IMM CONE CT Study Results

MIC Special Session:
Quadrennial Review

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Monitoring Analytics

Objective of Study

- **Develop an independent determination of CONE CT revenue requirements for the four CONE Areas**
- **Participants**
  - **Pasteris Energy, Inc. – Overall coordination, soft cost development, proforma**
  - **Stantec – EPC cost estimate, project schedule, drawdown and escalation**
  - **David R. Alexander, Consulting – Emissions Reductions Credits, permits and costs**
  - **deGrouchy, Sifer and Company, CPA – Tax and accounting advisors**

CONE CT Technology Comparison

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
State	NJ	MD	PA	PA	NJ	MD	PA	PA
County	Gloucester	Charles	Westmoreland	Luzerne	Gloucester	Charles	Westmoreland	Luzerne
Design Summary								
CT OEM	GE	GE	GE	GE	GE	GE	GE	GE
CT Model	7HA.02	7HA.02	7HA.02	7HA.02	7HA.02	7HA.02	7HA.02	7HA.02
Number of CTs	2	2	2	2	1	1	1	1
NOx Selective Catalytic Reduction (SCR)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CO Oxidation Catalyst	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dual Fuel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Gas Contract	No	No	No	No	No	No	No	No
Black Start Capability	No	No	No	No	No	No	No	No
On Site Gas Compression	No	No	No	No	No	No	No	No
Performance - CT Inlet Air Chilling to 50 F								
Net Capacity (MW) (ICAP)	755.760	746.726	725.204	742.611	377.880	373.363	362.602	371.305
Net Heat Rate (BTU/kWh) (ICAP)	9,147	9,122	9,273	9,208	9,147	9,122	9,273	9,208
Performance - CT Inlet Air Evaporative Coolers								
Net Capacity (MW) (ICAP)	722.303	716.057	694.653	711.651	361.152	358.029	347.327	355.825
Net Heat Rate (BTU/kWh) (ICAP)	9,117	9,149	9,243	9,178	9,117	9,149	9,243	9,178
Net Capacity Increase via TIC (MW) (ICAP)	33.457	30.668	30.551	30.960	16.728	15.334	15.275	15.480
Site Conditions								
Site Elevation (Ft)	0	180	975	520	0	180	975	520
Ambient Temperature (F)	94.1	93.2	87.1	90.3	94.1	93.2	87.1	90.3
Relative Humidity (%)	44.8%	49.4%	57.8%	47.9%	44.8%	49.4%	57.8%	47.9%

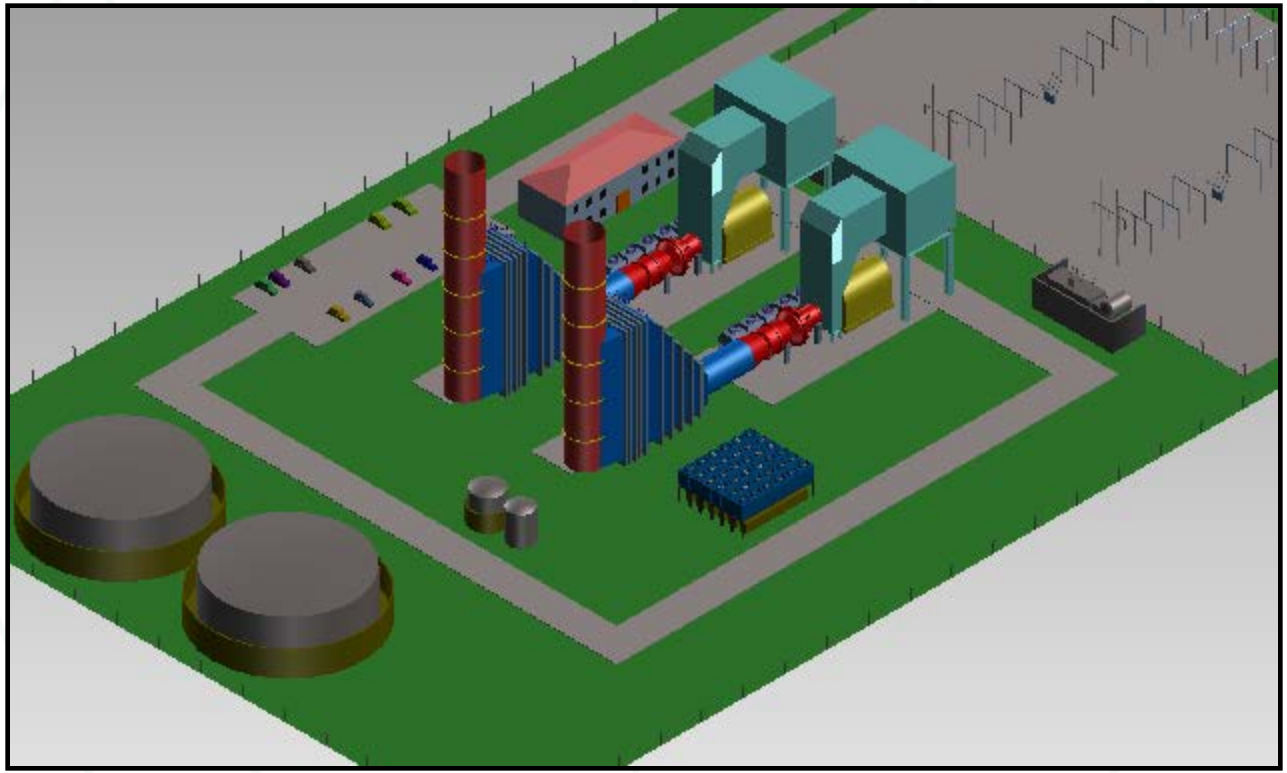
CONE CT Technology Comparison

CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
State	North-NJ	MD	PA-OH	PA
County	NA	Charles	NA	Luzerne
CT OEM	GE	GE	GE	GE
CT Model	7HA.02	7HA.02	7HA.02	7HA.02
Number of CTs	1	1	1	1
NOx Selective Catalytic Reduction (SCR)	Yes	Yes	No	Yes
CO Oxidation Catalyst	Yes	Yes	No	Yes
CT Inlet Air Chilling to 50 F	No	No	No	No
CT Inlet Air Evaporative Coolers	Yes	Yes	Yes	Yes
Dual Fuel	Yes	Yes	Yes	Yes
Firm Gas Contract	No	No	No	No
Black Start Capability	No	No	No	No
On Site Gas Compression	No	No	No	No
Net Capacity (MW) (ICAP)	352.000	355.000	321.000	344.000
Net Capacity (MW) (ICAP) (Two CTs)	704.000	710.000	642.000	688.000
Net Heat Rate (BTU/kWh) (ICAP)	9,274	9,270	9,221	9,263
Site Elevation (Ft)	330	150	990	1200
Ambient Temperature (F)	92.0	96.0	89.8	91.2
Relative Humidity (%)	55.5%	44.6%	49.7%	49.2%

CONE CT Technology Comparison

- **IMM ambient conditions are based on PJM Manual 21 procedures.**
  - **Uses mean ambient condition at time of PJM system summer peak over last 15 years.**
- **IMM CONE CT employs SCR and CO catalyst in Rest of RTO.**

Rendering of CONE CT Power Plant

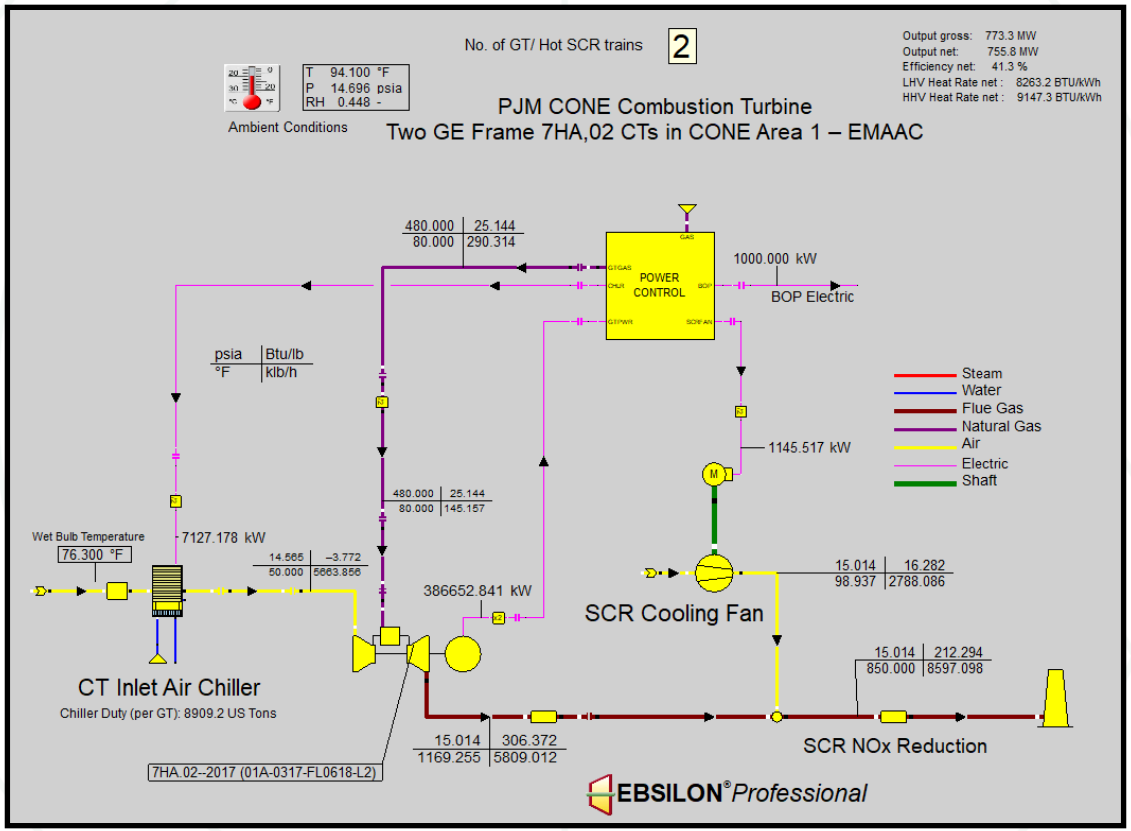


PJM Manual 21 ICAP Ambient Conditions

PJM System Peak Ambient Conditions 15 Year Average

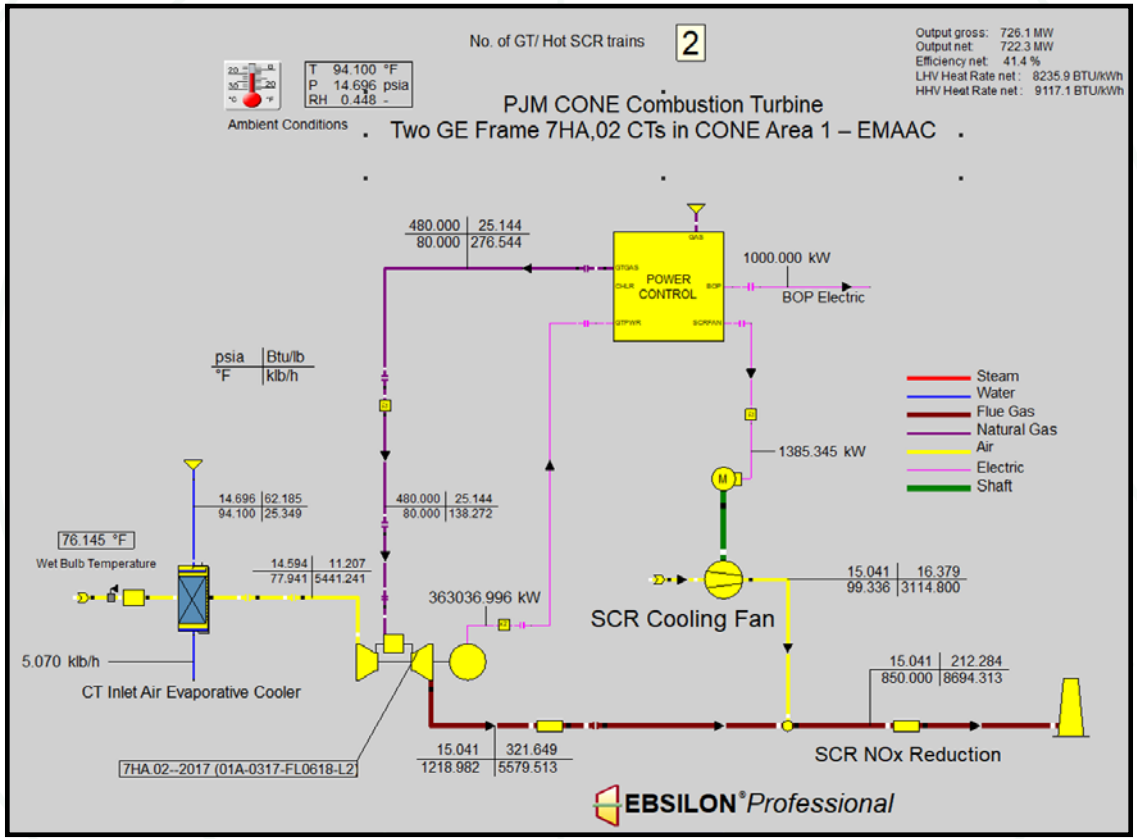
PJM Historical System Peaks		EMAAC		SWMAAC		Rest of RTO		WMAAC	
PJM Peak Date	PJM Peak Hour EDT	DBT	WBT	DBT	WBT	DBT	WBT	DBT	WBT
8/22/2003	16	91.0	79.4	91.4	79.6	82.4	73.6	84.9	75.8
8/3/2004	17	82.0	75.7	80.6	75.5	80.6	72.0	84.0	71.2
7/27/2005	16	97.0	77.6	98.6	79.1	75.2	67.0	87.1	76.4
8/2/2006	17	96.1	77.4	95.0	79.3	89.6	76.8	91.9	76.3
8/8/2007	17	96.1	78.1	98.4	78.0	89.6	78.1	91.9	74.1
6/9/2008	17	96.1	74.7	93.0	75.7	89.6	74.9	91.9	72.4
8/10/2009	17	93.9	78.1	93.4	76.1	80.6	75.5	87.1	75.8
7/7/2010	17	100.9	72.1	97.5	76.2	91.4	70.2	93.9	71.9
7/21/2011	17	97.0	78.9	96.8	83.4	93.2	82.4	96.1	76.4
7/17/2012	17	97.0	72.8	98.4	73.5	93.2	75.6	96.1	73.1
7/18/2013	17	96.1	79.4	95.0	76.1	89.6	78.1	95.0	75.5
6/17/2014	18	91.9	71.3	90.9	76.4	86.0	74.8	84.9	72.2
7/28/2015	17	90.0	74.7	85.1	76.9	87.8	73.2	90.0	70.8
8/11/2016	16	93.9	78.8	92.1	77.7	91.4	78.4	91.0	78.6
7/19/2017	18	93.0	75.5	92.3	75.5	86.0	74.8	89.1	74.1
Mean		**94.1**	**76.3**	**93.2**	**77.3**	**87.1**	**75.0**	**90.3**	**74.3**

EBSILON Model Flow Diagram – Inlet Air Chillers



Monitoring Analytics

EBSILON Model Flow Diagram – Evaporative Coolers



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EBSILON Model Results

CONE CT - Plant Performance at PJM ICAP Ambient Conditions - EBSILON Model Results

CONE Area		1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Inputs	**Units**	**With Turbine Inlet Air Chillers**				**With Turbine Inlet Air Evaporative Cooling**			
Equivalent Elevation	ft.	0	180	975	520	0	180	975	520
Ambient Temperature	°F	94.1	93.2	87.1	90.3	94.1	93.2	87.1	90.3
Wet Bulb Temperature	°F	76.3	77.3	75.0	74.3	76.3	77.3	75.0	74.3
Ambient Relative Humidity	Percent	44.8%	49.4%	57.8%	47.9%	44.8%	49.4%	57.8%	47.9%
CT 1 Desired Inlet Air Temperature	°F	50.0	50.0	50.0	50.0	77.9	78.7	76.1	75.8
CT 1 Chiller System Input	kW/Ton	0.80	0.80	0.80	0.80	0.90	0.90	0.90	0.90
CT 2 Desired Inlet Air Temperature	°F	50.00	50.00	50.00	50.00	NA	NA	NA	NA
CT 2 Chiller System Input	kW/Ton	0.80	0.80	0.80	0.80	0.90	0.90	0.90	0.90
CT 1 SCR Cooling Air Desired Exit Pressure	PSIA	15.081	15.081	15.081	15.081	15.081	15.081	15.081	15.081
CT 1 SCR Cooling Air Fan Isentropic Efficiency	Percent	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
CT 2 SCR Cooling Air Desired Exit Pressure	PSIA	15.081	15.081	15.081	15.081	15.081	15.081	15.081	15.081
CT 2 SCR Cooling Air Fan Isentropic Efficiency	Percent	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
BOP Parasitic Load	kW	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Results									
Actual Net Power	MW	755.760	746.726	725.204	742.611	722.303	716.057	694.653	711.651
CT 1 Net Power	MW	386.653	381.844	372.807	380.513	363.037	360.301	351.246	358.809
CT 2 Net Power	MW	386.653	381.844	372.807	380.513	363.037	360.301	351.246	358.809
Gross Power	MW	773.306	763.688	745.614	761.026	726.074	720.603	702.492	717.618
CT 1 Chiller Electric Load	kW	7,127.2	7,399.0	6,662.9	6,454.8	0.0	0.0	0.0	0.0
CT 2 Chiller Electric Load	kW	7,127.2	7,399.0	6,662.9	6,454.8	0.0	0.0	0.0	0.0
CT 1 SCR Cooling Air Fan Load	MW	1.1455	0.5823	3.0419	2.2528	1.3853	1.7728	3.4193	2.4835
CT 2 SCR Cooling Air Fan Load	MW	1.1455	0.5823	3.0419	2.2528	1.3853	1.7728	3.4193	2.4835
BOP Parasitic Load	kW	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Net Power (ICAP)	**MW**	**755.760**	**746.726**	**725.204**	**742.611**	**722.303**	**716.057**	**694.653**	**711.651**
CT 1 Heat Consumption	BTU/Hr. (LHV)	3,122,486,722	3,076,627,055	3,037,410,538	3,088,638,270	2,974,392,028	2,959,134,318	2,899,896,656	2,950,099,588
CT 2 Heat Consumption	BTU/Hr. (LHV)	3,122,486,722	3,076,627,055	3,037,410,538	3,088,638,270	2,974,392,028	2,959,134,318	2,899,896,656	2,950,099,588
Total Fuel	MMBTU/Hr. (LHV)	6,245.0	6,153.3	6,074.8	6,177.3	5,948.8	5,918.3	5,799.8	5,900.2
Total Fuel	MMBTU/Hr. (HHV)	6,913.2	6,811.7	6,724.8	6,838.2	6,585.3	6,551.5	6,420.4	6,531.5
Net Plant Heat Rate	BTU/kWh (HHV)	**9,147**	**9,122**	**9,273**	**9,208**	**9,117**	**9,149**	**9,243**	**9,178**

Capital Cost Comparison

IMM CONE CT Capital Cost Summary ($000) (Inlet Air Chillers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Net Capacity (MW) (ICAP)	**755.760**	**746.726**	**725.204**	**742.611**	**377.880**	**373.363**	**362.602**	**371.305**
Equipment and EPC	$385,577	$360,506	$363,347	$366,160	$220,898	$203,117	$205,126	$207,134
Non - EPC	$79,043	$74,298	$71,581	$74,129	$47,935	$45,347	$43,876	$45,245
Overnight Cost	$464,620	$434,804	$434,928	$440,289	$268,833	$248,464	$249,002	$252,379
IDC	$12,480	$11,679	$11,682	$11,826	$7,221	$6,674	$6,688	$6,779
Total Project Cost	$477,100	$446,483	$446,611	$452,116	$276,054	$255,138	$255,691	$259,158
Total Project Cost ($/kW)	**$631.29**	**$597.92**	**$615.84**	**$608.82**	**$730.53**	**$683.35**	**$705.16**	**$697.97**

IMM CONE CT Capital Cost ($000) (Evaporative Coolers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Net Capacity (MW) (ICAP)	**722.303**	**716.057**	**694.653**	**711.942**	**361.152**	**358.029**	**347.327**	**355.825**
Equipment and EPC	$369,725	$345,684	$348,409	$351,106	$212,972	$195,706	$197,657	$199,607
Non - EPC	$76,690	$72,207	$69,481	$72,009	$46,733	$44,276	$42,801	$44,160
Overnight Cost	$446,414	$417,891	$417,889	$423,115	$259,704	$239,982	$240,458	$243,766
IDC	$12,286	$11,499	$11,501	$11,643	$7,124	$6,584	$6,597	$6,687
Total Project Cost	$458,700	$429,390	$429,390	$434,758	$266,828	$246,566	$247,055	$250,454
Total Project Cost ($/kW)	**$635.05**	**$599.66**	**$618.14**	**$610.66**	**$738.83**	**$688.68**	**$711.30**	**$703.87**

Capital Cost Comparison

Brattle CONE CT Capital Cost ($000) (One CT - Evaporative Coolers)

CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Net Capacity (MW) (ICAP)	352.000	355.000	321.000	344.000
Equipment and EPC	$244,539	$227,622	$193,912	$236,365
Non - EPC	$71,432	$69,153	$62,625	$68,299
Overnight Cost	$315,971	$296,775	$256,537	$304,664
IDC	$14,086	$13,365	$11,440	$13,587
Total Project Cost	$330,057	$310,140	$267,977	$318,251
Total Project Cost ($/kW)	**$937.66**	**$873.63**	**$834.82**	**$925.15**
Total Project Cost ($/kW) (Combined Cycle)	**$950.76**	**$841.37**	**$887.06**	**$928.53**

Capital Cost Comparison

- **IMM CONE CT total project cost (TPC) is 68.5 percent of Brattle TPC on a $/kW basis.**
- **IMM lower cost is due to economies of scale with two CT configuration.**
- **IMM CONE single CT with evaporative coolers TPC is 79.6 percent of Brattle TPC on a $/kW basis.**
- **Brattle EPC cost $91/kW higher than IMM EPC cost.**
- **Brattle gas interconnection cost is 3.4 x IMM cost.**
- **Brattle line size is 20 to 24 inch whereas 10 to 12 inch would work.**

Capital Cost Comparison

IMM CONE CT Capital Cost Detail ($000) (Inlet Air Chillers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Plant Proper EPC	$385,577	$360,506	$363,347	$366,160	$220,898	$203,117	$205,126	$207,134
State Sales Tax	$465	$435	$435	$440	$269	$248	$249	$252
Electric Interconnect	$15,509	$14,327	$14,024	$14,472	$7,754	$7,164	$7,012	$7,236
Gas Interconnect	$19,670	$18,172	$17,787	$18,355	$9,835	$9,086	$8,893	$9,177
Equipment Spares	$6,294	$6,294	$6,294	$6,294	$4,153	$4,153	$4,153	$4,153
Owner's Contingency	$9,639	$9,013	$9,084	$9,154	$5,522	$5,078	$5,128	$5,178
Mobilization and Startup	$3,137	$3,137	$3,137	$3,137	$2,070	$2,070	$2,070	$2,070
Land Purchase	$3,236	$2,178	$1,200	$1,600	$1,618	$1,089	$600	$800
Development Expenses	$7,078	$7,078	$7,078	$7,078	$7,078	$7,078	$7,078	$7,078
Legal Fees	$2,199	$2,199	$2,199	$2,199	$2,199	$2,199	$2,199	$2,199
Financing Fees	$4,771	$4,465	$4,466	$4,521	$2,761	$2,551	$2,557	$2,592
Interest During Construction	$12,480	$11,679	$11,682	$11,826	$7,221	$6,674	$6,688	$6,779
Permits	$2,307	$2,263	$1,998	$2,141	$2,307	$2,263	$1,998	$2,141
Emissions Reduction Credits	$2,237	$2,237	$1,379	$2,237	$1,119	$1,119	$690	$1,119
Initial Fuel Oil Inventory	$2,500	$2,500	$2,500	$2,500	$1,250	$1,250	$1,250	$1,250
Total Project Cost	**$477,100**	**$446,483**	**$446,611**	**$452,116**	**$276,054**	**$255,138**	**$255,691**	**$259,158**

Capital Cost Comparison

IMM CONE CT Capital Cost Detail ($000) (Evaporative Coolers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Plant Proper EPC	$369,725	$345,684	$348,409	$351,106	$212,972	$195,706	$197,657	$199,607
State Sales Tax	$449	$420	$420	$425	$261	$241	$242	$245
Electric Interconnect	$14,822	$13,739	$13,433	$13,874	$7,411	$6,869	$6,717	$6,937
Gas Interconnect	$18,800	$17,425	$17,038	$17,597	$9,400	$8,713	$8,519	$8,798
Equipment Spares	$6,194	$6,194	$6,194	$6,194	$4,103	$4,103	$4,103	$4,103
Owner's Contingency	$9,243	$8,642	$8,710	$8,778	$5,324	$4,893	$4,941	$4,990
Mobilization and Startup	$3,087	$3,087	$3,087	$3,087	$2,045	$2,045	$2,045	$2,045
Land Purchase	$3,236	$2,178	$1,200	$1,600	$1,618	$1,089	$600	$800
Development Expenses	$7,078	$7,078	$7,078	$7,078	$7,078	$7,078	$7,078	$7,078
Legal Fees	$2,149	$2,149	$2,149	$2,149	$2,149	$2,149	$2,149	$2,149
Financing Fees	$4,587	$4,294	$4,294	$4,348	$2,668	$2,466	$2,471	$2,505
Interest During Construction	$12,286	$11,499	$11,501	$11,643	$7,124	$6,584	$6,597	$6,687
Permits	$2,307	$2,263	$1,998	$2,141	$2,307	$2,263	$1,998	$2,141
Emissions Reduction Credits	$2,237	$2,237	$1,379	$2,237	$1,119	$1,119	$690	$1,119
Initial Fuel Oil Inventory	$2,500	$2,500	$2,500	$2,500	$1,250	$1,250	$1,250	$1,250
Total Project Cost	**$458,700**	**$429,390**	**$429,390**	**$434,758**	**$266,828**	**$246,566**	**$247,055**	**$250,454**

Capital Cost Comparison

Brattle CONE CT Capital Cost Detail

	CONE Area			
	1	2	3	4
	EMAAC	SWMAAC	Rest of RTO	WMAAC
Capital Costs (in $millions)	*352 MW*	*355 MW*	*321 MW*	*344 MW*
Owner Furnished Equipment				
Gas Turbines	$74.4	$74.4	$74.4	$74.4
HRSG / SCR	$26.6	$26.6	$0.0	$26.6
Sales Tax	$6.7	$6.1	$4.7	$6.4
Total Owner Furnished Equipment	**$107.7**	**$107.1**	**$79.1**	**$107.4**
EPC Costs				
Equipment				
Condenser	$0.0	$0.0	$0.0	$0.0
Steam Turbines	$0.0	$0.0	$0.0	$0.0
Other Equipment	$25.7	$25.6	$28.5	$25.7
Construction Labor	$43.5	$31.8	$31.0	$37.6
Other Labor	$16.5	$15.3	$12.9	$16.0
Materials	$6.6	$6.5	$6.5	$6.6
Sales Tax	$2.1	$1.9	$2.2	$2.0
EPC Contractor Fee	$20.2	$18.8	$16.0	$19.5
EPC Contingency	$22.2	$20.7	$17.6	$21.5
Total EPC Costs	**$136.8**	**$120.5**	**$114.8**	**$128.9**
Non-EPC Costs				
Project Development	$12.2	$11.4	$9.7	$11.8
Mobilization and Start-Up	$2.4	$2.3	$1.9	$2.4
Net Start-Up Fuel Costs	$2.6	$1.7	$0.2	$0.6
Electrical Interconnection	$7.8	$7.8	$7.1	$7.6
Gas Interconnection	$29.1	$29.1	$29.1	$29.1
Land	$0.4	$0.7	$0.3	$0.5
Fuel Inventories	$3.0	$3.0	$2.7	$2.9
Non-Fuel Inventories	$1.2	$1.1	$1.0	$1.2
Owner's Contingency	$4.7	$4.6	$4.2	$4.5
Emission Reduction Credit	$0.0	$0.0	$0.0	$0.0
Financing Fees	$8.0	$7.5	$6.5	$7.7
Total Non-EPC Costs	**$71.4**	**$69.2**	**$62.6**	**$68.3**
Total Capital Costs	**$316.0**	**$296.8**	**$256.5**	**$304.7**
Overnight Capital Costs ($million)	**$316**	**$297**	**$257**	**$305**
Overnight Capital Costs ($/kW)	**$898**	**$836**	**$799**	**$886**
Installed Cost ($/kW)	**$938**	**$874**	**$835**	**$925**

First Year Fixed Expenses Comparison

IMM First Year Fixed Expenses ($000) (Inlet Air Chillers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Site O&M Labor	$1,527.3	$1,428.0	$1,439.2	$1,450.4	$1,527.3	$1,428.0	$1,439.2	$1,450.4
BOP O&M Parts and Labor	$672.7	$629.0	$633.9	$638.8	$443.8	$415.0	$418.2	$421.5
LTSA Fixed Fee	$264.9	$264.9	$264.9	$264.9	$264.9	$264.9	$264.9	$264.9
VOM Major Maintenance	$9,139.6	$9,316.2	$9,492.8	$9,227.9	$4,569.8	$4,658.1	$4,746.4	$4,613.9
Electric Purchases	$274.0	$274.0	$274.0	$274.0	$180.8	$180.8	$180.8	$180.8
Employee Training	$99.3	$99.3	$99.3	$99.3	$99.3	$99.3	$99.3	$99.3
O&M Management Fee	$146.0	$146.0	$146.0	$146.0	$146.0	$146.0	$146.0	$146.0
Insurance	$2,137.6	$1,998.7	$2,009.4	$2,028.6	$1,214.5	$1,118.8	$1,127.2	$1,139.8
General and Administrative Expenses	$204.1	$204.1	$204.1	$204.1	$204.1	$204.1	$204.1	$204.1
Property Taxes	$1,170.2	$1,039.0	$303.4	$554.3	$677.1	$657.2	$248.0	$452.5
Total Fixed O&M	**$15,635.6**	**$15,399.1**	**$14,867.0**	**$14,888.2**	**$9,327.6**	**$9,172.1**	**$8,874.0**	**$8,973.1**
Total Fixed O&M (No Major Maintenance)	**$6,496.1**	**$6,082.9**	**$5,374.2**	**$5,660.4**	**$4,757.8**	**$4,514.0**	**$4,127.6**	**$4,359.2**

IMM First Year Fixed Expenses ($000) (Evaporative Coolers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Site O&M Labor	$1,527.3	$1,428.0	$1,439.2	$1,450.4	$1,527.3	$1,428.0	$1,439.2	$1,450.4
BOP O&M Parts and Labor	$622.7	$579.0	$583.9	$588.8	$418.8	$390.0	$393.2	$396.5
LTSA Fixed Fee	$264.9	$264.9	$264.9	$264.9	$264.9	$264.9	$264.9	$264.9
VOM Major Maintenance	$9,051.3	$9,316.2	$9,404.5	$9,227.9	$4,522.6	$4,657.0	$4,701.3	$4,603.5
Electric Purchases	$274.0	$274.0	$274.0	$274.0	$180.8	$180.8	$180.8	$180.8
Employee Training	$89.3	$89.3	$89.3	$89.3	$89.3	$89.3	$89.3	$89.3
O&M Management Fee	$146.0	$146.0	$146.0	$146.0	$146.0	$146.0	$146.0	$146.0
Insurance	$2,049.9	$1,917.3	$1,927.5	$1,946.0	$1,170.7	$1,078.2	$1,086.2	$1,098.4
General and Administrative Expenses	$204.1	$204.1	$204.1	$204.1	$204.1	$204.1	$204.1	$204.1
Property Taxes	$1,124.4	$998.6	$291.5	$532.7	$654.2	$636.9	$242.0	$441.7
Total Fixed O&M	**$15,353.8**	**$15,217.3**	**$14,624.9**	**$14,724.0**	**$9,178.7**	**$9,075.1**	**$8,747.0**	**$8,875.6**
Total Fixed O&M (No Major Maintenance)	**$6,302.6**	**$5,901.1**	**$5,220.4**	**$5,496.1**	**$4,656.1**	**$4,418.1**	**$4,045.7**	**$4,272.1**

First Year Fixed Expenses Comparison

Brattle First Year Fixed Expenses

O&M Costs	CONE Area 1 EMAAC *352 MW*	2 SWMAAC *355 MW*	3 Rest of RTO *321 MW*	4 WMAAC *344 MW*
Fixed O&M (2022$ million)				
LTSA	$0.270	$0.270	$0.270	$0.270
Labor	$1.079	$1.176	$0.820	$0.869
Maintenance and Minor Repairs	$0.518	$0.534	$0.473	$0.482
Administrative and General	$0.231	$0.247	$0.190	$0.198
Asset Management	$0.518	$0.565	$0.394	$0.418
Property Taxes	$0.256	$4.070	$1.843	$0.251
Insurance	$1.896	$1.781	$1.539	$1.828
Firm Gas Contract	$0.000	$0.000	$0.000	$0.000
Working Capital	$0.035	$0.033	$0.028	$0.034
Total Fixed O&M (2022$ million)	**$4.803**	**$8.676**	**$5.557**	**$4.350**

First Year Fixed Expenses Comparison

- **IMM CONE CT includes major maintenance in fixed O&M.**
  - **If major maintenance is removed by IMM total fixed expenses are close to Brattle total fixed expenses.**
- **Brattle SWMACC annual property tax $4.1 million while IMM is $640,000.**

Revenue Requirements Comparison

CONE CT Gross Revenue Requirements 2022 Capacity Year ($/MW-Year)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Current RPM	$133,144	$140,953	$133,016	$134,124	$133,144	$140,953	$133,016	$134,124
Brattle Study (One CT with Evaporative Coolers)	$106,400	$108,400	$98,200	$103,800	$106,400	$108,400	$98,200	$103,800
IMM Gross CONE CT	Inlet Air Chillers				Inlet Air Chillers			
No Parent Co. with NOL carryforwards	$101,530	$97,219	$99,558	$98,176	$118,346	$112,261	$115,151	$113,916
Parent Co. no NOL carryforwards	$89,735	$86,275	$87,606	$86,377	$104,668	$99,731	$101,446	$100,366
IMM Gross CONE CT	Inlet Air Evaporative Coolers				Inlet Air Evaporative Coolers			
No Parent Co. with NOL carryforwards	$104,724	$100,091	$102,507	$101,129	$122,286	$115,752	$118,760	$117,491
Parent Co. no NOL carryforwards	$92,822	$89,105	$90,439	$89,224	$108,405	$103,109	$104,861	$103,759

Revenue Requirements Comparison

CONE CT Net Revenue Requirements 2022 Capacity Year ($/MW-Day) (Inlet Air Chillers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Brattle								
Gross CONE					$292	$297	$269	$284
EAS Revenues					$58	$131	$47	$77
Net CONE					**$234**	**$166**	**$222**	**$207**
IMM - No Parent Co. with NOL carryforwards								
Gross CONE	$278.17	$266.35	$272.76	$268.97	$324.24	$307.56	$315.48	$312.10
EAS Revenues (Three Year Average)	$110.59	$197.13	$151.31	$187.42	$110.59	$197.13	$151.31	$187.42
Net CONE	**$167.58**	**$69.22**	**$121.45**	**$81.55**	**$213.65**	**$110.43**	**$164.17**	**$124.68**
IMM - Parent Co. with no NOL carryforwards								
Gross CONE	$245.85	$236.37	$240.02	$236.65	$286.76	$273.24	$277.93	$274.97
EAS Revenues (Three Year Average)	$110.59	$197.13	$151.31	$187.42	$110.59	$197.13	$151.31	$187.42
Net CONE	**$135.26**	**$39.24**	**$88.71**	**$49.23**	**$176.17**	**$76.11**	**$126.62**	**$87.55**

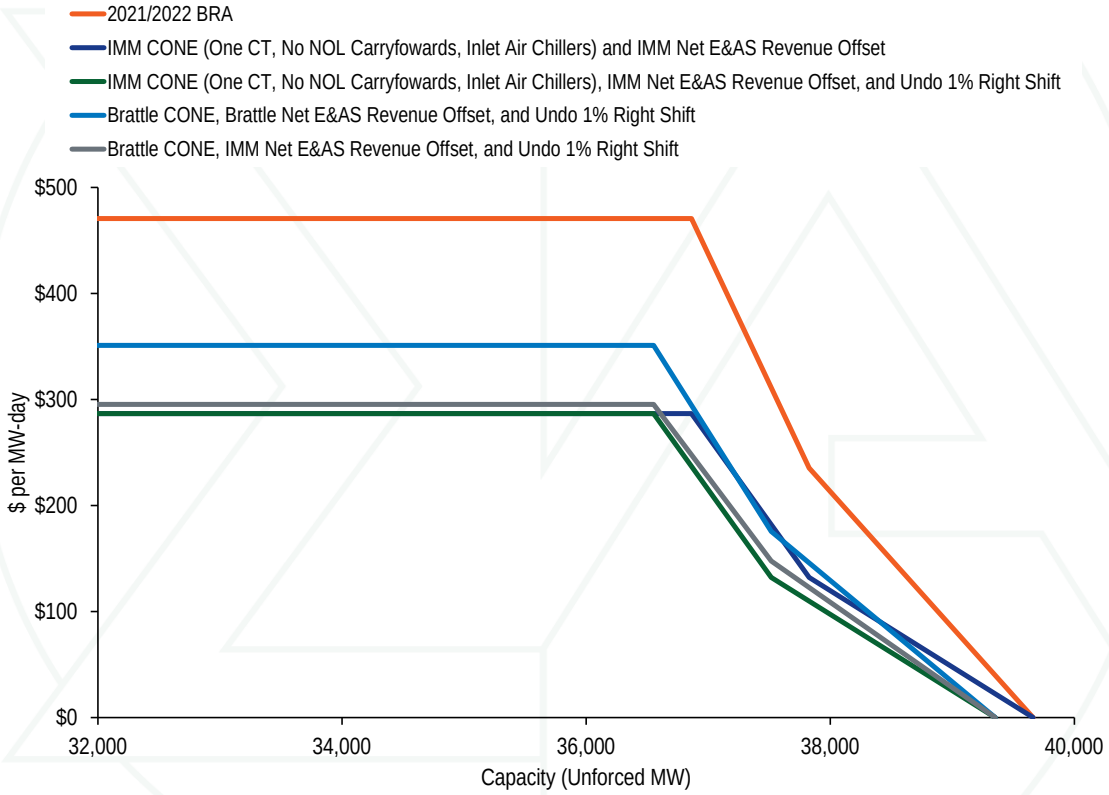
CONE CT Net Revenue Requirements 2022 Capacity Year ($/MW-Day) (Evaporative Coolers)

Configuration	Two CTs				One CT			
CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
Brattle								
Gross CONE					$292	$297	$269	$284
EAS Revenues					$58	$131	$47	$77
Net CONE					**$234**	**$166**	**$222**	**$207**
IMM - No Parent Co. with NOL carryforwards								
Gross CONE	$286.91	$274.22	$280.84	$277.07	$335.03	$317.13	$325.37	$321.89
EAS Revenues (Three Year Average)	$94.82	$167.44	$136.00	$151.51	$94.82	$167.44	$136.00	$151.51
Net CONE	**$192.09**	**$106.78**	**$144.84**	**$125.56**	**$240.21**	**$149.69**	**$189.37**	**$170.38**
Net CONE - TIC Advantage Over Evaporative Coolers	**$24.52**	**$37.56**	**$23.39**	**$44.00**	**$26.56**	**$39.25**	**$25.20**	**$45.71**
IMM - Parent Co. with no NOL carryforwards								
Gross CONE	$254.31	$244.12	$247.78	$244.45	$297.00	$282.49	$287.29	$284.27
EAS Revenues (Three Year Average)	$94.82	$167.44	$136.00	$151.51	$94.82	$167.44	$136.00	$151.51
Net CONE	**$159.49**	**$76.68**	**$111.78**	**$92.94**	**$202.18**	**$115.05**	**$151.29**	**$132.76**
Net CONE - TIC Advantage Over Evaporative Coolers	**$24.23**	**$37.44**	**$23.07**	**$43.71**	**$26.01**	**$38.95**	**$24.67**	**$45.21**

Revenue Requirements Comparison

- **Brattle model appears to represent a project with a large parent company to absorb 100 percent of bonus depreciation. (From new tax law.)**
- **IMM has calculated costs:**
  - **with a parent company**
  - **with a project only company with net operating loss carryforwards**
- **Inlet air chillers provide a lower Net CONE over evaporative coolers.**

VRR Curve Comparison for EMAAC



Economic Assumptions Comparison

IMM Economic Assumptions

CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
GDP Deflator (%)	2.50%	2.50%	2.50%	2.50%
EPC Escalation (%) (Materials, Equipment & Labor)	3.00%	3.00%	3.00%	3.00%
Property Tax Escalation (%)	2.50%	2.50%	2.50%	2.50%
ATWAAC (%)	8.52%	8.54%	8.49%	8.49%
Federal Tax Rate (%)	21.0%	21.0%	21.0%	21.0%
State Tax Rate (%)	9.00%	8.25%	9.99%	9.99%
Effective Income Tax Rate (%)	28.11%	27.52%	28.89%	28.89%

Brattle Economic Assumptions

CONE Area	1 - EMAAC	2 - SWMAAC	3 - Rest of RTO	4 - WMAAC
GDP Deflator (%)	2.20%	2.20%	2.20%	2.20%
EPC Escalation (%) (Equipment & Materials)	2.40%	2.40%	2.40%	2.40%
EPC Escalation (%) (Labor)	3.90%	3.90%	3.90%	3.90%
Property Tax Escalation (%)	2.20%	2.20%	2.20%	2.20%
ATWAAC (%)	7.44%	7.44%	7.40%	7.40%
Federal Tax Rate (%)	21.0%	21.0%	21.0%	21.0%
State Tax Rate (%)	9.00%	8.25%	9.99%	9.99%
Effective Income Tax Rate (%)	30.00%	29.25%	30.99%	30.99%

Economic Assumptions Comparison

- **IMM tax advisor concludes that state income tax remains deductible for federal income tax.**
  - **This was agreed to by Brattle.**

Financial Assumptions Comparison

Financial Assumptions

Study	IMM	Brattle
Equity (%):	50%	35%
Debt (%):	50%	65%
Debt Interest Rate (%):	7.0%	6.5%
Target ATIRR (%)	12.00%	12.80%
ATWAAC (%)	8.5%	7.5%
Federal Tax Rate (%)	21.0%	21.0%
NOL Carryforward Limit	80.0%	Unclear
Cap on Interest Deductions (% of EBITDA)	30.0%	Unclear
Debt Term (Yrs.):	20	20
Construction Schedule (Months):	20	20

Financial Assumptions Comparison

- For a stand alone corporation using 100 percent bonus expensing, NOL carryforwards should be used.
- There is a 30 percent of EBITDA limit on loan interest deductions.
- These lost deductions can be carried forward.
- Based on IMM analysis:
  - Limit is exceeded at 55 percent debt for a stand alone corporation.
  - Limit is exceeded in the first operating year at 50 percent debt for structure with a parent company.

Areas for Discussion

- One or two unit CT configuration
- CONE CT financial structure as stand alone project or with parent company
- Brattle study questions
  - 30 percent of EBITDA interest expense limit
  - NOL carryforwards for a stand alone project
  - Manual 21 for ICAP capacity determination

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