Quadrennial Review Issues

MIC - Quadrennial Review

June 30, 2025

IMM

Monitoring Analytics

IMM Package

In a well designed market, prices should reflect underlying supply and demand fundamentals

Reference Resource

- **CT with dual fuel capability**
  - The use of CC Gross CONE as the maximum price is a market design choice that is not well supported
- **Forward E&AS**

VRR Curve

- **Maximum price (Point A) should be set at 1.5 *Net CONE**
- **Point B should be 0.5*Maximum Price**
- **Point C should be $0**

Overview of IMM CONE Review Process

- **Monitoring Analytics, LLC (“MA”) retained Pasteris Energy, Inc. to develop the revenue requirements of a new entrant (“CONE”) combustion turbine (“CT”) and combined cycle (“CC”) power plant located in five (5) PJM Locational Deliverability Areas (“LDA”) on a 2028 dollar basis for commercial operation in the 2028-2029 capacity year as part of the PJM RPM 2024 Quad-Review.**

Overview of IMM CONE Review Process

- **Stantec Consulting Services, Inc. (“Stantec”) a power plant design and engineering firm with CT and CC plant design experience was contracted by Pasteris Energy, Inc. to determine the plant proper capital cost estimate for the CONE CT and CC power plant at the five locations within PJM.**
- **Stantec assembled these estimates based upon recent major equipment CT and CC Power Island cost quotes from GE and balance of plant (“BOP”) equipment quotations.**

GE quotes obtained April 21, 2025.

Overview of IMM CONE Review Process

- **The power plant construction estimates were developed based on data from recent actual construction proposals by Stantec and input obtained from multiple construction contractors. For these estimates labor rates and labor productivity for each CONE Area were verified and used to develop the direct and indirect construction costs. The plant proper estimate is an engineering, procurement and construction ("EPC") turnkey cost estimate in overnight mid-year 2028 dollars.**

IMM Gross and Net CONE

	IMM CT Gross & Net CONE					
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED	RTO
Gross CONE (ICAP)	$552	$529	$505	$496	$592	$535
Forward E&AS	$129	$281	$354	$319	$195	$270
Net CONE (ICAP)	$424	$248	$151	$176	$397	$264
Gross CONE (UCAP)	$717	$687	$656	$644	$768	$695
Net CONE (UCAP)	$550	$322	$196	$229	$515	$343

	IMM CC Gross & Net CONE					
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED	RTO
Gross CONE (ICAP)	$648	$594	$591	$581	$743	$631
Forward E&AS	$234	$447	$521	$478	$340	$417
Net CONE (ICAP)	$413	$148	$71	$103	$403	$214
Gross CONE (UCAP)	$800	$734	$730	$717	$917	$780
Net CONE (UCAP)	$510	$182	$87	$127	$497	$265

	IMM COMED Battery Gross CONE	
$ in millions	Conservative	Moderate
Total Project Overnight Cost (2028$)	$436	$342
Total Project Overnight Cost 2028 ($/kW)	$2,178	$1,711
Total Project Installed Cost (2028$)	$472	$371
Total Project Installed Cost 2028 ($/kW)	$2,361	$1,854
Gross CONE (ICAP)	$749	$543

IMM forwards as of May 23, 2025.
IMM did not limit the CT to 40 percent capacity factor.
IMM used $5.30/MWh VOM for the CT ($0.40/MWh consumables + $4.90/MWh major maintenance).
IMM used $2.80/MWh VOM for the CC ($0.60/MWh consumables + $2.20/MWh major maintenance).

CT Unit Details

Model	GE Frame 7HA.03 CT
Description	CT with evaporative coolers, wet compression, SCR for NOx reduction, CO converter, and dual fuel capability
Configuration	1 × 0
Dual-Fuel Capability	Yes
Firm Gas Transportation Contract	No
ICAP by CONE Area (MW)	438 / 435 / 425 / 432 / 427
Net Heat Rate (Btu/kWh)	9,065
Equivalent Availability Factor (EAF)	88.9%

CT Gross CONE Comparison

$ in millions	IMM CT Capital Costs Dual Fuel - GE Frame 7HA.03 (2028$)					Brattle CT Capital Costs Dual Fuel - GE Frame 7HA.03 (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
ICAP (MW)	438	435	425	432	427	392	395	387	383	393
Owner Furnished Equipment (OFE)	$225	$225	$225	$225	$225	$212	$212	$212	$212	$212
EPC Costs	$200	$177	$186	$185	$209	$226	$208	$209	$216	$247
OFE + EPC Costs	$424	$402	$410	$410	$434	$438	$420	$421	$427	$473
Electric Interconnect/System Upgrades	$14	$13	$13	$13	$14	$22	$22	$22	$22	$22
Gas Interconnect	$20	$19	$20	$20	$21	$35	$35	$35	$35	$35
Equipment Spares	$7	$7	$7	$7	$7	$2	$2	$2	$2	$2
Initial Fuel and Other Inventory	$5	$5	$5	$5	$5	$4	$4	$4	$4	$4
Mobilization and Startup	$3	$3	$3	$3	$3	$4	$4	$4	$4	$5
Land Purchase/Land Reservation Payment	$3	$1	$1	$1	$2	$1	$1	$0	$1	$1
Development Expenses	$8	$8	$8	$8	$8	$22	$21	$21	$21	$24
Legal Fees	$3	$3	$3	$3	$3	$0	$0	$0	$0	$0
Permits	$3	$3	$3	$3	$3	$0	$0	$0	$0	$0
Emission Reduction Credits	$43	$43	$1	$1	$1	$0	$0	$0	$0	$0
Financing Fees	$6	$5	$5	$5	$5	$12	$11	$11	$11	$13
Owner's Contingency	$11	$10	$10	$10	$11	$7	$7	$7	$7	$8
Sales Tax	$1	$1	$0	$0	$1	$0	$0	$0	$0	$0
Additional Escalations	$3	$3	$2	$2	$2	-	-	-	-	-
Net Start Up Fuel	-	-	-	-	-	($1)	$0	($2)	($3)	$1
Non-EPC Costs	$127	$123	$80	$80	$84	$109	$108	$105	$105	$114
Total Project Overnight Cost (2028$)	$552	$525	$490	$490	$518	$547	$528	$526	$532	$587
Total Project Overnight Cost 2028 ($/kW)	$1,259	$1,208	$1,154	$1,133	$1,214	$1,395	$1,339	$1,361	$1,390	$1,495
Total Project Installed Cost (2028$)	$607	$577	$542	$541	$572	$672	$651	$648	$655	$722
Total Project Installed Cost 2028 ($/kW)	$1,385	$1,328	$1,275	$1,251	$1,341	$1,715	$1,647	$1,674	$1,710	$1,837

CT Fixed O&M Comparison

$ in millions	IMM CT Fixed O&M - GE Frame 7HA.03 (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Site O&M Labor	$2.2	$2.1	$2.1	$2.1	$2.1
O&M Contract Parts and Labor	$0.7	$0.7	$0.7	$0.7	$0.7
LTSA Fixed Fee	$0.5	$0.5	$0.5	$0.5	$0.5
O&M Management Fees	$0.2	$0.2	$0.2	$0.2	$0.2
Electric Purchases	$0.4	$0.4	$0.4	$0.4	$0.4
Employee Training Expenses	$0.1	$0.1	$0.1	$0.1	$0.1
Insurance	$2.3	$2.2	$2.3	$2.3	$2.4
General and Administrative Expenses	$0.3	$0.3	$0.3	$0.3	$0.3
Property Taxes	$1.5	$1.5	$0.4	$0.4	$0.6
Other	-	-	-	-	-
Total Fixed O&M	$8.3	$8.0	$7.1	$7.0	$7.3

	Brattle CT Fixed O&M - GE Frame 7HA.03 (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Site O&M Labor	$1.2	$1.3	$0.9	$1.0	$1.1
O&M Contract Parts and Labor	$0.5	$0.5	$0.5	$0.5	$0.5
LTSA Fixed Fee	$0.5	$0.5	$0.5	$0.5	$0.5
O&M Management Fees	$0.6	$0.7	$0.5	$0.5	$0.6
Electric Purchases	-	-	-	-	-
Employee Training Expenses	-	-	-	-	-
Insurance	$3.3	$3.2	$3.2	$3.2	$3.5
General and Administrative Expenses	$0.3	$0.3	$0.3	$0.3	$0.3
Property Taxes	$0.5	$6.7	$3.4	$0.6	$0.5
Other	$0.2	$0.2	$0.2	$0.2	$0.2
Total Fixed O&M	$7.0	$13.2	$9.2	$6.8	$7.2

	IMM CT Variable O&M (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Major Maintenance - Starts Based ($/Start)	-	-	-	-	-
Consumables, Waste Disposal, Other VOM ($/MWh)	$0.4	$0.4	$0.4	$0.4	$0.4
Major Maintenance ($/MWh)	$4.9	$4.9	$4.9	$4.9	$4.9

	Brattle CT Variable O&M (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Major Maintenance - Starts Based ($/Start)	$33,007	$33,007	$33,007	$33,007	$33,007
Consumables, Waste Disposal, Other VOM ($/MWh)	$1.1	$1.1	$1.0	$1.1	$1.1
Major Maintenance ($/MWh)	-	-	-	-	-

CC Unit Details

Model	GE Frame 7HA.03 CC
Description	Each CC with a single CT, HRSG, and steam turbine, equipped with CT evaporative cooler and wet compression, SCR for NOx reduction, CO converter, air cooled condensers, duct burners, and dual fuel capability
Configuration	2 trains of 1×1 single shaft
Dual-Fuel Capability	Yes
Firm Gas Transportation Contract	No
ICAP by CONE Area (MW)	1,420 / 1,411 / 1,385 / 1,406 / 1,390
Net Heat Rate (Btu/kWh)	6,564
Equivalent Availability Factor (EAF)	84.4%

CC Gross CONE Comparison

$ in millions	IMM CC Capital Costs Dual Fuel - GE Frame 7HA.03 (2028$)					Brattle CC Capital Costs Firm Gas - GE Frame 7HA.03 (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
ICAP (MW)	1,420	1,411	1,385	1,406	1,390	1,289	1,289	1,276	1,264	1,294
Owner Furnished Equipment (OFE)	$567	$567	$567	$567	$567	$542	$542	$542	$542	$576
EPC Costs	$1,044	$895	$952	$946	$1,135	$1,142	$1,013	$1,014	$1,066	$1,255
OFE + EPC Costs	$1,611	$1,462	$1,519	$1,513	$1,703	$1,684	$1,555	$1,556	$1,608	$1,831
Electric Interconnect/System Upgrades	$40	$36	$37	$37	$42	$72	$72	$71	$70	$72
Gas Interconnect	$28	$26	$27	$27	$30	$49	$49	$49	$49	$49
Water and Sewer Connection	$8	$7	$7	$7	$8	-	-	-	-	-
Equipment Spares	$12	$12	$12	$12	$12	$8	$8	$8	$8	$9
Initial Fuel and Other Inventory	$10	$10	$10	$10	$10	-	-	-	-	-
Mobilization and Startup	$7	$6	$7	$7	$7	$17	$16	$16	$16	$18
Land Purchase/Land Reservation Payment	$9	$5	$3	$4	$7	$6	$6	$3	$6	$7
Development Expenses	$11	$11	$11	$11	$11	$84	$78	$78	$80	$92
Legal Fees	$3	$3	$3	$3	$3	-	-	-	-	-
Permits	$4	$4	$4	$4	$4	-	-	-	-	-
Emission Reduction Credits	$105	$105	$5	$5	$5	$2	$2	$2	$2	$2
Financing Fees	$20	$18	$18	$18	$20	$42	$39	$39	$40	$46
Owner's Contingency	$40	$37	$38	$38	$43	$17	$17	$16	$16	$19
Sales Tax	$2	$2	$2	$2	$2	-	-	-	-	-
Additional Escalations	$21	$19	$16	$16	$19	-	-	-	-	-
Net Start Up Fuel	-	-	-	-	-	($25)	($21)	($26)	($31)	($12)
Non-EPC Costs	$321	$300	$200	$200	$222	$273	$265	$255	$256	$302
Total Project Overnight Cost (2028$)	$1,932	$1,762	$1,719	$1,713	$1,925	$1,956	$1,820	$1,811	$1,864	$2,133
Total Project Overnight Cost 2028 ($/kW)	$1,360	$1,249	$1,241	$1,219	$1,385	$1,517	$1,411	$1,419	$1,476	$1,649
Total Project Installed Cost (2028$)	$2,275	$2,077	$2,037	$2,030	$2,277	$2,487	$2,314	$2,305	$2,372	$2,712
Total Project Installed Cost 2028 ($/kW)	$1,602	$1,472	$1,471	$1,444	$1,639	$1,929	$1,795	$1,806	$1,877	$2,096

CC Fixed O&M Comparison

$ in millions	IMM CC Fixed O&M - GE Frame 7HA.03 (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Site O&M Labor	$5.5	$5.3	$5.4	$5.4	$5.2
O&M Contract Parts and Labor	$3.6	$3.3	$3.4	$3.4	$3.8
LTSA Fixed Fee	$1.1	$1.1	$1.1	$1.1	$1.1
O&M Management Fees	$0.4	$0.4	$0.4	$0.4	$0.4
Electric Purchases	$0.5	$0.5	$0.5	$0.5	$0.5
Employee Training Expenses	$0.2	$0.2	$0.2	$0.2	$0.2
Insurance	$8.6	$7.8	$8.1	$8.1	$9.1
General and Administrative Expenses	$1.3	$1.3	$1.3	$1.3	$1.3
Property Taxes	$5.3	$5.0	$2.4	$2.3	$3.3
Firm Gas Contract	-	-	-	-	-
Other	$0.0	$0.0	$0.0	$0.0	$0.0
Total Fixed O&M	$26.4	$24.8	$22.8	$22.7	$24.9

	Brattle CC Fixed O&M - GE Frame 7HA.03 (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Site O&M Labor	$5.3	$5.7	$3.9	$4.7	$5.1
O&M Contract Parts and Labor	$7.8	$8.0	$7.0	$7.5	$7.7
LTSA Fixed Fee	$1.1	$1.1	$1.1	$1.1	$1.1
O&M Management Fees	$1.7	$1.8	$1.2	$1.4	$1.6
Electric Purchases	-	-	-	-	-
Employee Training Expenses	-	-	-	-	-
Insurance	$11.7	$10.9	$10.9	$11.2	$12.8
General and Administrative Expenses	$1.6	$1.6	$1.6	$1.6	$1.6
Property Taxes	$3.3	$22.9	$12.6	$4.2	$3.1
Firm Gas Contract	$10.7	$20.4	$26.2	$18.7	$8.6
Other	$0.6	$0.5	$0.5	$0.5	$0.6
Total Fixed O&M	$44.0	$73.0	$65.1	$50.9	$42.3

	IMM CC Variable O&M (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Major Maintenance - Starts Based ($/Start)	-	-	-	-	-
Consumables, Waste Disposal, Other VOM ($/MWh)	$0.6	$0.6	$0.6	$0.6	$0.6
Major Maintenance ($/MWh)	$2.2	$2.2	$2.2	$2.2	$2.2

	Brattle CC Variable O&M (2028$)				
	EMAAC	SWMAAC	Rest of RTO	WMAAC	COMED
Major Maintenance - Starts Based ($/Start)	-	-	-	-	-
Consumables, Waste Disposal, Other VOM ($/MWh)	$0.8	$0.8	$0.8	$0.8	$0.8
Major Maintenance ($/MWh)	$1.9	$1.9	$1.9	$1.9	$1.9

COMED Battery

- **Not well supported by the market**
- **In 2024 all PJM batteries had < $0/MWh E&AS and positive ancillary revenue**

	Battery Units in PJM		
	Current	Retired	Total
COMED	7	4	11
PJM (excl. COMED)	27	6	33
Total	34	10	44

VRR Curve

- In a well designed market, prices should reflect underlying supply and demand fundamentals
- The use of CC Gross CONE as the maximum price is a market design choice that is not well supported
- Reference resource should be a CT with dual fuel capability
- Maximum price (Point A) should be set at 1.5 *Net CONE, not to exceed Gross CONE
- Point B should be 0.5*Maximum Price
- Point C should be $0

Core Issue

- Broader goal is to address underlying issue/cause of tight supply-demand conditions in the capacity market.
- The current conditions are not the result of organic load growth.
- The current conditions in the capacity market are almost entirely the result of load additions from data centers, both actual historical and forecast
- This is not a reason to introduce cost of service regulation through an accelerated/distorted version of reliability backstop
- The solution includes:
  - Planning queue for large load additions
  - Large new loads should be added only if they can be served reliably
  - Requirement for large loads to bring your own generation

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