

IMM Proposals and Results

2022 Quadrennial Review
February 11, 2022

IMM



Monitoring Analytics

CONE CT and CC Technology

- **IMM cost estimated same designs as Brattle**
 - **CT – Single GE Frame 7HA.02**
 - CT Inlet Air Evaporative Cooling
 - SCR and CO Catalyst
 - **CC – 2x1 and 1x1 Single Shaft GE Frame 7HA.02**
 - CT Inlet Air Evaporative Cooling
 - SCR and CO Catalyst
 - Air Cooled Condenser (ACC)

CONE Financial Structure

- **IMM used Brattle assumptions:**
 - **Equity Percent – 45%**
 - **Debt Percent – 55%**
 - **Target IRR – 12.95%**
 - **Debt Interest Rate- 4.20%**
 - **Asset/Economic Life – 30 Years**
 - **Federal Income Tax rate – 21%**
 - **State Tax Rates**
 - **NJ - 9.0%**
 - **MD – 8.25%**
 - **PA – 9.99%**
 - **Depreciation Effective in 2026**
 - **First Year Bonus 20%**
 - **MACRS – 80%**
 - **Fixed O&M General Escalation – 2.0%**

CT Capital Cost Comparison

CT Capital Costs (000\$) (2021\$)	IMM				Brattle			
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO
Plant ICAP (MW)	362.430	359.402	350.786	357.480	360.589	362.838	352.927	349.94
Plant Proper EPC	\$226,346	\$215,025	\$214,176	\$212,472	\$229,029	\$215,686	\$218,732	\$223,282
Electric Interconnect/System Upgrades	\$7,757	\$7,369	\$7,339	\$7,281	\$6,807	\$6,850	\$6,663	\$6,606
Gas Interconnect	\$18,790	\$17,850	\$17,780	\$17,638	\$37,575	\$37,575	\$37,575	\$37,575
Water and Sewer Connection	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Equipment Spares	\$4,452	\$4,452	\$4,452	\$4,452	\$1,145	\$1,078	\$1,094	\$1,116
Initial Fuel and Other Inventory	\$1,194	\$1,194	\$1,194	\$1,194	\$3,497	\$3,365	\$3,409	\$3,380
Mobilization and Startup	\$2,313	\$2,197	\$2,189	\$2,171	\$2,290	\$2,157	\$2,187	\$2,233
Land Purchase/Land Reservation Payment	\$2,123	\$1,173	\$646	\$862	\$350	\$282	\$156	\$293
Construction Period/Upfront Land Lease	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Decommissioning Bond Costs	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Development Expenses	\$7,093	\$7,093	\$7,093	\$7,093	\$11,451	\$10,784	\$10,937	\$11,164
Legal Fees	\$2,204	\$2,204	\$2,204	\$2,204	\$0	\$0	\$0	\$0
Permits	\$2,570	\$2,055	\$2,055	\$2,055	\$0	\$0	\$0	\$0
Emission Reduction Credits	\$15,320	\$15,171	\$560	\$965	\$0	\$0	\$0	\$0
Financing Fees	\$3,072	\$2,920	\$2,753	\$2,739	\$6,545	\$6,207	\$6,309	\$6,389
Interest During Construction	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Owner's Contingency	\$5,659	\$5,376	\$5,354	\$5,312	\$5,073	\$4,923	\$5,040	\$4,972
Sales Tax	\$299	\$284	\$268	\$267	\$0	\$0	\$0	\$0
Net Start Up Fuel	\$0	\$0	\$0	\$0	\$292	(\$555)	\$978	(\$218)
Total Project Overnight Cost (2021\$)	\$299,191	\$284,362	\$268,063	\$266,703	\$304,054	\$288,352	\$293,080	\$296,793
Total Project Cost (\$/kW)	\$825.51	\$791.21	\$764.18	\$746.06	\$843.22	\$794.71	\$830.43	\$848.12

CT Capital Cost Comparison

- **IMM CONE CT EPC cost is similar to Brattle cost on a \$/kW basis.**
- **Brattle gas interconnection cost 2 x IMM cost.**
- **Brattle did not include Emissions Reductions Credits.**
- **These two items partially offset.**

CT First Year Fixed Expenses Comparison

CT Fixed O&M (000\$) (2026\$)	IMM				Brattle				
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Site O&M Labor		\$1,850	\$1,757	\$1,750	\$1,737	\$1,023	\$1,099	\$782	\$806
O&M Contract Parts and Labor		\$538	\$511	\$509	\$505	\$507	\$519	\$464	\$468
Major Maintenance		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
LTSA Fixed Fee		\$333	\$333	\$333	\$333	\$331	\$331	\$331	\$331
O&M Management Fees		\$162	\$162	\$162	\$162	\$521	\$563	\$390	\$399
Gas Transport Demand Charge		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Electric Purchases		\$305	\$305	\$305	\$305	\$0	\$0	\$0	\$0
Employee Training Expenses		\$110	\$110	\$110	\$110	\$0	\$0	\$0	\$0
Insurance		\$1,422	\$1,352	\$1,347	\$1,337	\$1,990	\$1,888	\$1,918	\$1,943
General and Administrative Expenses		\$226	\$226	\$226	\$226	\$238	\$252	\$197	\$201
Property Lease		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Taxes		\$863	\$716	\$358	\$361	\$324	\$4,188	\$2,223	\$319
Other (Brattle Working Capital)		\$0	\$0	\$0	\$0	\$37	\$35	\$35	\$36
Total Fixed O&M		\$5,808	\$5,472	\$5,099	\$5,074	\$4,971	\$8,875	\$6,340	\$4,503

CT First Year Fixed Expenses Comparison

- **IMM CONE CT site labor higher than Brattle.**
- **Brattle SWMACC and RTO annual property tax higher than IMM.**
- **Most other Fixed O&M line items are similar.**

1x1 CC Capital Cost Comparison

CC Capital Costs (000\$) (2021\$)	IMM - 1 on 1 CC ACC				Brattle - 1 on 1 CC ACC				
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Plant ICAP (MW)		552.069	548.171	536.208	545.146	592.612	596.210	580.120	574.924
Plant Proper EPC		\$616,440	\$543,455	\$553,157	\$563,570	\$516,656	\$463,330	\$478,929	\$496,560
Electric Interconnect/System Upgrades		\$11,893	\$10,930	\$10,591	\$10,671	\$11,188	\$11,256	\$10,952	\$10,854
Gas Interconnect		\$18,790	\$17,850	\$17,780	\$17,638	\$20,795	\$20,795	\$20,795	\$20,795
Water and Sewer Connection		\$4,679	\$4,312	\$4,215	\$4,219	\$0	\$0	\$0	\$0
Equipment Spares		\$5,248	\$5,226	\$5,157	\$5,209	\$2,583	\$2,317	\$2,395	\$2,483
Initial Fuel and Other Inventory		\$1,194	\$1,194	\$1,194	\$1,194	\$3,497	\$0	\$3,409	\$3,380
Mobilization and Startup		\$3,721	\$3,430	\$3,353	\$3,356	\$5,167	\$4,633	\$4,789	\$4,966
Land Purchase/Land Reservation Payment		\$3,185	\$1,759	\$969	\$1,292	\$1,400	\$1,128	\$624	\$1,172
Construction Period/Upfront Land Lease		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Decommissioning Bond Costs		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Development Expenses		\$9,457	\$9,457	\$9,457	\$9,457	\$25,833	\$23,166	\$23,946	\$24,828
Legal Fees		\$2,834	\$2,834	\$2,834	\$2,834	\$0	\$0	\$0	\$0
Permits		\$2,158	\$2,149	\$2,121	\$2,142	\$0	\$0	\$0	\$0
Emission Reduction Credits		\$15,126	\$14,806	\$807	\$1,385	\$0	\$0	\$0	\$0
Financing Fees		\$7,180	\$6,380	\$6,324	\$6,441	\$12,904	\$11,527	\$12,040	\$12,419
Interest During Construction		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Owner's Contingency		\$15,411	\$13,586	\$13,829	\$14,089	\$5,177	\$4,489	\$5,064	\$5,032
Sales Tax		\$718	\$638	\$632	\$644	\$0	\$0	\$0	\$0
Net Start Up Fuel		\$0	\$0	\$0	\$0	(\$5,750)	(\$7,180)	(\$3,610)	(\$5,580)
Total Project Overnight Cost (2021\$)		\$718,034	\$638,006	\$632,421	\$644,142	\$599,450	\$535,461	\$559,333	\$576,909
Total Project Cost (\$/kW)		\$1,300.62	\$1,163.88	\$1,179.43	\$1,181.59	\$1,011.54	\$898.11	\$964.17	\$1,003.45

2x1 CC Capital Cost Comparison

CC Capital Costs (000\$) (2021\$)	IMM - 2 on 1 CC ACC				Brattle - 1 on 1 CC ACC			
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO
Plant ICAP (MW)	1,104.138	1,096.342	1,072.416	1,090.292	592.612	596.210	580.120	574.924
Plant Proper EPC	\$876,907	\$818,828	\$811,444	\$805,324	\$516,656	\$463,330	\$478,929	\$496,560
Electric Interconnect/System Upgrades	\$24,498	\$22,675	\$22,462	\$22,261	\$11,188	\$11,256	\$10,952	\$10,854
Gas Interconnect	\$26,478	\$24,507	\$24,277	\$24,060	\$20,795	\$20,795	\$20,795	\$20,795
Water and Sewer Connection	\$7,218	\$6,681	\$6,618	\$6,559	\$0	\$0	\$0	\$0
Equipment Spares	\$8,097	\$8,097	\$8,097	\$8,097	\$2,583	\$2,317	\$2,395	\$2,483
Initial Fuel and Other Inventory	\$2,387	\$2,387	\$2,387	\$2,387	\$3,497	\$0	\$3,409	\$3,380
Mobilization and Startup	\$5,741	\$5,314	\$5,264	\$5,217	\$5,167	\$4,633	\$4,789	\$4,966
Land Purchase/Land Reservation Payment	\$5,308	\$2,932	\$1,615	\$2,154	\$1,400	\$1,128	\$624	\$1,172
Construction Period/Upfront Land Lease	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Decommissioning Bond Costs	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Development Expenses	\$9,457	\$9,457	\$9,457	\$9,457	\$25,833	\$23,166	\$23,946	\$24,828
Legal Fees	\$2,834	\$2,834	\$2,834	\$2,834	\$0	\$0	\$0	\$0
Permits	\$3,330	\$3,330	\$3,330	\$3,330	\$0	\$0	\$0	\$0
Emission Reduction Credits	\$31,157	\$30,715	\$1,712	\$2,888	\$0	\$0	\$0	\$0
Financing Fees	\$10,367	\$9,689	\$9,300	\$9,249	\$12,904	\$11,527	\$12,040	\$12,419
Interest During Construction	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Owner's Contingency	\$21,923	\$20,471	\$20,286	\$20,133	\$5,177	\$4,489	\$5,064	\$5,032
Sales Tax	\$1,037	\$969	\$930	\$925	\$0	\$0	\$0	\$0
Net Start Up Fuel	\$0	\$0	\$0	\$0	(\$5,750)	(\$7,180)	(\$3,610)	(\$5,580)
Total Project Overnight Cost (2021\$)	\$1,036,739	\$968,885	\$930,015	\$924,874	\$599,450	\$535,461	\$559,333	\$576,909
Total Project Cost (\$/kW)	\$938.96	\$883.74	\$867.21	\$848.28	\$1,011.54	\$898.11	\$964.17	\$1,003.45

CC Capital Cost Comparison

- **IMM CONE 2x1 CC costs are lower than Brattle 1x1 CC costs on a \$/kW basis due to the 2x1 CC economies of scale compared to the 1x1 CC design.**
- **IMM CONE 1x1 CC costs are higher than Brattle 1x1 CC on a \$/kW basis by 18-30 percent.**
- **Brattle reduced the gas interconnection cost for the CC by 50 percent compared to the CT assuming a second power block would be built.**
- **Brattle did not include Emissions Reductions Credits.**

1x1 CC First Year Fixed Expenses Comparison

CC Fixed O&M (000\$) (2026\$) PJM LDA	IMM - 1 on 1 CC ACC				Brattle - 1 on 1 CC ACC			
	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Site O&M Labor	\$4,971	\$4,601	\$4,558	\$4,517	\$5,460	\$5,857	\$4,170	\$4,297
O&M Contract Parts and Labor	\$1,742	\$1,606	\$1,570	\$1,571	\$5,798	\$5,936	\$5,300	\$5,353
Major Maintenance	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
LTSA Fixed Fee	\$432	\$430	\$424	\$428	\$442	\$442	\$442	\$442
O&M Management Fees	\$355	\$355	\$355	\$355	\$763	\$825	\$571	\$583
Gas Transport Demand Charge	\$0	\$0	\$0	\$0	\$0	\$9,676	\$0	\$0
Electric Purchases	\$203	\$201	\$197	\$200	\$0	\$0	\$0	\$0
Employee Training Expenses	\$142	\$142	\$142	\$142	\$0	\$0	\$0	\$0
Insurance	\$3,631	\$3,215	\$3,266	\$3,323	\$3,898	\$3,487	\$3,638	\$3,753
General and Administrative Expenses	\$1,018	\$1,018	\$1,018	\$1,018	\$1,247	\$1,306	\$1,048	\$1,068
Property Lease	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Taxes	\$2,071	\$1,607	\$1,258	\$1,313	\$1,793	\$7,623	\$4,714	\$1,765
Other (Brattle Working Capital)	\$0	\$0	\$0	\$0	\$72	\$64	\$67	\$69
Total Fixed O&M	\$14,565	\$13,176	\$12,788	\$12,868	\$19,473	\$35,216	\$19,950	\$17,330

2x1 CC First Year Fixed Expenses Comparison

CC Fixed O&M (000\$) (2026\$)	IMM - 2 on 1 CC ACC				Brattle - 1 on 1 CC ACC				
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Site O&M Labor		\$4,971	\$4,601	\$4,558	\$4,517	\$5,460	\$5,857	\$4,170	\$4,297
O&M Contract Parts and Labor		\$2,688	\$2,488	\$2,464	\$2,442	\$5,798	\$5,936	\$5,300	\$5,353
Major Maintenance		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
LTSA Fixed Fee		\$666	\$666	\$666	\$666	\$442	\$442	\$442	\$442
O&M Management Fees		\$355	\$355	\$355	\$355	\$763	\$825	\$571	\$583
Gas Transport Demand Charge		\$0	\$0	\$0	\$0	\$0	\$9,676	\$0	\$0
Electric Purchases		\$417	\$417	\$417	\$417	\$0	\$0	\$0	\$0
Employee Training Expenses		\$142	\$142	\$142	\$142	\$0	\$0	\$0	\$0
Insurance		\$5,213	\$4,868	\$4,824	\$4,787	\$3,898	\$3,487	\$3,638	\$3,753
General and Administrative Expenses		\$1,018	\$1,018	\$1,018	\$1,018	\$1,247	\$1,306	\$1,048	\$1,068
Property Lease		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Taxes		\$2,990	\$2,441	\$1,851	\$1,886	\$1,793	\$7,623	\$4,714	\$1,765
Other (Brattle Working Capital)		\$0	\$0	\$0	\$0	\$72	\$64	\$67	\$69
Total Fixed O&M		\$18,460	\$16,996	\$16,296	\$16,232	\$19,473	\$35,216	\$19,950	\$17,330

CC First Year Fixed Expenses Comparison

- **IMM CONE CC site labor similar to Brattle.**
- **Brattle SWMACC and RTO annual property tax higher than IMM.**
- **Most other Fixed O&M line items are similar.**
- **Brattle included a \$9.7 million/year gas transport demand charge for SWMACC.**

CT Revenue Requirements Comparison: Historic and Forward EAS

CT Revenue Requirement (\$/MW-Day)	IMM				Brattle				
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Gross CONE		\$294.59	\$281.42	\$271.86	\$265.07	\$287.67	\$293.15	\$289.32	\$286.85
IMM EAS Historical (2019-2021)		\$53.34	\$90.20	\$113.72	\$120.71	\$53.34	\$90.20	\$113.72	\$120.71
Net CONE		\$241.25	\$191.22	\$158.14	\$144.36	\$234.33	\$202.95	\$175.60	\$166.14

CT Revenue Requirement (\$/MW-Day)	IMM				Brattle				
	PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Gross CONE		\$294.59	\$281.42	\$271.86	\$265.07	\$287.67	\$293.15	\$289.32	\$286.85
IMM EAS Projected (26/27 DY)		\$85.26	\$153.85	\$217.22	\$233.45	\$85.26	\$153.85	\$217.22	\$233.45
Net CONE		\$209.33	\$127.57	\$54.64	\$31.62	\$202.41	\$139.30	\$72.10	\$53.40

CC Revenue Requirements Comparison: Historic and Forward EAS

CC Revenue Requirement (\$/MW-Day)	IMM - 1 on 1 CC ACC				Brattle - 1 on 1 CC ACC			
PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Gross CONE	\$491.75	\$441.33	\$447.34	\$446.64	\$418.36	\$444.11	\$399.73	\$407.67
IMM EAS Historical (2019-2021)	\$116.47	\$210.05	\$226.67	\$229.38	\$116.47	\$210.05	\$226.67	\$229.38
Net CONE	\$375.28	\$231.28	\$220.67	\$217.26	\$301.89	\$234.06	\$173.06	\$178.29

CC Revenue Requirement (\$/MW-Day)	IMM - 1 on 1 CC ACC				Brattle - 1 on 1 CC ACC			
PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Gross CONE	\$491.75	\$441.33	\$447.34	\$446.64	\$418.36	\$444.11	\$399.73	\$407.67
IMM EAS Projected (26/27 DY)	\$187.56	\$310.89	\$391.44	\$395.46	\$187.56	\$310.89	\$391.44	\$395.46
Net CONE	\$304.19	\$130.44	\$55.90	\$51.18	\$230.80	\$133.22	\$8.29	\$12.21

CC Revenue Requirement (\$/MW-Day)	IMM - 2 on 1 CC ACC				Brattle - 1 on 1 CC ACC			
PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Gross CONE	\$346.88	\$325.09	\$320.22	\$313.27	\$418.36	\$444.11	\$399.73	\$407.67
IMM EAS Historical (2019-2021)	\$116.47	\$210.05	\$226.67	\$229.38	\$116.47	\$210.05	\$226.67	\$229.38
Net CONE	\$230.41	\$115.04	\$93.55	\$83.89	\$301.89	\$234.06	\$173.06	\$178.29

CC Revenue Requirement (\$/MW-Day)	IMM - 2 on 1 CC ACC				Brattle - 1 on 1 CC ACC			
PJM LDA	EMACC	SWMACC	Rest of RTO	WMAAC	EMACC	SWMACC	Rest of RTO	WMAAC
Gross CONE	\$346.88	\$325.09	\$320.22	\$313.27	\$418.36	\$444.11	\$399.73	\$407.67
IMM EAS Projected (26/27 DY)	\$187.56	\$310.89	\$391.44	\$395.46	\$187.56	\$310.89	\$391.44	\$395.46
Net CONE	\$159.32	\$14.20	(\$71.22)	(\$82.19)	\$230.80	\$133.22	\$8.29	\$12.21

Areas for Discussion

- **Emissions Reductions Credits (ERC)**
- **Cost of gas interconnection**
 - **Review validity of future 1 on 1 CC train credit**
- **Site O&M labor assumptions**
- **Asset economic life of 30 years**
- **Inclusion of VOM**

Notes on Using Historical E&AS

- **NJ joined RGGI in 2020**
 - **E&AS for 2019 excludes RGGI costs**
- **VA joined RGGI in 2021**
 - **E&AS for 2019 and 2020 excludes RGGI costs**

Key E&AS Assumptions

- **No 10 percent adder**
- **Unit is dispatched based on short run marginal cost, accounting for start costs**
 - **First against DA prices**
 - **Then against RT prices if not committed DA**
- **CT has a minimum run time of 2 hours**
- **CC has a minimum run time of 4 hours**

Objective of Gross CONE Study

- **Develop an independent determination of CONE CT and CC revenue requirements for the four CONE areas**
- **Participants**
 - **Pasteris Energy, Inc. – Overall coordination, soft cost development, plant performance modeling and proforma**
 - **Stantec – EPC cost estimate, project schedule, drawdown and escalation**
 - **David R. Alexander, Consulting – Emissions Reductions Credits (ERC), permitting and costs.**

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