

**Brattle CONE Combustion Turbine
Revenue Requirements Review**

For

Monitoring Analytics, LLC

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TABLE OF CONTENTS

Executive Summary

- Introduction2
- CT Generation Technology2
- Evaluation Methodology2
- Proforma Analysis3
- Financial Criteria.....3
- CONE CT Capital Cost and Revenue Requirement Results4

1.0 CONE Plant Design

- 1.1 GE Frame 7FA.05 CONE CT Power Plant5

2.0 Construction Scope and Capital Cost

- 2.1 Plant Proper Capital Cost.....7
- 2.2 Construction and Draw Down Schedules8
- 2.3 Black Start Capability9
- 2.4 Dual Fuel Capability9

3.0 Other Project Capital Costs

- 3.1 Electric Interconnection9
- 3.2 Natural Gas Interconnection.....9
- 3.3 Initial Capitalized Spare Parts Inventory10
- 3.4 Owner’s Contingency.....10
- 3.5 Plant Mobilization and Startup Costs10
- 3.6 Site Location and Land Costs11
- 3.7 Development Expenses.....11
- 3.8 Legal Fees.....11
- 3.9 Financing Fees.....11
- 3.10 Interest During Construction.....12
- 3.11 Air, EIS, Land Use and FERC Permits.....12
- 3.12 Emissions Reduction Credits.....12

4.0 Annual Fixed Operating Expenses

- 4.1 Operations and Maintenance Staffing.....13
- 4.2 Contract Parts and Labor14
- 4.3 Insurance Expenses14
- 4.4 Property Tax14
- 4.5 General and Administrative Expenses15

TABLE OF FIGURES

- Figure 1–Two GE Frame 7FA.05 at 92 F Ambient 7

TABLE OF TABLES

- Table 1 – CONE CT Capital Cost and Revenue Requirements4
- Table 2 – Cone CT EPC Plant Proper Cost Comparison8
- Table 3 – CONE CT Capital Cost Detail12
- Table 4 – CONE CT Capital Cost Comparison (Brattle Format).....13
- Table 5 – CONE CT First Year Annual Fixed O&M Expenses Detail15

Executive Summary**Introduction**

Monitoring Analytics, LLC (“MA”) retained Pasteris Energy, Inc. (“Pasteris Energy”) to review the May 15, 2014, report by Brattle entitled “*Cost of New Entry Estimate for Combustion Turbine and Combined Cycle Plants in PJM With June 1, 2018 Online Date*”. This report for MA will review only the Cost of New Entry (“CONE”) for a Combustion Turbine power plant (“CT”).

Since 2009 Pasteris Energy has been retained by MA to update the capital cost, fixed O&M and revenue requirements of a CONE CT in CONE Area 1 for inclusion in the State of the Market Report for PJM (“SOM”). The SOM report does not evaluate the CONE CT located within the other four (4) CONE areas. In February 2014 Pasteris Energy updated SOM CONE CT power plant located in CONE Area 1 to mid-year 2013 for inclusion in the SOM Report for 2013.

The 2013 SOM CONE CT revenue requirements are calculated on an overnight July 1, 2013 dollar basis, consistent with the same plant online date.

Escalation adjustments consistent with that of the Brattle Report were made to bring these 2013 SOM cost estimates to a June 1, 2018, online date. Net revenues from the sale of energy and ancillary services are not included in this report.

CT Generation Technology

The 2013 SOM CONE CT update utilizes two (2) dual fuel capable GE Frame 7FA.05 CT technology in simple cycle with selective catalytic reduction (“SCR”) for NO_x emissions control and carbon monoxide (“CO”) oxidation catalyst for CO emissions control. This is the same technology and design estimated by Brattle with the exception that Brattle uses CT inlet air evaporative cooling for hot weather power augmentation while the SOM CONE CT uses mechanical CT inlet air chilling (“TIC”) to 50 °F. The net capacity of the Brattle CONE CT power plant is 396 MW at 94 °F and a 44.2% relative humidity (76.2 °F wet bulb temperature) and the net capacity of the SOM CONE CT power plant is 410 MW at a 92 °F dry bulb and 78 °F wet bulb temperature. Pasteris Energy performance modeling results show a 17 MW increase in net capacity via TIC over evaporative cooling. Accordingly, the 14 MW difference between the Brattle CONE CT and the SOM CONE CT net capacities appears reasonable. The Brattle CONE CT and the SOM CONE CT heat rates are very close at 10,309 BTU/kWh (HHV) and 10,241 BTU/kWh (HHV).

Evaluation Methodology

Stantec Consulting Services, Inc. (“Stantec”) a power plant design and engineering firm with CT and CC plant design experience was contracted by Pasteris Energy to determine the plant proper capital cost estimate for the CONE CT power plant for the 2013 SOM Report. Stantec has performed this same activity since 2009. Stantec assembled these estimates using July 2013 based major equipment quotations from GE, recent participation with power plant developers, and balance of plant equipment quotations. The power plant construction estimate was developed based on data from recent construction proposals and input obtained from multiple construction contractors. For this effort, the labor rates and labor productivity for the geographical location of New

Jersey/AECO Zone were verified and used to develop the direct and indirect labor costs. The plant proper cost estimate is an engineering, procurement and construction (“EPC”) turnkey cost estimate in overnight July 1, 2013, dollars.

For the 2010 SOM CONE CT report, the Wood Group Power Operations, Inc. (“WGPO”) provided assistance in determining plant startup staffing and expenses, capitalized spare parts, O&M staffing, and annual maintenance expenses. The WGPO provides contracted operations and maintenance services to the power industry primarily with combustion turbine based power plants. For later SOM reports the WGPO was not available to perform the update. Accordingly, Pasteris Energy updated these line item expenses as described in this report.

Pasteris Energy determined and updated other development expenses such as the property purchase costs, environmental permitting, legal, project management and interest during construction. Pasteris Energy utilized PJM’s capital cost data to estimate electric interconnection and system upgrade costs. Pasteris Energy also determined the annual property tax payments and plant insurance premiums.

Proforma Analysis

For the SOM CONE CT a twenty (20) year after tax discounted cash flow (“ATDCF”) model was used to determine the nominal levelized revenue requirements for the CONE CT project to cover capital recovery, annual fixed O&M expenses and earn the target after tax internal rate of return (“IRR”) for the investor/owner. The mid-year convention was used to account for revenues and expenses incurred continuously throughout each year in the 20 year project evaluation. This methodology for evaluating power generation investment is commonly used by power plant owners and developers. Accordingly, the financial results of this study will be consistent with the financial results obtained by owners, developers and other consulting firms when applying the study capital costs, annual O&M expenses and financial criteria. The model accounts for the capital costs to develop and construct the plant and annual fixed O&M expenses. It includes, fixed capacity revenue, fixed O&M expense, debt service, depreciation, income taxes and after tax cash flow.

Financial Criteria

Target Internal Rate of Return (“IRR”)

A target IRR of 12% was chosen for the proforma evaluation. This target IRR has been used in all previous SOM CONE studies. Brattle used a target IRR of 13.8%.

Debt to Equity Ratio

A 50% debt to 50% equity ratio was assumed in the proforma model evaluation. This ratio is consistent with the financial structure of a creditworthy integrated electric utility company or independent power producer (“IPP”). This would be a reasonable financial structure for the CONE CT power plant project and has been used in all previous CONE CT studies. Brattle used a debt to equity ratio of 60% debt and 40% equity.

Debt Term and Interest Rate

Consistent with the financial structure of a creditworthy integrated electric utility company or IPP a, 20-year bond with an interest rate of 7.0% was used in the proforma model. A mortgage style loan was used which provides for increasing principal payment

and decreasing interest payments over the loan term. This loan structure has been used in all previous CONE studies. Brattle also used a 7.0% debt interest rate.

Tax Depreciation

The federal tax code allows for CT simple cycle power plants to utilize Modified Accelerated Cost Recovery System (“MACRS”) over a 15 year tax life. Brattle used the same MACRS depreciation.

Federal and State Income Taxes

Both Pasteris Energy and Brattle used the 35.0% corporate federal income tax rate the 9.0% state tax rate for New Jersey in their proforma models.

After Tax Weighted Average Cost of Capital

The combined financial assumptions result in an after tax weighted average cost of capital (“ATWACC”) of 8.07% for the SOM CONE CT and 8.00% for the Brattle CONE CT.

General Escalation

The SOM CONE CT used an annual escalation or inflation rate of 2.5% for all fixed O&M expenses over the entire project life. This is consistent with all previous SOM CONE studies. The Brattle CONE CT used an annual long term inflation rate of 2.25%.

CONE CT Capital Cost and Revenue Requirement Results

The resulting capital cost and fixed revenue requirements for the 2013 SOM, the 2013 SOM escalated to 2018 and the 2018 Brattle CONE CT power plant are found in Table 1. Revenue requirements are expressed in \$/MW-Year and \$/MW-Day and are total nominal-levelized. The total nominal-levelized value represents constant, non-escalating annual capacity revenues over the 20-year project life.

**TABLE 1
CONE CT CAPITAL COST AND REVENUE REQUIREMENTS**

CONE CT Capital Cost		
CONE Area1-AECO Zone	\$Million	\$/kW
2018 Brattle	\$420,000	\$1,060.61
2013 SOM Escalated to 2018	\$357,895	\$872.57
2013 SOM	\$311.036	\$758.33

Levelized Revenue Requirements						
CONE Area1-AECO Zone	Brattle 2018		2013 SOM Escalated to 2018		2013 SOM	
Levelized Revenue Requirements	\$/MW-Day	\$/MW-Year	\$/MW-Day	\$/MW-Year	\$/MW-Day	\$/MW-Year
Capital	\$369.86	\$135,000	\$301.57	\$110,074	\$262.21	\$95,708
Fixed O&M	\$41.10	\$15,000	\$44.70	\$16,316	\$38.42	\$14,023
Total	\$410.96	\$150,000	\$346.27	\$126,390	\$300.63	\$109,731

Plant Description	Brattle	SOM
CT Model	GE Frame 7FA.05	GE Frame 7FA.05
Number of CTs	2	2
Plant Capacity (MW)	396,000	410,162
Heat Rate (BTU/kWh) (HHV)	10,309	10,241
Financial Assumptions		
Percent Equity	40%	50%
Percent Debt	60%	50%
Debt Term (Years)	20	20
Project Life (Years)	20	20
Debt Interest Rate (%)	7.0%	7.0%
Federal Tax Rate (%)	35.0%	35.0%
State Tax Rate (%)	9.0%	9.0%
Effective Tax Rate (%)	40.9%	40.9%
Target Equity IRR (%)	13.8%	12.0%
ATWACC (%)	8.00%	8.07%
General Escalation (%)	2.3%	2.5%
MACRS Depreciation (Yrs.)	15	15

The Brattle CONE CT revenue requirements are \$150,000/MW-Year. The 2013 SOM CONE CT fixed revenue requirements are \$109,731/MW-Year. When most components making up the capital cost and fixed O&M of the 2013 SOM CONE CT are escalated to 2018 the revenue requirements increase to \$126,360/MW-Year, which are 15.7% less than the Brattle CONE CT revenue requirements. The escalation rates applied to the various cost components are detailed in this report.

1.0 SOM CONE CT Plant Design

1.1 GE Frame 7FA.05 CONE CT Power Plant

Since its introduction to the market about twenty years ago, the GE Frame 7FA has been a technically and commercially successful combustion turbine in simple and combined cycle operation. The particular model used in previous CONE CT studies was the PG7241 or GE Frame 7FA.04. There are more than thirty GE Frame 7FA.04 units currently installed and operating in the PJM region. In 2011, GE introduced an increased capacity-higher efficiency CT designated the 7FA.05. This CT provides an increase in capacity of 22.1% over the 7FA.04 and a 5.4% decrease in net heat rate. The SOM CONE CT evaluations since 2011 employ the new 7FA.05 CT in its design.

The Frame 7FA.05 CT plant design configuration for this CONE CT update is the same as the original 2005 CONE CT study which consisted of two GE Frame 7FA.04 units. This is consistent with the majority of new CT plants constructed in PJM having two or more GE Frame 7FA.04 units. The primary fuel is natural gas with distillate kerosene as liquid fuel backup with onsite storage. It is assumed that the pipeline natural gas is available at adequate pressure to be utilized by the CT without onsite fuel gas compression. The minimum fuel gas pressure requirement of the GE Frame 7FA.05 is 450 PSIG.

The GE Frame 7FA.05, when firing natural gas, utilizes dry low NO_x (“DLN”) combustor technology to reduce NO_x emissions to 9.0 PPM at 15% O₂. Carbon monoxide (“CO”) emissions from the CT are also 9.0 PPM at 15%. Selective Catalytic Reduction (“SCR”) technology has been added to further reduce emissions from the stack to 2.0 PPM at 15% O₂. Oxidation catalyst has also been installed to reduce CO emissions to 2.0 PPM at 15% O₂. Due to the high exhaust temperatures of the Frame 7FA.05 CT, which are greater than 1,100°F, cooling air is introduced upstream of the SCR to lower and control the CT exhaust temperatures to an acceptable temperature range below 850°F for effective SCR operation. Cooling air fans and associated ductwork are included in the Frame 7FA.05 CT plant scope and capital cost. A hot SCR catalyst design is incorporated. Assuming two CT units both operating at a maximum of 4,000 hours annually the NO_x emissions are estimated at 74.1 tons per year. This total includes NO_x emitted during plant operation, startup, shutdown and 250 hours on kerosene. While firing distillate fuel, water injection is used to reduce emissions from the CT to 42 PPM. At this 42 PPM NO_x level entering the SCR achieving a stack NO_x level of 2.0 PPM would not be expected. Accordingly, the plant may be limited to a specified, not to exceed annual operating hours on oil.

The unit is not designed with black start capability. Because of the large mass of the rotating elements, the Frame 7FA.05 windings in the electric generator are used to start the unit. Smaller CT units typically use an external motor driven hydraulic system for

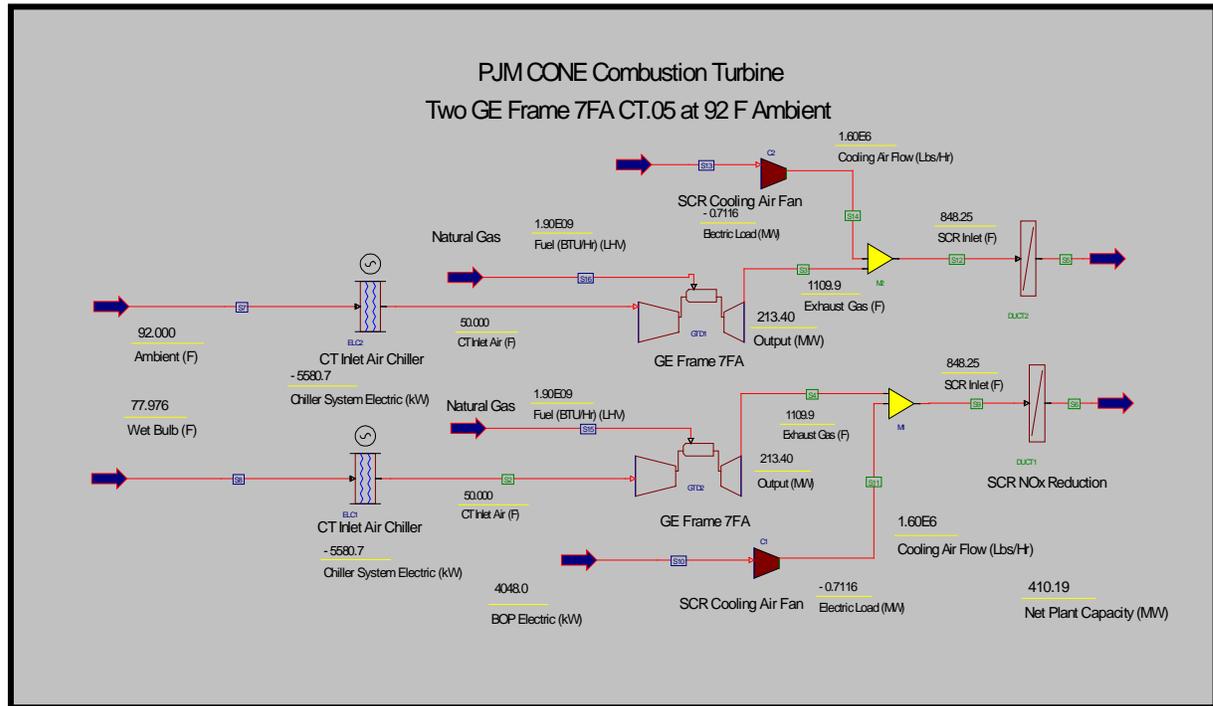
startup. Accordingly, it was deemed impractical to consider black start for the CONE CT with two GE Frame 7FA.05 units. Recently however owners are retrofitting large frame CT and CC power plants with black start capability. No black start ancillary service revenues are available from the Frame 7FA.05 CONE CT power plant.

Mechanical turbine inlet air-cooling (“TIC”) to 50°F is included in the Frame 7FA.05 CONE CT power plant design. Electric motor driven mechanical chillers will chill water to approximately 40°F. The chilled water is pumped through a heat exchange coil located upstream of the CT compressor inlet and cools the CT compressor inlet air. The CT electric capacity and heat rate are equal to that on a 50°F ambient day in spite of actual ambient temperatures much greater than 50°F.

Figure 1 provides details of the Frame 7FA.5 CT plant under ambient conditions of a 92°F dry bulb temperature and a 78°F wet bulb temperature. The net electric capacity of the Frame 7FA.05 CT plant is 410.16 MW. This capacity is net of the chiller system parasitic load of 11.16 MW. Each CT output is 213.40 MW with TIC to 50°F compressor inlet temperature. With evaporative TIC the net electric capacity is 393.41 MW with each CT output at only 198.59 MW at the same ambient conditions. The net plant capacity increase due to mechanical TIC over evaporative cooling is 16.75 MW.

The SOM CONE CT is essentially the same technology and design estimated by Brattle with the exception the Brattle uses CT inlet air evaporative cooling for hot weather power augmentation while the SOM CONE CT uses mechanical CT inlet air chilling (“TIC”) to 50 °F. The net capacity of the Brattle CONE CT power plant is 396 MW at 94 °F and 44.2% relative humidity (76.2 °F WBT) and the net capacity of the SOM CONE CT power plant is 410 MW at a 92 °F dry bulb and 78 °F wet bulb temperature. Pasteris Energy performance modeling results show a 16.75 MW increase in net capacity via TIC over evaporative cooling. Accordingly, the 14 MW difference between the Brattle CONE CT and the SOM CONE CT appears reasonable. Brattle CONE CT and the SOM CONE CT heat rates are very close at 10,309 BTU/kWh (HHV) and 10,241 BTU/kWh (HHV).

Figure 1



2.0 Construction Scope and Capital Cost

2.1 Plant Proper Capital Cost

Stantec, a power plant design and engineering firm with CT and CC plant experience was contracted by Pasteris Energy to determine the plant proper capital cost estimates for the CONE CT power plant. Stantec assembled these estimates using recent major equipment costs, recent participation with power plant developers, and balance of plant equipment quotations. The power plant construction estimate was developed based on data from recent construction proposals and input obtained from multiple construction contractors. For this effort, the labor rates and labor productivity for geographical locations of New Jersey were verified and used to develop the direct and indirect costs. The plant proper estimate is an engineering, procurement and construction (“EPC”) turnkey cost estimate in July 1, 2013, dollars.

The 2013 SOM CONE CT EPC plant proper cost was estimated by Stantec at \$246.0 million. When escalated to 2018, the cost increased to of \$283.7 million but is still 10.6% less than the Brattle CONE CT EPC plant proper cost of \$317.3 million.

Table 2 shows in detail the various EPC cost components of the 2013 SOM, the 2018 SOM and the Brattle CONE CT. Note that the major cost components resulting in Brattle’s higher capital cost are construction labor, other labor and EPC contingency. The Brattle Report does not provide construction and other labor man-hours and the associated hourly trade rates. The Stantec construction labor estimate carried 360,000 man-hours at an average labor rate of \$86 per hour or \$31.0 million and was further escalated at 3.75% for five year to \$37.3 million in 2018. Stantec carried 5% contingency

on equipment and materials and 10% contingency on labor. Brattle carried 10% contingency on all EPC components per page 18 of the Brattle Report.

TABLE 2
CONE CT EPC PLANT PROPER COST COMPARISON

Capital Costs (in \$Millions)	2013 SOM CONE CT	2013 SOM CONE CT Escalated to 2018	Brattle 2018 CONE CT	Brattle vs. Escalated 2018 SOM CONE CT
Owner Furnished Equipment				
Gas Turbines	\$89.8	\$102.29	\$98.80	(\$3.5)
HRSG / SCR/TIC	\$29.9	\$34.10	\$18.90	(\$15.2)
Sales Tax	Included	Included	\$8.20	\$8.2
Total Owner Furnished Equipment	\$119.7	\$136.4	\$125.9	(\$10.5)
EPC Costs				
Equipment				
Other Equipment	\$25.6	\$29.2	\$30.9	\$1.7
Construction Labor	\$31.0	\$37.3	\$71.7	\$34.4
Fuel Oil Capability	\$8.2	\$9.3	Included	(\$9.3)
Sales Tax	\$0.3	\$0.3	\$2.8	\$2.5
Other Labor	\$13.3	\$16.0	\$21.2	\$5.2
Materials	\$14.3	\$16.3	\$9.7	(\$6.6)
Total	\$212.4	\$244.8	\$262.3	\$17.4
EPC Contractor Fee	\$21.2	\$24.5	\$26.2	\$1.7
EPC Contingency	\$12.4	\$14.4	\$28.8	\$14.4
TOTAL EPC & OWNER FURNISHED EQUIPMENT	\$246.0	\$283.7	\$317.3	\$33.5
Brattle Escalation Assumptions Applied to 2013 SOM CONE CT				
Equipment & Materials (%)	2.65%			
Equipment and Materials Factor Overall	1.1397			
Escalation Labor (%)	3.75%			
Labor Factor Overall	1.2021			
SOM Assumptions				
General Inflation Rate	2.50%			
General Inflation Overall	1.1314			
SOM Year	2013			
Capacity Year Start	2018			
Years of Escalation	5			
Weighted Equipment And Labor Escalation Overall	1.153			
Contractor Fee of Direct Costs (%)	10.00%			
Contingency on Equipment and Materials (%)	5.00%			
Contingency on Labor (%)	10.00%			

2.2 Construction and Draw Down Schedules

Stantec also provided construction and draw down schedules. The construction schedule from site mobilization to commercial operation is 14 months. The cost draw down schedule however extends over a 30 month period accounting for a Limited Notice to Proceed (“LNTP”) in month one, a release of the step-up transformer purchase in month four, due to the 20-month delivery of the transformer. The release of the combustion turbine purchase is required in month seven, and the balance of plant procurement from months nine through thirteen. Site mobilization occurs in month sixteen of the overall schedule. Stantec provided the percent of total plant proper capital cost at each of the 30

months in the schedule and was used by Pasteris Energy to determine interest during construction (“IDC”).

Brattle used a 20 month drawdown schedule with 80% of the cost incurred in the final 11 months prior to commercial operation per footnote 20 page 25 of the Brattle Report.

2.3 Black Start Capability

Black start capability is not included in the SOM CONE CT power plant. The GE Frame 7FA.05 CT is not started via a separate motor driven hydraulic system but utilizes the generator windings as a motor to start the unit using electric from the system. The required installed oil fired diesel generator capacity exceeds 8.0 MW to start a single Frame 7FA.05 CT. Though black start is feasible for a 410 MW CT power plant and is being considered by owners, it is not included in the CONE CT fixed revenue requirements as PJM has separate black start cost recovery process. Brattle also did not include black start in its CONE CT design and cost estimate.

2.4 Dual Fuel Capability

The SOM CONE CT power plant using GE Frame 7FA.05 technology is capable of natural gas and distillate kerosene operation and the necessary equipment including on site kerosene storage has been included in the plant proper capital cost. Brattle included dual fuel capability in its CONE CT design and cost estimate.

3.0 Other Project Capital Costs

3.1 Electric Interconnection

The PJM Transmission Planning Department tracks the capital costs for power plant direct interconnection to the PJM system as well as the cost of PJM system upgrades. Actual power plant interconnection and system upgrade costs were available for proposed projects, projects in construction and recently completed power projects. The database was sorted into a 100 MW to 400 MW capacity range that represented the capacity of the CONE CT project under evaluation. In 2008 this capacity range produced 23 projects with an average direct interconnection cost of \$12.483 per kW and system upgrade costs of \$7.194 per kW. This produced a total combined cost of \$19.676 per kW of installed net plant capacity. This value was increased by \$2.00 per kW to a value of \$21.676 per kW net plant capacity to include power lines from the CONE CT plant proper to the PJM interconnection point. Since 2008, these costs have been adjusted using the Handy-Whitman index for Total Electric Transmission (E-1 Line-33). For the 2013 SOM CONE CT these adjustments resulted in in a unit cost of \$24.37 per kW or \$10.0 million. When escalated to 2018 using a blended equipment-labor annual escalation rate of 2.89% the cost increased to \$11.5 million. This compares to the 2018 Brattle estimate of \$13.0 million.

3.2 Natural Gas Interconnection

PJM does not maintain data on natural gas interconnection costs. The pipeline distance from the plant to the high-pressure gas interconnection point is assumed to be five (5) miles for this cost estimate. The SOM CONE CT evaluation assumes that natural gas is available at a pressure level adequate to be used directly in the CT without onsite fuel gas compression. For the CONE CT plant this pressure is assumed to be a minimum of 450 PSIG. For the 2012 gas interconnection cost, Stantec was asked to review their current

cost data base. Stantec's review resulted in adjusting the gas pipeline cost per mile to \$2.0 million with a metering station cost of \$1.0 million. The total gas interconnection cost for 2012 was \$11.0 million or \$26.82 per kW. For the 2013 SOM CONE CT the Handy-Whitman index for Natural Gas Transmission (G-1 Line-25) was 0.955 which reduced the gas interconnection cost to \$10.5 million or \$25.612 per kW. When escalated to 2018 using the blended equipment-labor annual rate of 2.89% the cost increased to \$12.1 million. This is well below the 2018 Brattle estimate \$22.6 million. Brattle obtained pipeline cost data that averaged \$3.5 million per mile with an average metering station cost of \$2.9 Million to develop this cost for a 5 mile gas interconnection. See Table 14 - Gas Interconnection Costs on page 21 of the Brattle Report.

3.3 Initial Capitalized Spare Parts Inventory

The WGPO estimated the spare parts inventory consistent with their estimate for startup and O&M services provided to the CONE CT power plant for the 2009 SOM Report. Since 2009 these costs have been adjusted using the Handy-Whitman index for Gas Turbogenerators (E-1 Line-30) which resulted in a spare parts inventory cost for the 2013 SOM CONE CT power plant of \$3.3 million in 2013. When escalated to 2018 at the Battle equipment annual escalation rate of 2.65% the cost increased to \$3.7 million. This is well below the 2018 Brattle estimate of \$6.9 million.

3.4 Owner's Contingency

In the SOM CONE CT power plant evaluation an owner's contingency was added to the total project capital cost equal to 2.5% of the plant proper EPC cost or about 2.0% of the total project capital cost. This is consistent with all previous CONE CT studies. For the 2013 SOM CONE CT, the owner's contingency is \$6.2 million. When the total project cost was escalated to 2018 the contingency increased to \$7.1 million. This compares with the 2018 Brattle estimate of \$6.1 million. Brattle assumed 9% of the Owner's Cost as contingency.

3.5 Plant Mobilization and Startup Costs

As a power plant nears construction completion, the owner begins to mobilize for the plant commissioning, testing and startup. These costs are typically capitalized and include hiring, relocation expenses, and labor costs of the O&M staff five to six months before startup, training, production of O&M manuals, special tools and office equipment and furnishings. Startup consumables were also capitalized which include purchased electricity, fuel, water and chemicals.

The WGPO provided the mobilization costs for the CONE CT plant for the 2009 and 2010 SOM Reports. The WGPO provides power plant startup, operations and maintenance services for CT based power plants. The 2009 and 2010 mobilization cost for the CONE CT power plant were estimated at \$1.6 million. Since 2010 adjustments were made based on the Handy-Whitman index for Total Steam Production Plant (E-1 Line 6) which resulted in a mobilization cost for the 2013 SOM CONE CT power plant of \$1.7 million.

Fuel, water and electric costs were assumed to include 72 hours of CT full load testing and 3,600 hours or five months of plant parasitic electric load purchased from the local utility. No credit was taken for electric revenues during plant testing. The 2013 SOM CONE CT power plant consumable expenses were \$1.5 million assuming a natural gas

price of \$5.00 per MMBTU. The total mobilization cost for 2013 is \$3.2 million. When escalated to 2018 at 2.5% annually the cost increased to \$3.6 Million. This compares to the 2018 Brattle estimate of \$7.2 million.

3.6 Site Location and Land Costs

In general the locations for the CONE CT power plant are zoned industrial near high pressure gas transmission pipe lines and high voltage transmission.

The CONE Area 1/AECO Zone south New Jersey site is generally located in Gloucester County along I-295 and NJ Route 130 and is designated union construction.

The original 2008 cost of heavy industrial zoned property for siting the CONE CT power plant was obtained by contacting real estate agencies in appropriate counties of south New Jersey/AECO Zone. The 2013 unit property cost was \$118,814 per acre with a resulting land purchase cost of \$2.4 million. Annual property cost estimates adjustments were made using LoopNet Online published trends for the actual sale price of industrial property in New Jersey. Property cost were not changed for the SOM CONE CT power plant for 2018. The 2018 Brattle property cost was close at \$2.0 million.

The plant proper foot print for the power plant was approximately 10 acres. Additional property as land buffer area was added surrounding the plant proper footprint equal to 10 additional acres. The total purchased property for the SOM CONE CT power plant is 20 acres. The Brattle CONE CT power plant assumed 30 acres of purchased property.

3.7 Development Expenses

Internal and contracted expenses for professional services can be capitalized. These costs include development, legal, financial and technical professionals during the development, construction and startup of the project. Pasteris Energy, having experience in power project development, estimated these costs. Development expenses for the 2013 SOM CONE CT power plant were estimated at \$6.1 million. When escalated to 2018 at 2.5% annually the cost increased to \$6.9 million which compares to the 2018 Brattle estimate of \$15.9 million. The Brattle line item entitled Development Expense may include other costs such as legal fees, permits and emissions reduction credits. This should be further broken down by Brattle.

3.8 Legal Fees

Legal fees include professional support for the construction agreements, gas procurement contracts, any power sale agreements, land acquisition and lease agreements, O&M contracts and other legal matters. Legal fees for the 2013 SOM CONE CT were estimated at \$1.9 million. When escalated to 2018 at 2.5% annually the cost increased to \$2.1 million. Brattle did not have a specific legal fees line item expense estimate.

3.9 Financing Fees

These fees are paid to lenders for securing the project debt and are estimated at 1.0% of the total project capital cost which for the 2013 SOM CONE CT is \$3.1 million. When the total project cost was escalated to 2018 the contingency financing fees increased to \$3.6 million. The 2018 Brattle financing fee estimate is \$9.4 million. Brattle assumed 4% of the EPC and non-EPC costs financed by debt as described in section 8. Financing Fees are on page 23 of the Brattle Report.

3.10 Interest During Construction

Interest during construction (“IDC”) was determined based on the construction costs and monthly draw down schedules provided by Stantec. An interest rate of 5.0% on the outstanding construction loan debt was utilized for the calculation of IDC by Pasteris Energy. Due to the extended 30 month schedule and the need to place down payments on the main step-up transformer and the combustion turbines early in the schedule, IDC has become a significant expense, about 5.25% of the total project capital cost or \$16.3 million for the 2013 SOM CONE CT. When the total project cost was escalated to 2018 the IDC increased to \$18.8 million.

The 2018 Brattle Cost of Capital During Construction estimate is \$19.6 million. Brattle assumed its ATWACC of 8% to calculate the total project present value which will include both the interest during construction from the debt financing portion and the cost of equity for the equity financed portion. This is explained on page 25 of the Brattle Report.

3.11 Air, EIS, Land Use and FERC Permits

Environmental and regulatory professional services and application fees to obtain air, land use and FERC permits were estimated for the 2013 SOM CONE CT at \$1.3 million. When escalated to 2018 at 2.5% annually, the cost increased to \$1.5 million. Brattle did not have a specific line item expense estimate for this category.

3.12 Emissions Reduction Credits

For each of the regions for the siting of the CONE CT the purchase of emissions offsets is required. These are known as emissions reduction credits or ERCs. The cost of the ERCs for a particular pollutant is the product of the annual expected emissions in tons per year and the cost per ton of that pollutant times the emissions offset factor. The cost of ERCs for the 2013 SOM CONE CT was estimated at \$0.8 million and was not changed for 2018 as these future markets are not predictable. Brattle did not have a specific line item expense estimate for this category.

The total capital cost buildup for the 2013 and 2018 SOM CONE CT power plant and the 2018 Brattle CONE CT power plant is in Table 3.

TABLE 3
CONE CT CAPITAL COST DETAIL

CONE Area 1-AECO Zone	Brattle 2018		2013 SOM Escalated to 2018		2013 SOM	
	\$000	\$/kW	\$000	\$/kW	\$000	\$/kW
Plant Proper EPC	\$317,300	\$801.26	\$283,748	\$691.80	\$246,014	\$599.80
Electric Interconnect	\$13,000	\$32.83	\$11,527	\$28.10	\$9,996	\$24.37
Gas Interconnect	\$22,600	\$57.07	\$12,114	\$29.54	\$10,505	\$25.61
Equipment Spares-Inventories	\$6,900	\$17.42	\$3,770	\$9.19	\$3,308	\$8.06
Total Direct Costs	\$359,800	\$908.59	\$311,160	\$758.63	\$269,823	\$657.85
Owners Contingency	\$6,100	\$15.40	\$7,094	\$17.29	\$6,150	\$15.00
Mobilization and Startup	\$7,200	\$18.18	\$3,597	\$8.77	\$3,179	\$7.75
Land Purchase	\$2,000	\$5.05	\$2,376	\$5.79	\$2,376	\$5.79
Development Expenses	\$15,900	\$40.15	\$6,894	\$16.81	\$6,094	\$14.86
Legal Fees	\$0	\$0.00	\$2,142	\$5.22	\$1,893	\$4.62
Financing Fees	\$9,400	\$23.74	\$3,579	\$8.73	\$3,110	\$7.58
Interest During Construction	\$19,600	\$49.49	\$18,787	\$45.80	\$16,317	\$39.78
Permits	\$0	\$0.00	\$1,482	\$3.61	\$1,310	\$3.19
Emissions Reductions Credits	\$0	\$0.00	\$783	\$1.91	\$783	\$1.91
Total Soft Costs	\$60,200	\$152.02	\$46,735	\$113.94	\$41,213	\$100.48
Total Project Cost	\$420,000	\$1,060.61	\$357,895	\$872.57	\$311,036	\$758.33

Table 4 provides the total capital cost buildup for the 2013 and 2018 SOM CONE CT power plant and the 2018 Brattle CONE CT power plant in all CONE areas in the same format used by in Table 19 page 26 of the Brattle Report.

Table 4
CONE CT Capital Cost Comparison (Brattle Format)

CONE Area	1 - EMACC 2013 SOM	1 - EMACC 2018 SOM	1 - EMACC 2018 Brattle	2 - SWMAAC 2018 Brattle	3 - RTO 2018 Brattle	4 - WMAAC 2018 Brattle	5 - Dominion 2018 Brattle
Owner Furnished Equipment (\$Millions)							
Gas Turbines	\$89.8	\$102.3	\$98.8	\$98.4	\$94.0	\$98.7	\$98.6
HRSG / SCR	\$30.2	\$34.4	\$18.9	\$18.7	\$17.9	\$18.8	\$18.8
Sales Tax	Included	Included	\$8.2	\$7.0	\$6.7	\$7.1	\$7.3
Total Owner Furnished Equipment	\$120.0	\$136.7	\$125.9	\$124.1	\$118.6	\$124.6	\$124.8
EPC Costs							
Equipment (\$Millions)							
Other Equipment	\$25.6	\$29.2	\$30.9	\$30.5	\$25.5	\$30.8	\$30.7
Construction Labor	\$31.0	\$37.3	\$71.7	\$55.4	\$55.3	\$54.5	\$48.2
Other Labor	\$13.3	\$16.0	\$21.2	\$19.6	\$18.6	\$19.6	\$19.0
Materials	\$14.3	\$16.3	\$9.7	\$9.0	\$8.6	\$9.6	\$9.4
Fuel Oil Capability	\$8.2	\$9.3	Included	Included	Included	Included	Included
Sales Tax	Included	Included	\$2.8	\$2.4	\$2.0	\$2.4	\$2.5
EPC Contractor Fee	\$21.2	\$24.5	\$26.2	\$24.1	\$22.9	\$24.1	\$23.5
EPC Contingency	\$12.4	\$14.4	\$28.8	\$26.5	\$25.2	\$26.6	\$25.8
Total EPC Costs	\$126.0	\$147.0	\$191.4	\$167.4	\$158.1	\$167.6	\$159.2
Total EPC and Equipment Costs	\$246.0	\$283.7	\$317.3	\$291.5	\$276.7	\$292.2	\$284.0
Non-EPC Costs (\$Millions)							
Project Development	\$10.1	\$11.3	\$15.9	\$14.6	\$13.8	\$14.6	\$14.2
Mobilization and Start-Up	\$1.7	\$2.3	\$3.2	\$2.9	\$2.8	\$2.9	\$2.8
Net Start-Up Fuel Costs	\$1.5	\$1.9	\$4.0	\$4.7	\$3.2	\$4.6	\$4.7
Electrical Interconnection	\$10.0	\$11.5	\$13.0	\$12.9	\$12.7	\$12.6	\$12.9
Gas Interconnection	\$10.5	\$12.1	\$22.6	\$22.6	\$22.6	\$22.6	\$22.6
Land	\$2.4	\$2.4	\$2.0	\$2.2	\$1.1	\$1.2	\$1.6
Fuel Inventories	\$0.0	\$0.0	\$5.3	\$5.3	\$0.0	\$5.1	\$5.2
Non-Fuel Inventories	\$3.3	\$3.8	\$1.6	\$1.5	\$1.4	\$1.5	\$1.4
Owner's Contingency	\$6.2	\$7.1	\$6.1	\$6.0	\$5.2	\$5.9	\$5.9
Financing Fees	\$3.1	\$3.6	\$9.4	\$8.7	\$8.1	\$8.7	\$8.5
Total Non-EPC Costs	\$48.7	\$55.9	\$82.9	\$81.4	\$70.9	\$89.6	\$79.8
Total Capital Costs	\$294.7	\$339.7	\$400.2	\$372.9	\$347.6	\$371.8	\$363.8
Overnight Capital Costs	\$295	\$340	\$400	\$373	\$348	\$372	\$364
IDC	\$16.3	\$18.8	\$19.4	\$18.1	\$16.9	\$18.0	\$18.0
Total Installed Costs	\$311	\$358	\$420	\$391	\$365	\$390	\$382
Plant Capacity (MW)	410	410	396	393	385	383	391
Overnight Capital Costs (\$/kW)	\$718	\$828	\$1,012	\$948	\$903	\$971	\$931
Installed Cost (\$/kW)	\$758	\$874	\$1,061	\$994	\$947	\$1,018	\$977

4.0 Annual Fixed Operating Expenses

4.1 Operations and Maintenance Staffing

The WGPO initially provided the O&M staffing and expense for the CONE CT power plant for the 2009 SOM Report. The staffing complement for the CONE CT power plant is nine (9) on-site personnel. A 51.0% benefits and G&A burden was added to the base hourly rate as well as 25% overtime hours above the base 2,080 hours at time and one half hourly rates. For the 2013 SOM CONE CT power plant this annual expense is \$1.4 million. These costs were adjusted since 2008 based on the Handy-Whitman index for Total Steam Production Plant (E-1 Line 6). When escalated to 2018 at 2.5% annually the annual expense increased to \$1.7 million. The 2018 Brattle estimate was \$1.5 million.

5.2 Contract Parts and Labor

WGPO provided the annual contract parts and labor expenses for the 2009 SOM CONE CT power plant. For the 2013 SOM CONE CT power plant this annual expense is \$0.6 million. These costs were adjusted since 2008 based on the Handy-Whitman index for Total Steam Production Plant (E-1 Line 6). When escalated to 2018 at 2.5% annually the annual expense increased to \$0.7 million. The 2018 Brattle estimate was also \$0.7 million.

4.3 Insurance Expenses

Overall power plant annual insurance premiums were estimated to be 0.5% of the insured asset value. Power plant insurance was extended to the asset value of the plant proper, the electric interconnection, the gas interconnection and capitalized spare parts. Coverage included general liability, property, boiler and machinery and business interruption. This amounted to a \$1.3 million annual premium for the 2013 SOM CONE CT power plant. When the total project cost was escalated to 2018 the annual insurance premium increased to \$1.6 million. The 2018 Brattle insurance premium estimate is \$2.4 million. Brattle assumed 0.6% of the insured assets based on the overnight capital cost of \$400 million. This may be high due to applying the 0.6% factor over the \$40.6 million of indirect or soft costs which do not represent physical assets of the CONE CT power plant. See page 28 of the Brattle Report for details.

Insurance premiums increase or decrease based on the capital cost/asset value. Guidelines for the determination of SOM CONE CT insurance premiums were provided by Moore-McNeil LLC Insurance Consulting.

4.4 Property Tax

In the original 2005 CONE CT study property taxes were determined for plant site locations in New Jersey by obtaining public information on actual taxes paid by recently constructed power plants. This information was obtained from FERC filings and/or directly from the township or county tax assessors. These tax rates for power plants were compared with statutory tax rates in the counties and townships where the plants were constructed as well as surrounding counties and townships. In all cases the power plant tax rates were lower than the statutory rates indicating that development/enterprise zone tax relief was made available or payments in lieu of taxes (“PILOT”) were negotiated. In addition, manufacturing equipment is exempt from property taxes so in most cases the tax base is built up from real property and building structures which represent a small percentage of a power plant’s total capital cost. The base 2005 average of the actual tax rates incurred by the power plants surveyed in each region was used in this study.

To update the original CONE CT and the SOM CONE CT property taxes actual property tax rates from 2005 to 2013, for Gloucester County, NJ, were used to develop an index of the original 2005 tax rate. For the 2013 SOM CONE CT the resulting annual property tax for the first year of operation is \$0.8 million and increases each year at the general inflation rate of 2.5%. When the total project cost was escalated to 2018, the annual property tax increased to \$0.9 million due to the increase in assessed value. The property tax rate per asset value was not adjusted from 2013 to 2018 as historical increases in

property tax rates in Gloucester County have now declined since 2012. The 2018 Brattle property tax payment is much lower at \$0.4 million.

4.5 General and Administrative Expenses

General and administrative expenses cover any technical, legal, accounting and permitting fees incurred on an annual basis. For the 2009 SOM CONE CT, the annual G&A expenses were estimated by WGPO. For 2013 SOM CONE CT, G&A expense was \$0.18 million. This was based on the Handy-Whitman index for Total Steam Production Plant (E-1 Line 6). When escalated to 2018 at 2.5% annually, this annual expense increased to \$0.21 million. The 2018 Brattle estimate was \$0.20 million.

The detailed annual fixed O&M expenses for the first year of operation for the 2013 and 2018 SOM CONE CT power plant and the 2018 Brattle CONE CT power plant are summarized in Table 5. The 2018 total fixed O&M expenses are \$5.7 million, compared to the Brattle estimate of \$5.8 million.

**TABLE 5
CONE CT FIRST YEAR ANNUAL FIXED O&M EXPENSES DETAIL**

CONE Area 1-AECO Zone	Brattle 2018		2013 SOM Escalated to 2018		2013 SOM	
	\$000	\$/MW-Year	\$000	\$/MW-Year	\$000	\$/MW-Year
Site O&M Labor	\$1,500	\$3,788	\$1,714	\$4,179	\$1,426	\$3,476
O&M Contract Parts & Labor	\$700	\$1,768	\$665	\$1,621	\$576	\$1,405
Electric Purchases-Consumables	\$200	\$505	\$267	\$651	\$236	\$575
Training-Employee Expenses	\$0	\$0	\$132	\$322	\$117	\$285
Asset O&M Management Fee	\$400	\$1,010	\$300	\$731	\$265	\$646
Insurance	\$2,400	\$6,061	\$1,556	\$3,793	\$1,349	\$3,289
G&A	\$200	\$505	\$205	\$500	\$181	\$442
Property Taxes	\$400	\$1,010	\$882	\$2,151	\$767	\$1,869
Total	\$5,800	\$14,646	\$5,721	\$13,947	4,917	\$11,987