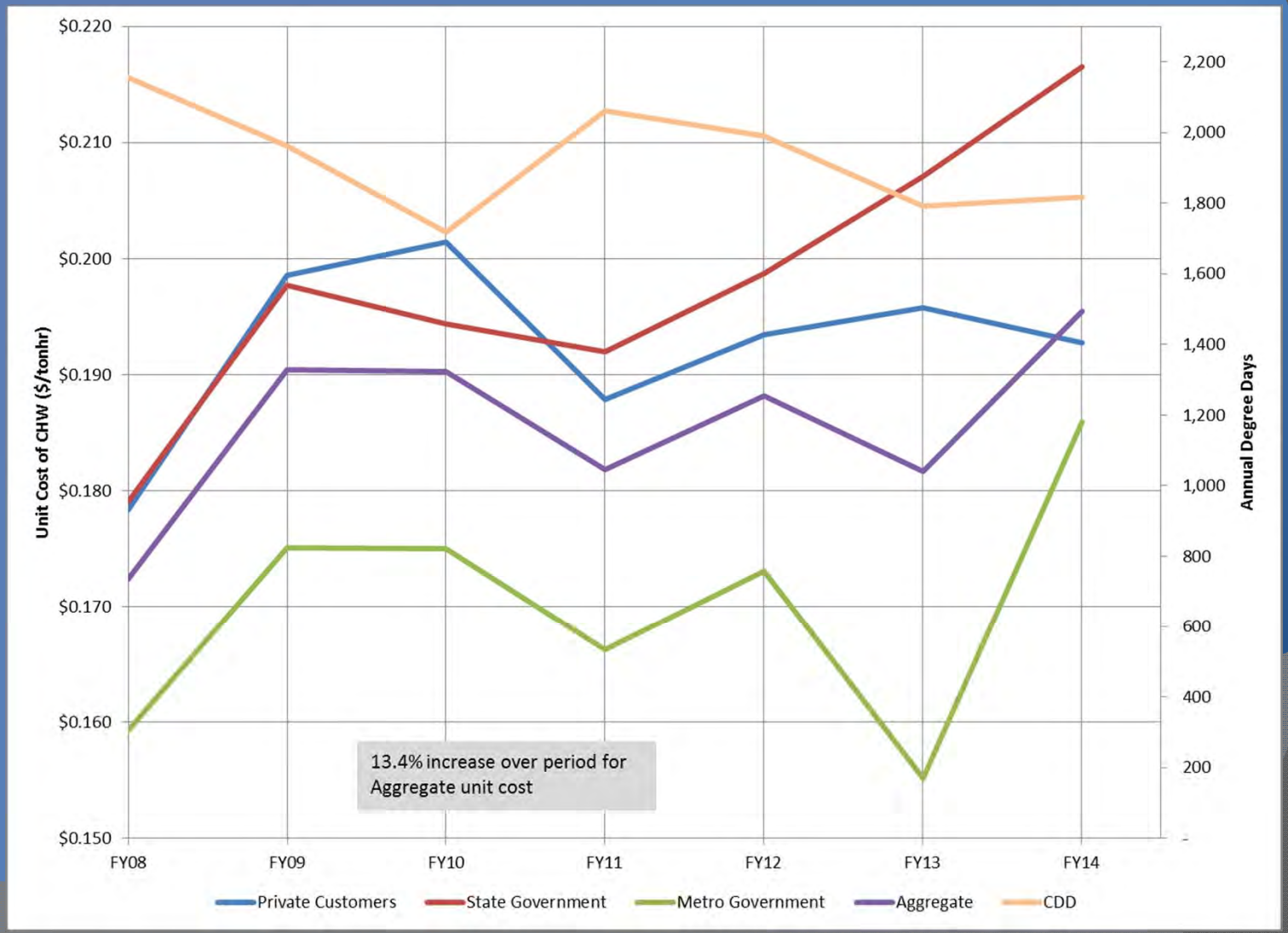


2. Historic Customer Expenses

- Figure 2A. Historic CHW Expenses
- Figure 2B. Historic Steam Expenses
- Table 2. Rolling Twelve Month Expenses

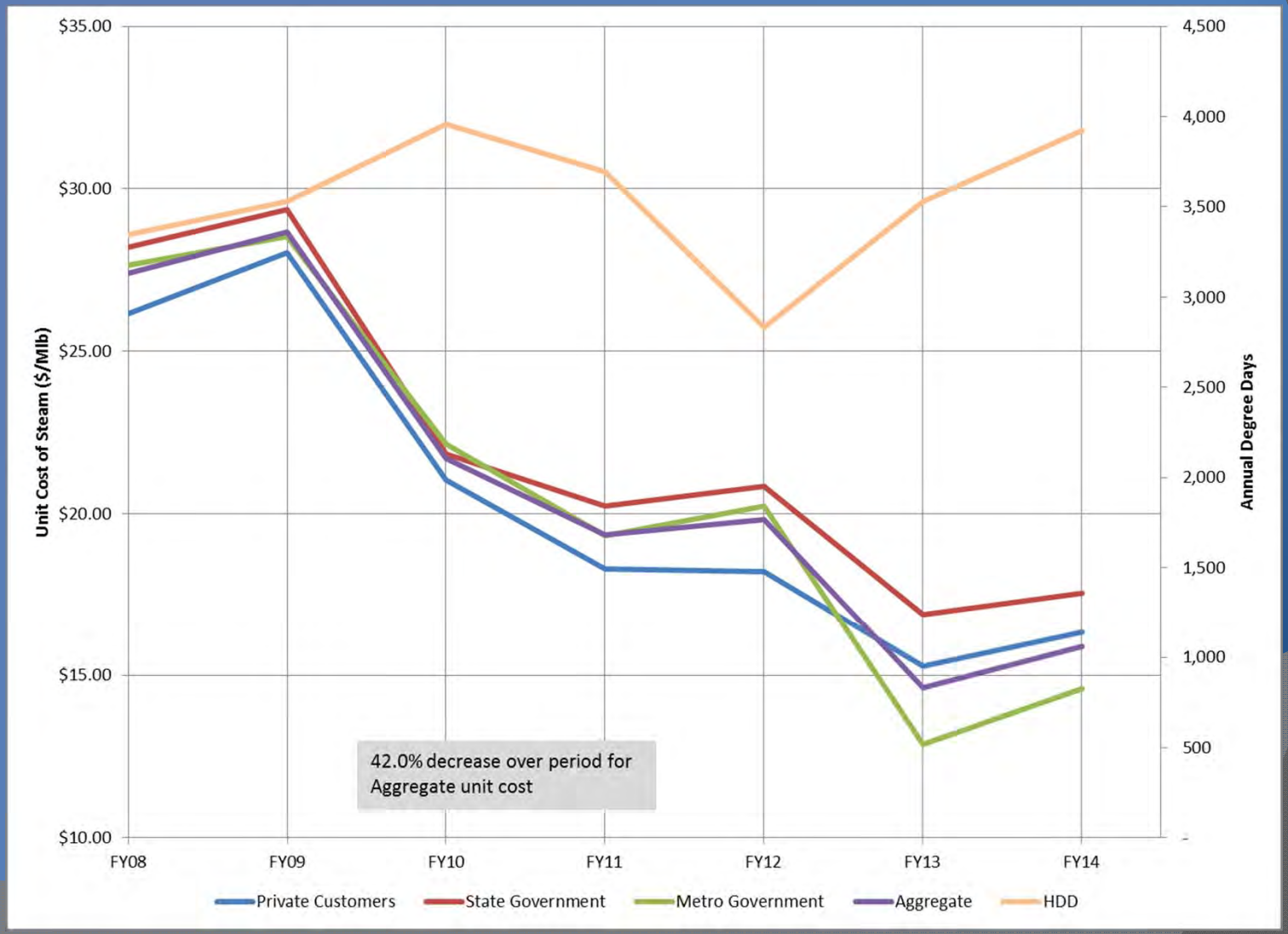
Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 2A. Historic CHW Expenses



Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 2B. Historic Steam Expenses



Metro Nashville
DISTRICT ENERGY SYSTEM

Table 2. Rolling Twelve Month Expenses

		Steam - Rolling 12 Month			Chilled Water - Rolling 12 Month		
		Apr 2013 - Mar 2014	Apr 2014 - Mar 2015	% Diff.	Apr 2013 - Mar 2014	Apr 2014 - Mar 2015	% Diff.
Private	Cost	$ 1,483,949	$ 1,515,809	2.15%	$ 3,280,829	$ 3,455,202	5.31%
	Usage (lbs or tonhrs)	92,899,687	96,247,402	3.60%	17,085,057	16,957,135	-0.75%
	Unit Cost	$ 15.97	$ 15.75	-1.4%	$ 0.192	$ 0.204	6.1%
State	Cost	$ 2,114,416	$ 2,100,201	-0.67%	$ 3,280,775	$ 3,316,303	1.08%
	Usage (lbs or tonhrs)	121,369,414	119,743,240	-1.34%	15,422,519	13,916,501	-9.77%
	Unit Cost	$ 17.42	$ 17.54	0.7%	$ 0.213	$ 0.238	12.0%
Metro	Cost	$ 2,797,364	$ 2,581,398	-7.72%	$ 5,277,441	$ 5,550,143	5.17%
	Usage (lbs or tonhrs)	198,953,156	170,815,595	-14.14%	29,794,610	28,295,720	-5.03%
	Unit Cost	$ 14.06	$ 15.11	7.5%	$ 0.177	$ 0.196	10.7%
Aggregate	Cost	$ 6,469,935	$ 6,326,148	-2.22%	$ 11,839,045	$ 12,431,041	5.00%
	Usage (lbs or tonhrs)	416,787,726	392,641,651	-5.79%	62,302,186	59,743,570	-4.11%
	Unit Cost	$ 15.52	$ 16.11	3.8%	$ 0.190	$ 0.208	9.50%

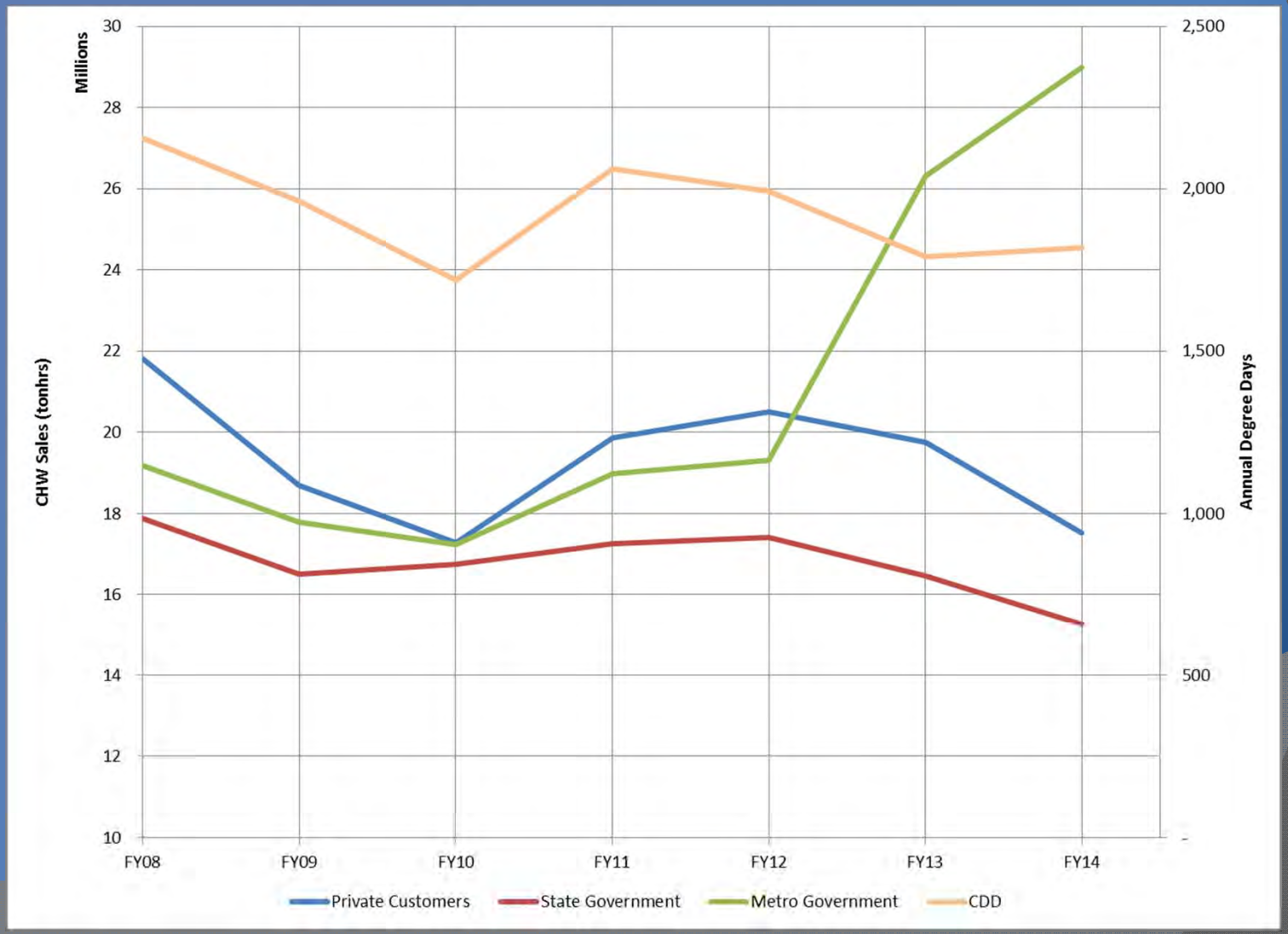
MFA not included in values shown

3. Historic Customer Consumption

- Figure 3A. Historic CHW Consumptions
- Figure 3B. Historic Steam Consumptions

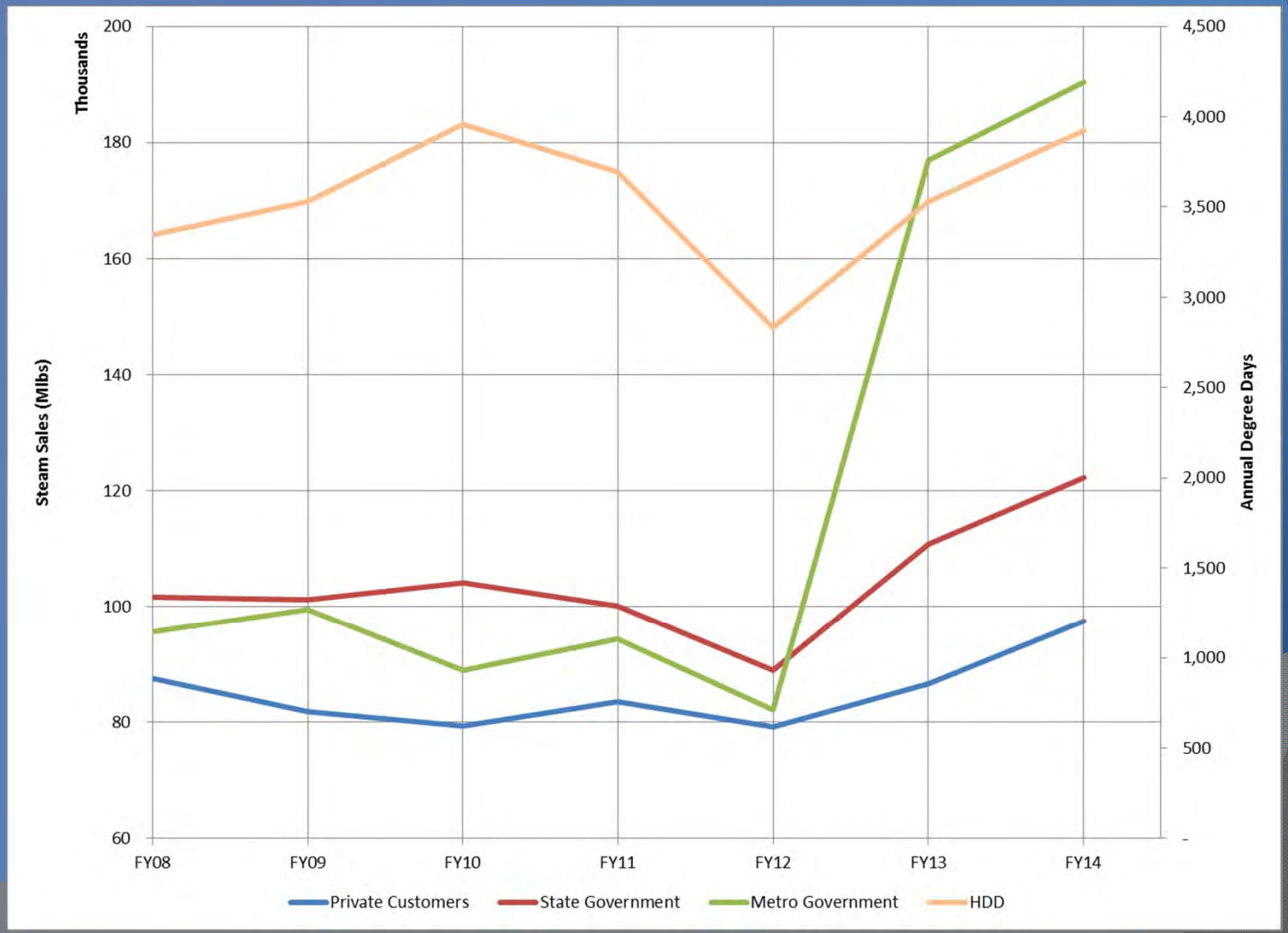
Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 3A. Historic CHW Consumptions



Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 3B. Historic Steam Consumptions

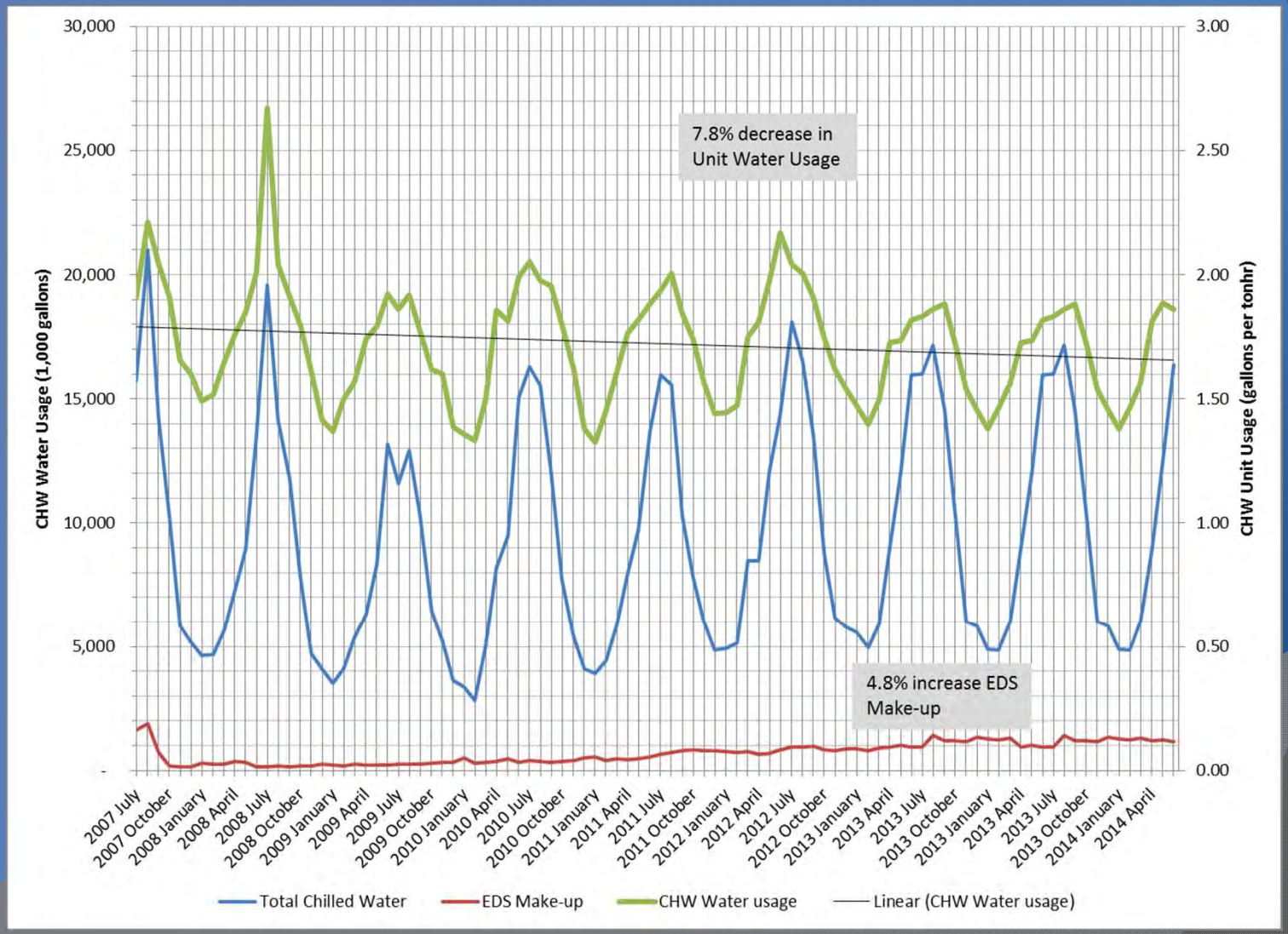


4. Historic System Efficiency

- Figure 4A. Historic CHW Water Usages
- Figure 4B. Historic CHW Electric Efficiency
- Figure 4C. Historic Steam Fuel and Electric Efficiencies
- Figure 4D. Historic Steam Water Usage and Condensate Return

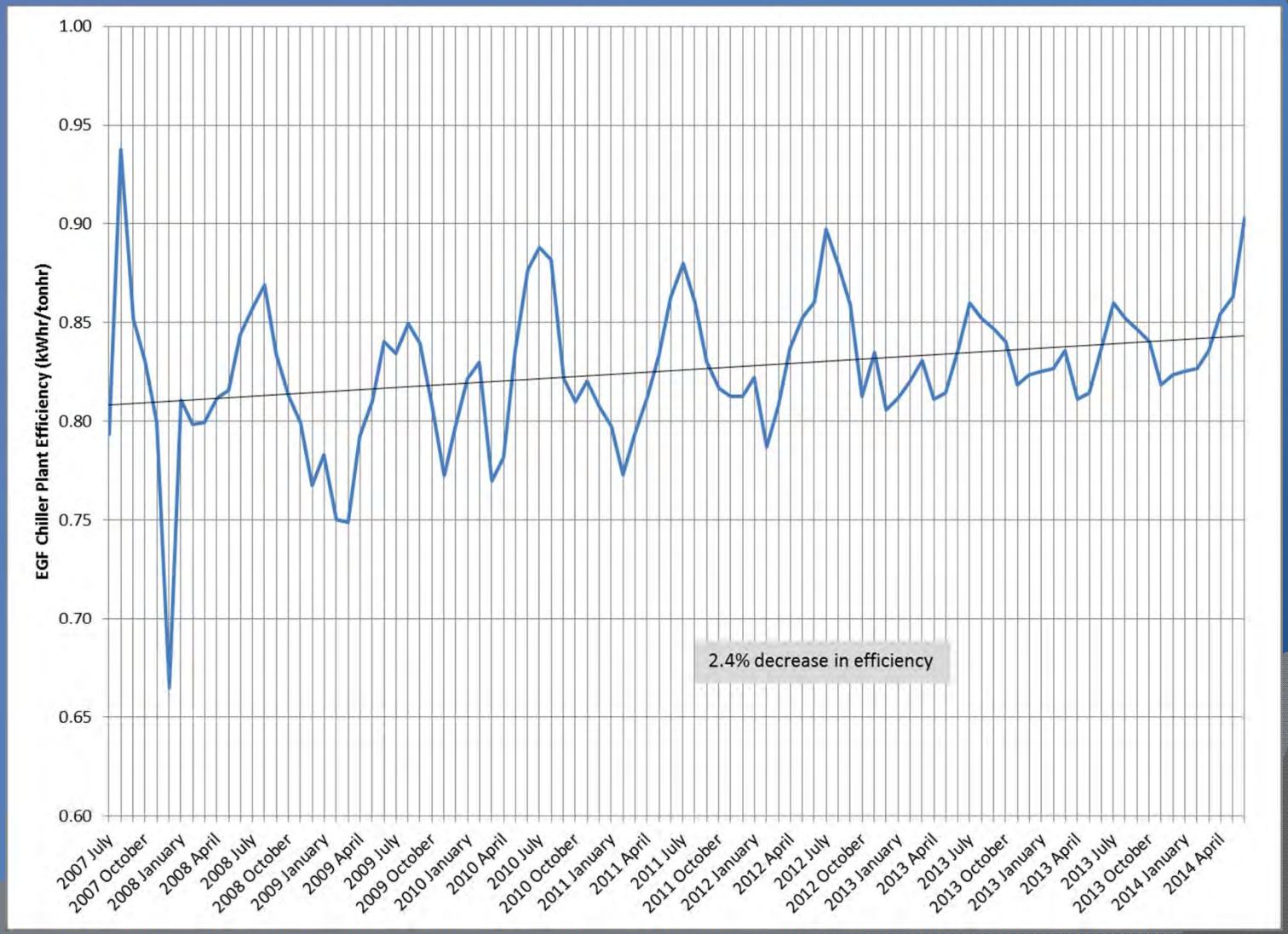
Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 4A. Historic CHW Water Usages



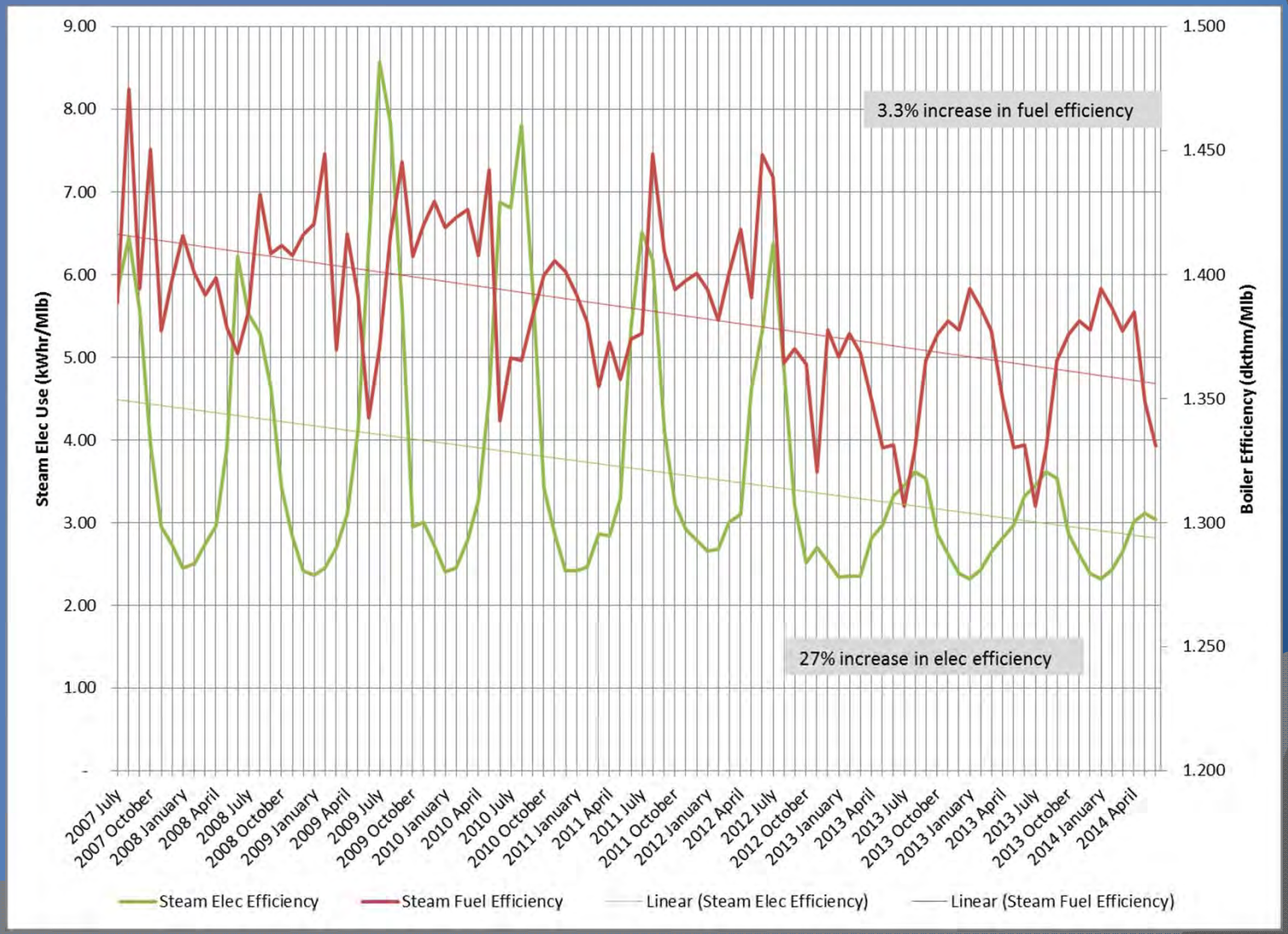
Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 4B. Historic CHW Electric Efficiency



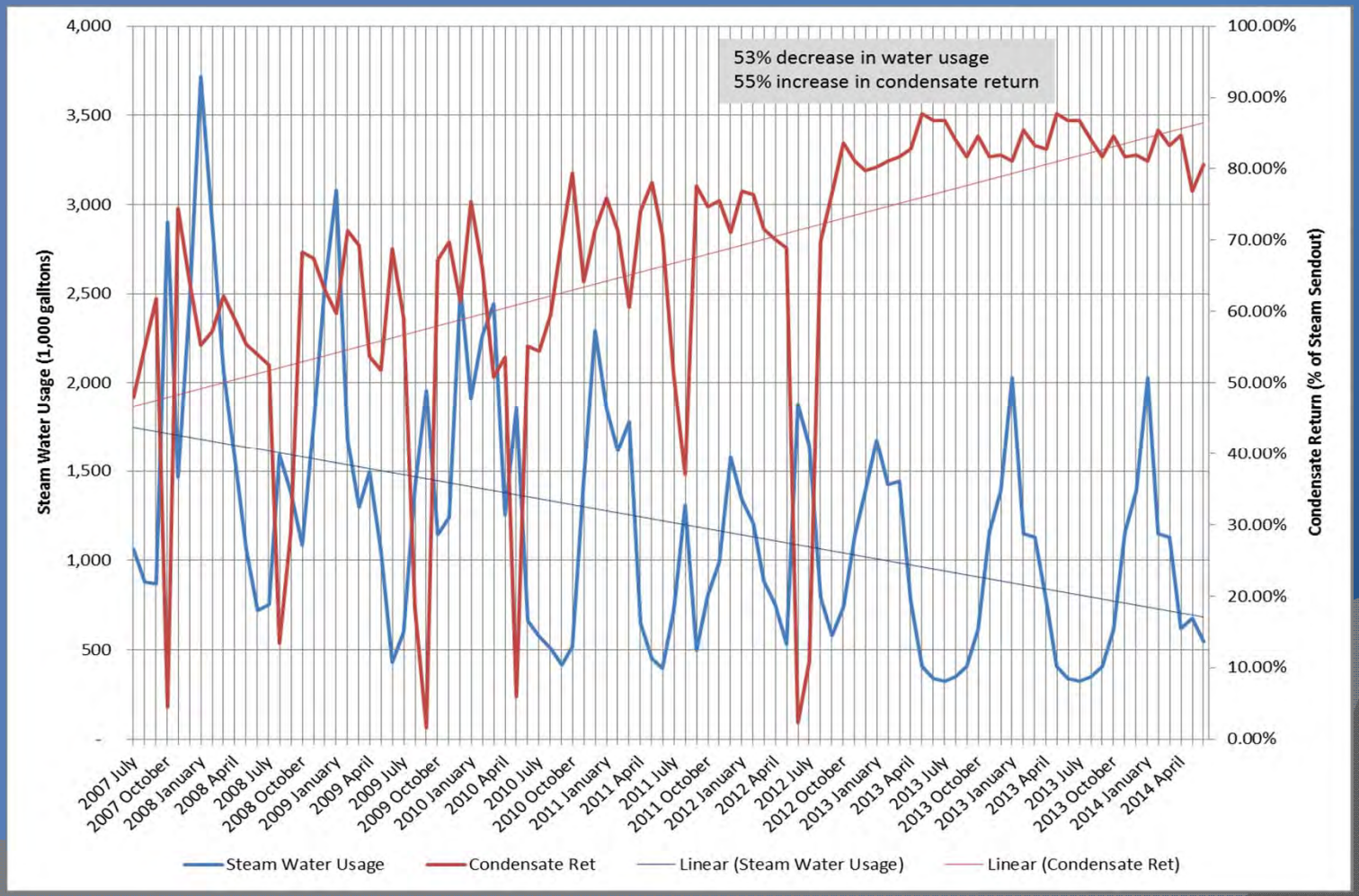
Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 4C. Historic Steam Fuel and Electric



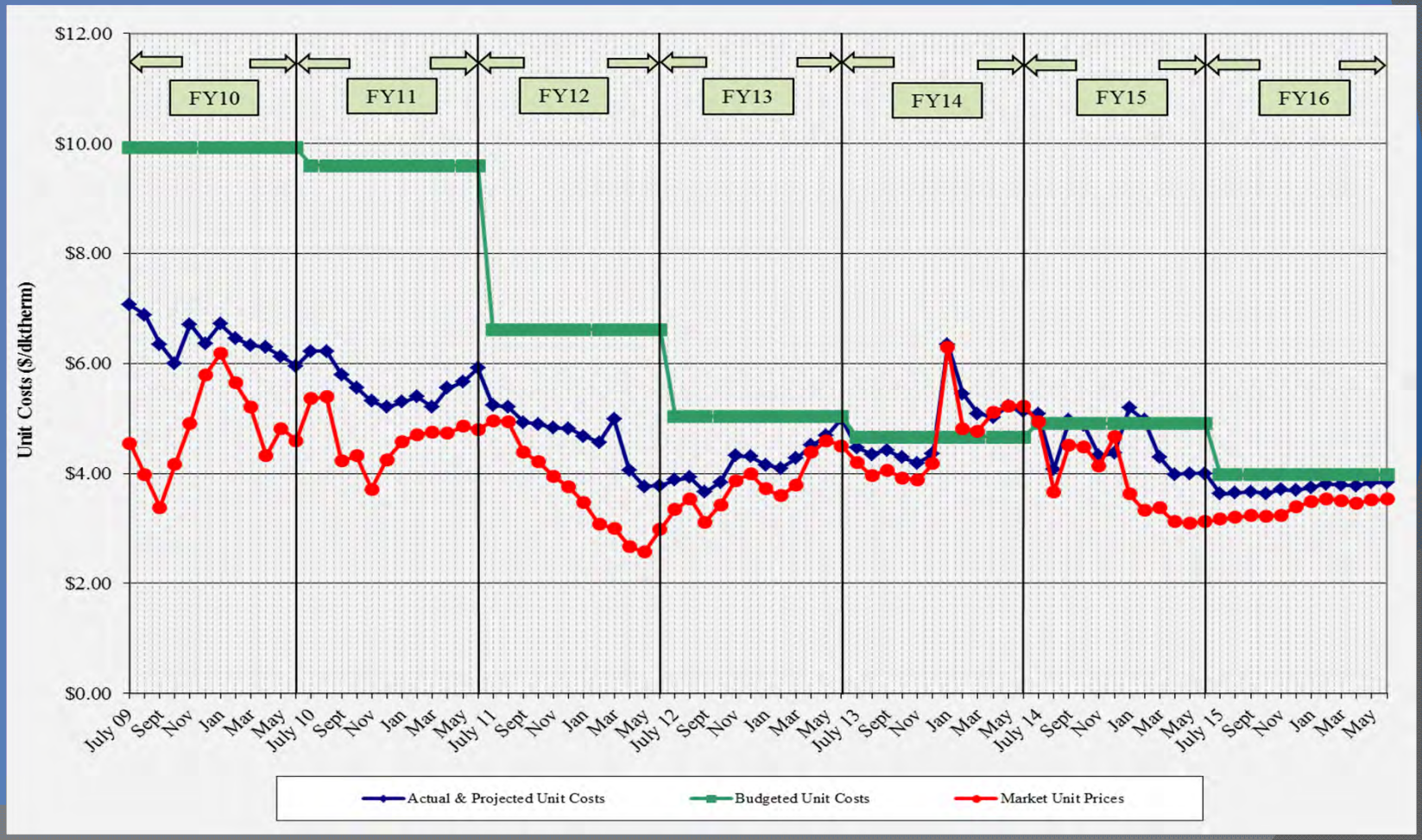
Metro Nashville
DISTRICT ENERGY SYSTEM

Figure 4D. Historic Steam Water Usage and Condensate Return



Metro Nashville
DISTRICT ENERGY SYSTEM

5. Natural Gas Pricing



Natural Gas Curtailments FY15

- Piedmont Natural Gas Co Provides 24 Hour Notice of Curtailments
- Propane Back-up
  - Tank Capacity: 18,000 Gallons
  - Maximum Fill Level: (80%) 14,400 Gallons
  - Burn Rate: 2,000 gallons per hour
  - Propane Heat Value = 91,000 BTU per gallon
  - Full Storage Tank = 6.5 Hours
  - Refill Every 3 to 6 Hours
- Curtailment Periods:
  - 9:00 am Wednesday Jan 7 to 9:00 am Friday Jan 9
    - 93,538 gallons, $103,910 = $12.21/Dth; $7.59/Dth more than natural gas
  - 9:00 am Wednesday Feb 18 to 9:00 am Friday Feb 20
    - 101,003 gallons @ $102,914 = $11.20/Dth; $6.92/Dth more than natural gas
- Interruption in Natural Gas March 5 Due to Piedmont's Regulator

6. DES FY15 and FY16 Budgets

- Table 6A. DES FY15 Costs to Date
- Table 6B. DES FY16 Budget

Metro Nashville
DISTRICT ENERGY SYSTEM

Table 6A. DES FY15 Costs to Date

Item	FY14 Actual	FY15 Budget	FY15 Actual to date	Percent of FY15 Budget
FOC's	$ 4,459,927	$ 4,606,800	$ 3,399,057	73.78%
Pass Throughs				
Non-Energy	$ 1,082,270	$ 1,190,567	$ 971,962	81.64%
Water/Sewer	$ 485,337	$ 724,600	$ 388,972	53.68%
Natural Gas Base	$ 3,354,335	$ 2,972,673	$ 2,488,048	83.70%
Natural Gas Contingency	$ -	$ 635,260	$ -	0.00%
Electricity	$ 5,225,956	$ 6,574,600	$ 3,972,823	60.43%
Debt Service	$ 5,705,732	$ 5,470,700	$ 5,098,838	93.20%
Total Expenses	**$ 20,313,558**	**$ 22,175,200**	**$ 16,319,700**	**73.59%**
Total Revenues	**$ 18,396,977**	**$ 20,325,700**	**$ 14,097,148**	**69.36%**
Metro Funding Amount	**$ 1,916,581**	**$ 1,849,500**	**$ 1,387,125**	**75.00%**

Metro Nashville
DISTRICT ENERGY SYSTEM

Table 6B. DES FY16 Budget

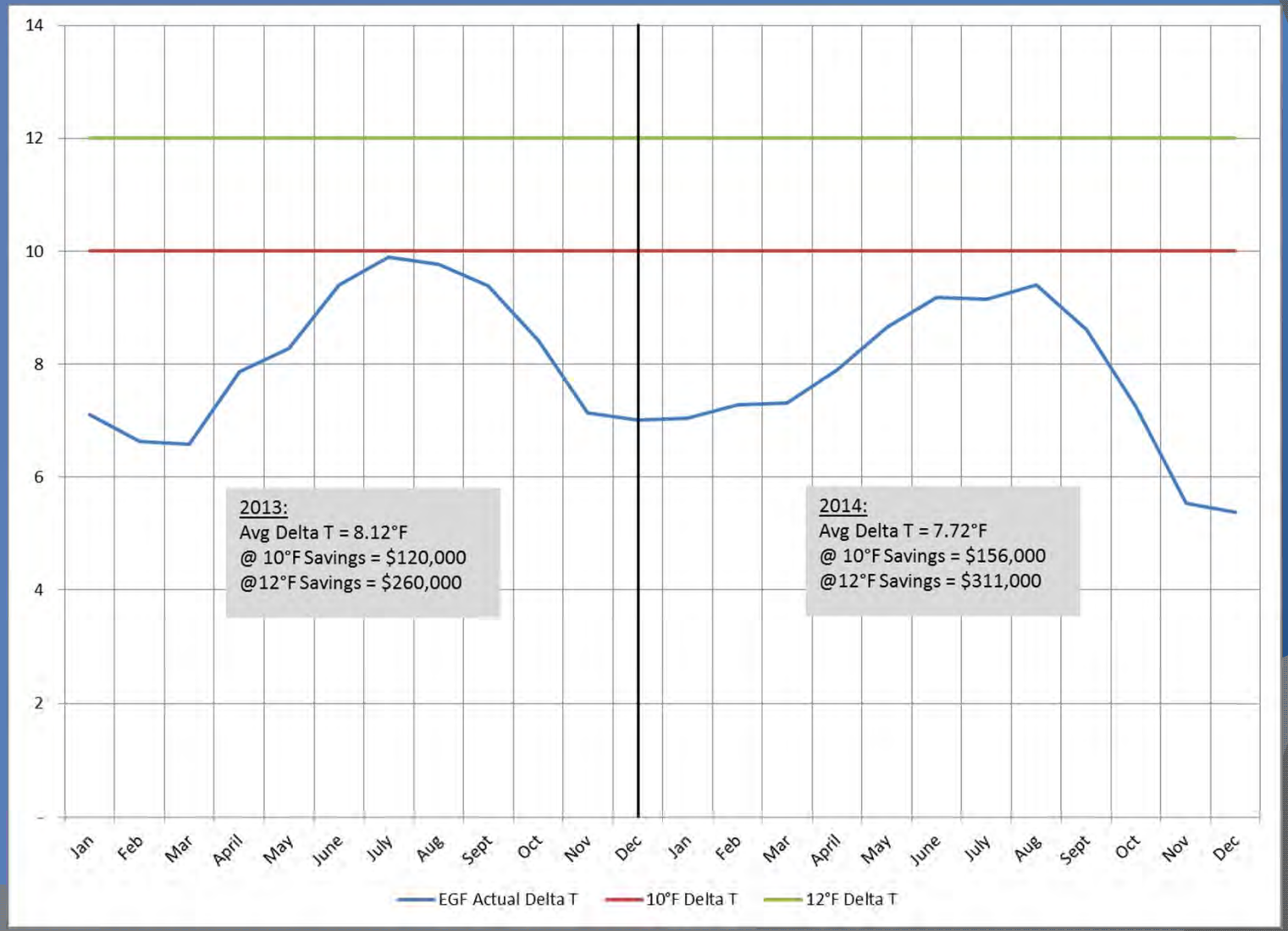
Item	FY15 Budget	FY16 Budget	Percent Change
FOC's	$ 4,606,800	$ 4,668,200	1.33%
Pass Throughs			
Non-Energy	$ 1,190,567	$ 1,358,037	14.07%
Water/Sewer	$ 724,600	$ 745,400	2.87%
Natural Gas Base	$ 2,972,673	$ 2,463,878	-17.12%
Natural Gas Contingency	$ 635,260	$ 878,717	38.32%
Electricity	$ 6,574,600	$ 6,545,700	-0.44%
Debt Service	$ 5,470,700	$ 5,409,000	-1.13%
Total Expenses	**$ 22,175,200**	**$ 22,068,932**	**-0.48%**
Total Revenues	**$ 20,325,700**	**$ 20,274,932**	**-0.25%**
Metro Funding Amount	**$ 1,849,500**	**$ 1,794,000**	**-3.00%**

7. Chilled Water Delta T Review and How It Affects You!

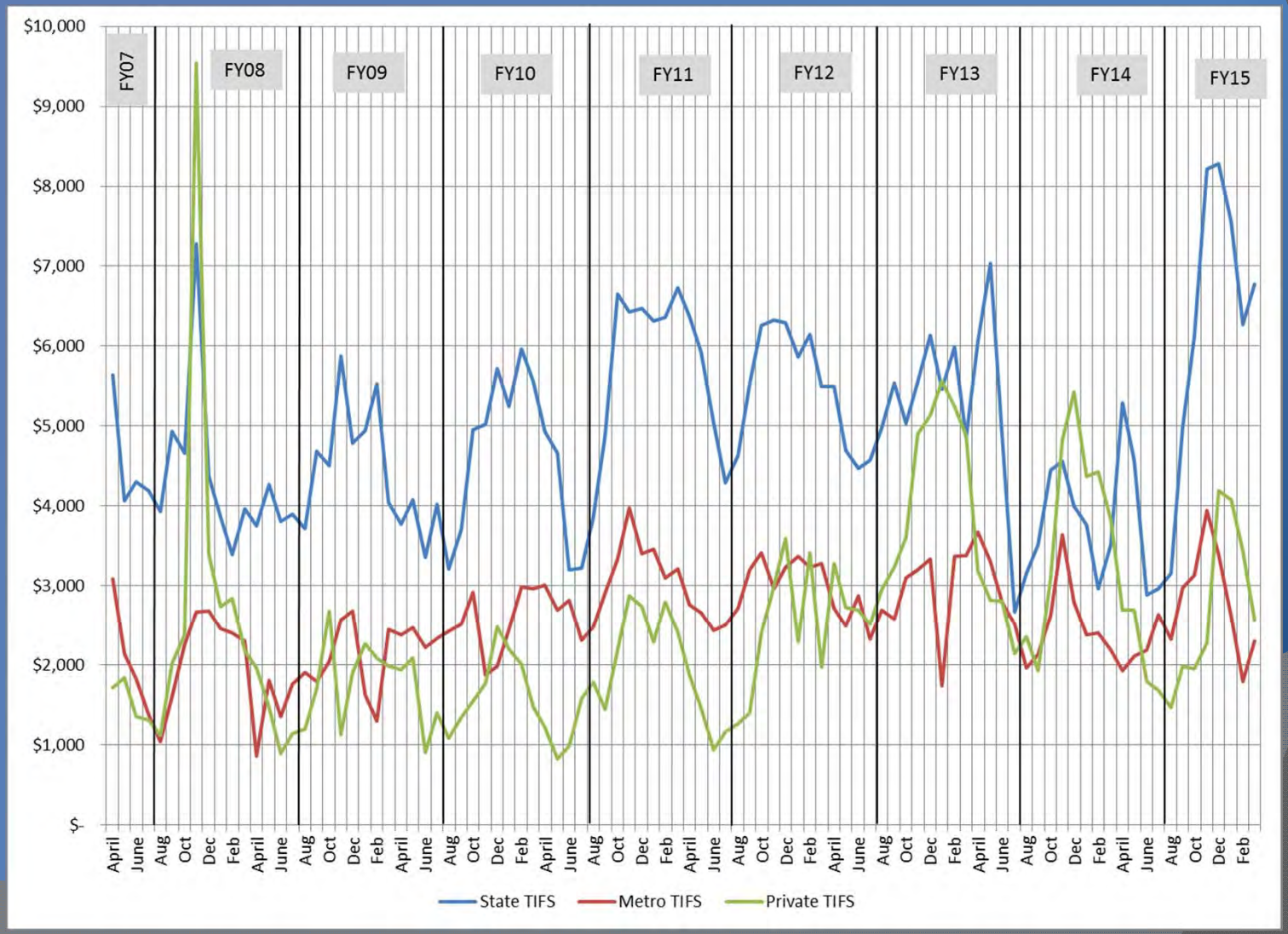
- Historic Decline in Customer Delta T's
- Low Delta T's:
  - Increase Customer In-building Pumping Costs
  - Increase DES Pumping Costs
  - Decreases Chiller Performance
  - Increase DES Chiller Electric Costs
- Customer TIFS
- Building Side Water Chemistry

Metro Nashville
DISTRICT ENERGY SYSTEM

Historic CHW System Delta T



Customer TIFS



Customer TIFS

	State TIFS	Metro TIFS	Private TIFS	Totals
FY07	$ 13,997	$ 7,061	$ 4,912	$ 25,970
FY08	$ 52,421	$ 22,810	$ 31,830	$ 107,061
FY09	$ 53,165	$ 25,188	$ 21,022	$ 99,374
FY10	$ 56,182	$ 30,929	$ 18,318	$ 105,429
FY11	$ 68,228	$ 36,007	$ 24,372	$ 128,607
FY12	$ 65,471	$ 35,969	$ 29,201	$ 130,641
FY13	$ 66,074	$ 35,496	$ 46,829	$ 148,399
FY14	$ 45,327	$ 28,873	$ 39,558	$ 113,757
FY15	$ 54,318	$ 25,086	$ 23,623	$ 103,027
Cumulative	**$ 475,182**	**$ 247,419**	**$ 239,665**	**$ 962,266**
Percent of Total	49.38%	25.71%	24.91%	

Costs shown from April 2007 through March 2015

8. Building Side Water Chemistry

- For HW Loops and decoupled CHW Loops Scale and Deposits in Piping and Coils
  - Increases Pumping Costs – Decrease Water Flow Rates
  - Increases Approach Temperatures – Decreases Delta T
  - Hot Condensate
  - Decrease Coil and HX Capacity – Why is my building not at the right temperature?
- Dirty Air-side Coils
  - Increase Fan Power – Decrease Air Flow Rates
  - Increase Approach Temperatures – Decreases Delta T and Dehumidification
  - Decrease Coil Capacity – Why is my building not at the right temperature?
  - Create Environment for Bacteria and Fungi
- Corrosion/Erosion
  - Galvanic
  - Biological
  - Oxidation
  - High Velocity with Particles

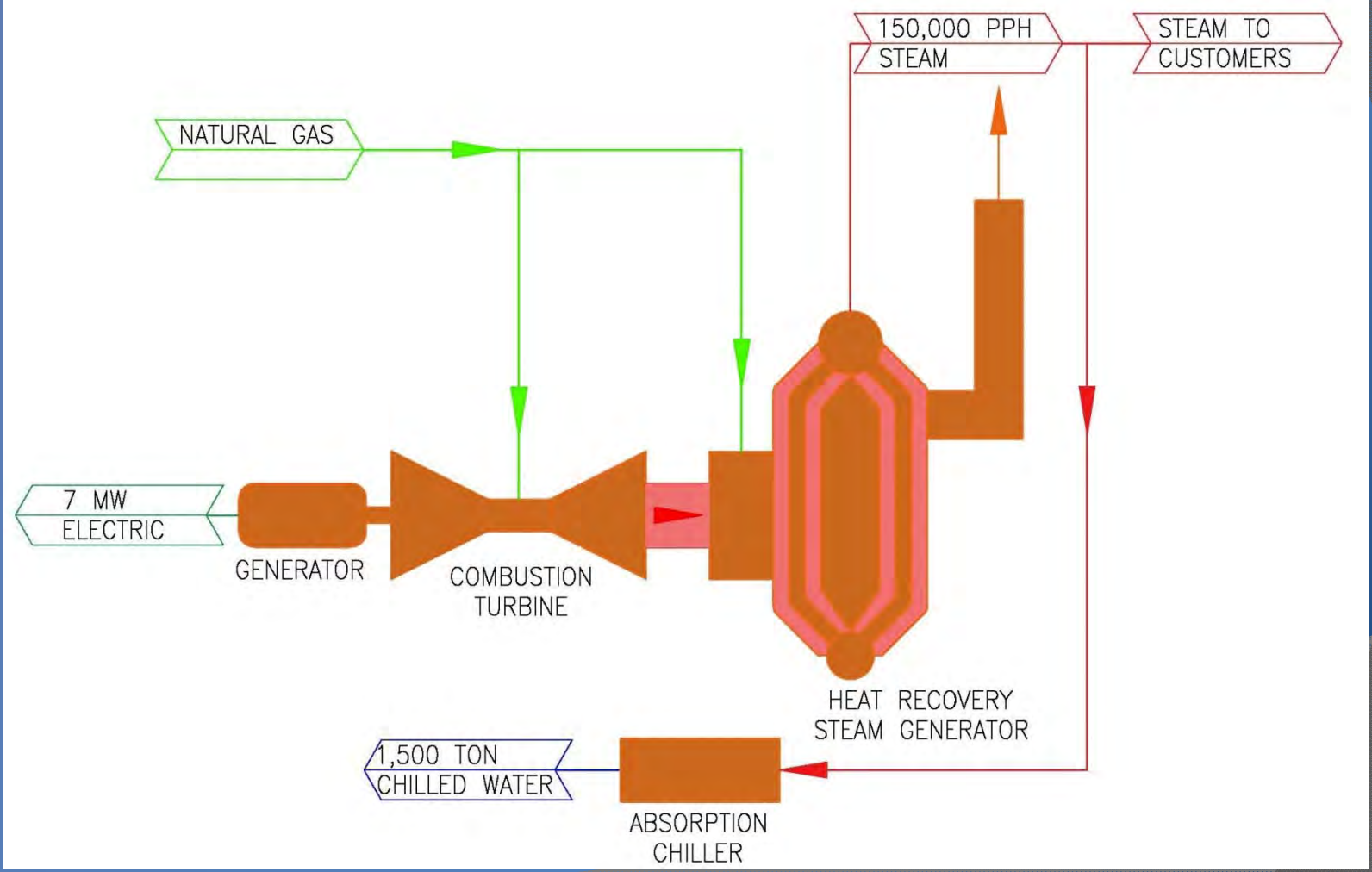
Water Chemistry (con't)

- Steam to Hot Water HX
  - Tube Leaks Introduce Hardness, Chemicals and Minerals into DES Condensate
  - Scale and Deposits on HW side Decrease Capacity and Leaving Temperature
- Prevent Chilled Water Leaks
  - Increased Chemical Costs
  - Increased Make-up
- DES CHW
  - Corrosion Inhibitors (Iron and Yellow Metals)
  - Biocide
- Maintenance
  - Clean Coils and HX's Regularly (inside and out)
  - Blowdown Strainers and Dirt Legs
  - Maintain a "Good" Water Chemistry Program and Monitor Regularly
  - Prevent Biological Contamination
  - Deferred Maintenance Costs More in the Long Run

9. DES Combined Heat and Power

- Provides Approximately 7,000 kW of Self-generated Electricity
- Provides 150,000 pph of Additional Steam
- Provides 1,500 tons of Additional Chilled Water
- Improves DES Efficiency
- Annual Operating Savings of $2,450,000 to DES Customers with Net 6.2% Average Annual Savings
- Provides Triple Electrical Redundancy to Riverfront Flood Mitigation Project
- Approximately $18 million in Net Capital Cost
- Less Than 8 Year Simple Return on Investment

CHP Flow Diagram



Metro Nashville
DISTRICT ENERGY SYSTEM

10. Questions and Answers

Steam Shut-down July 19, 2015
Anticipate 24 hour Outage

11. Adjourn