



California ISO
Your Link to Power

California Independent
System Operator Corporation

MRTU

Bid Cap for Start-up and Minimum Load Costs

Ming Yung Hsu
Sr. Market Monitoring Analyst
Dept. of Market Monitoring

Market Surveillance Committee Meeting
February 13, 2007



Background

- **CAISO's MRTU filing allows unit owners to choose from two options for startup and minimum load costs:**
 - Cost-based: Calculated based on spot market fuel costs and fixed unit operating parameters (start-up fuel, heat rate at minimum load, etc.)
 - Bid-based: Resource owner submits bids to be used for six month period
- **MRTU team initially felt that a 6-month election period would be sufficient to limit uncompetitive high bids under bid-based option**
- **CAISO now considering whether bid caps needed under bid-based option to mitigate local market power in chronic load pockets**
- **CAISO has identified 3 bid cap options for initial discussion**



Start-up Bid Cap Options

- **Option A: Start-up time-based / highest startup cost**
- **Option B: Individual generator's actual startup cost * 200%**
- **Option C: Generator Technology-based / typical startup cost * 200%**
- **Variance Option A: Generator Technology-based / highest startup cost**



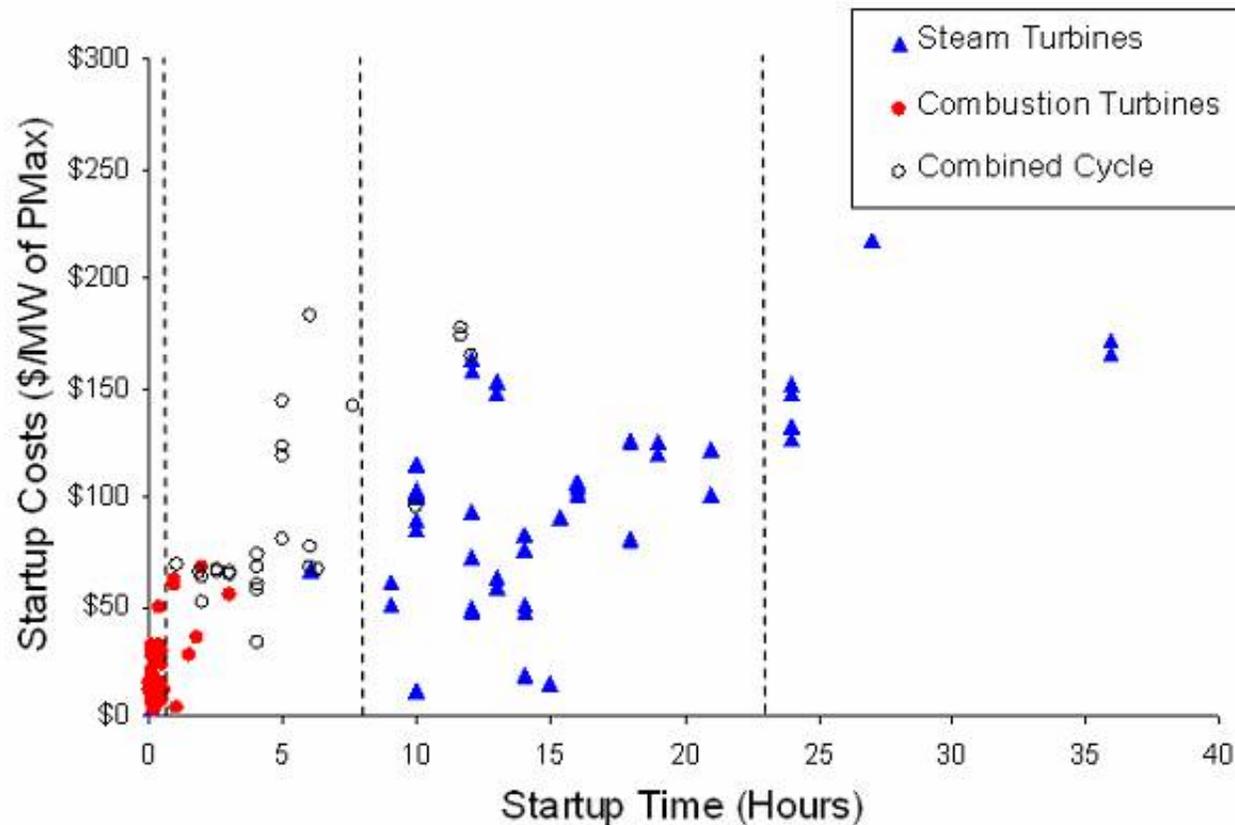
Start-up Bid Cap - Option A

- **Start-up time-based highest startup cost**

- **Startup Costs for each unit (u)**
 - Maximum $Bid_u = PMax_u \times Startup\ Cap_{UStart}$
 - Where $Startup\ Cap_{UStart} =$ Highest startup cost (\$/MW of PMax) of all units within start-up category ($UStart$)
 - Startup categories could be based on unit startup times, e.g.:
 - < 1 hour
 - 1-8 hours
 - 8-23 hours
 - \geq 23 hours

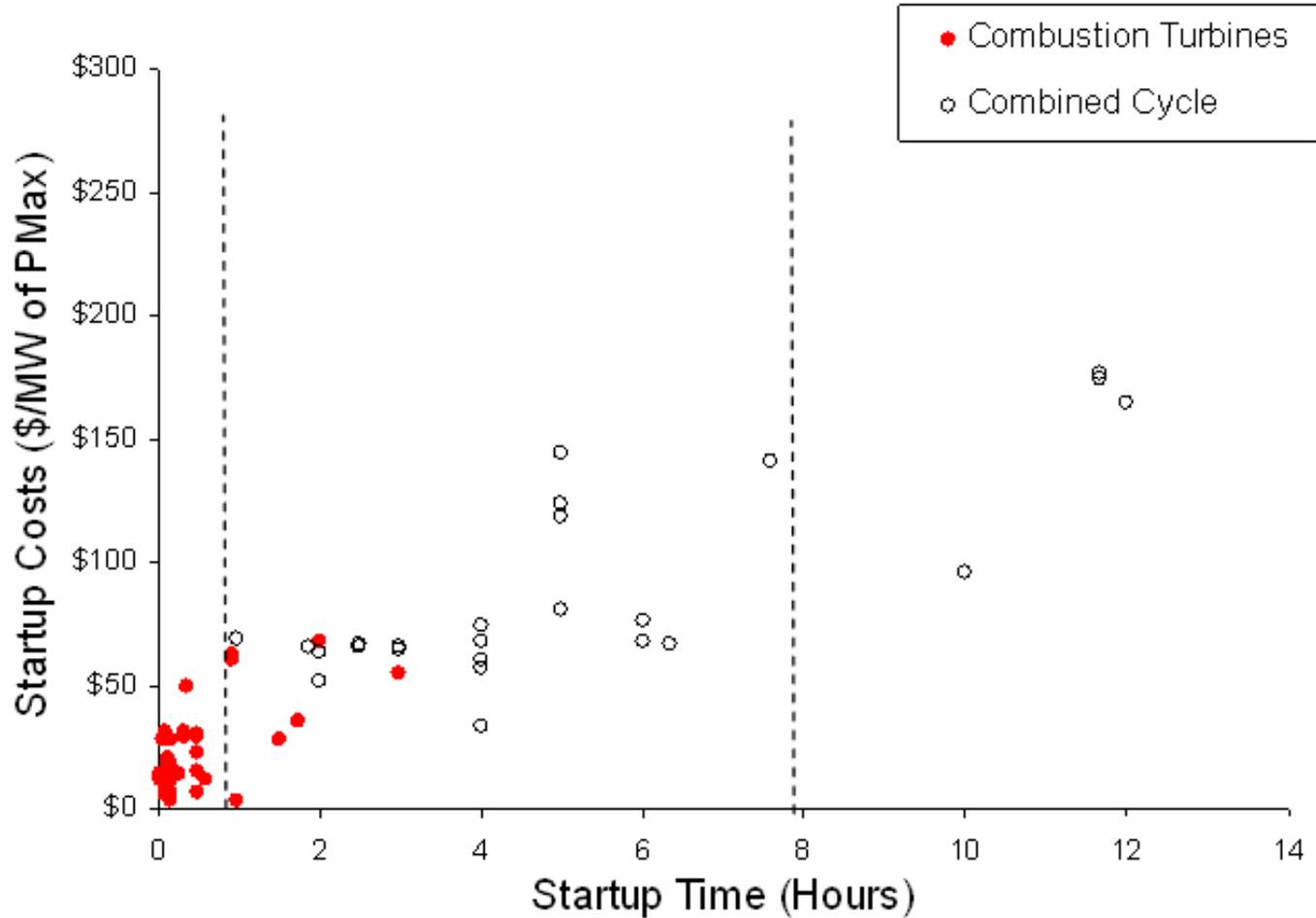


Option A: Gas Unit Start-Up Cost and Start Times



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price and \$85/MWh for auxiliary power.

Option A: Startup Costs and Start Times (CT & CC)



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price and \$85/MWh for auxiliary power.



Start-up Bid Cap - Option B

- **Individual generator's actual startup cost * 200%**

- **Startup Costs for each unit (u)**
 - Maximum $Bid_u = Startup\ Cost_u \times 200\%$
 - Where $Startup\ Cost_u =$ Cost-based calculation of startup cost for unit u based on projected gas price over 6-month period.



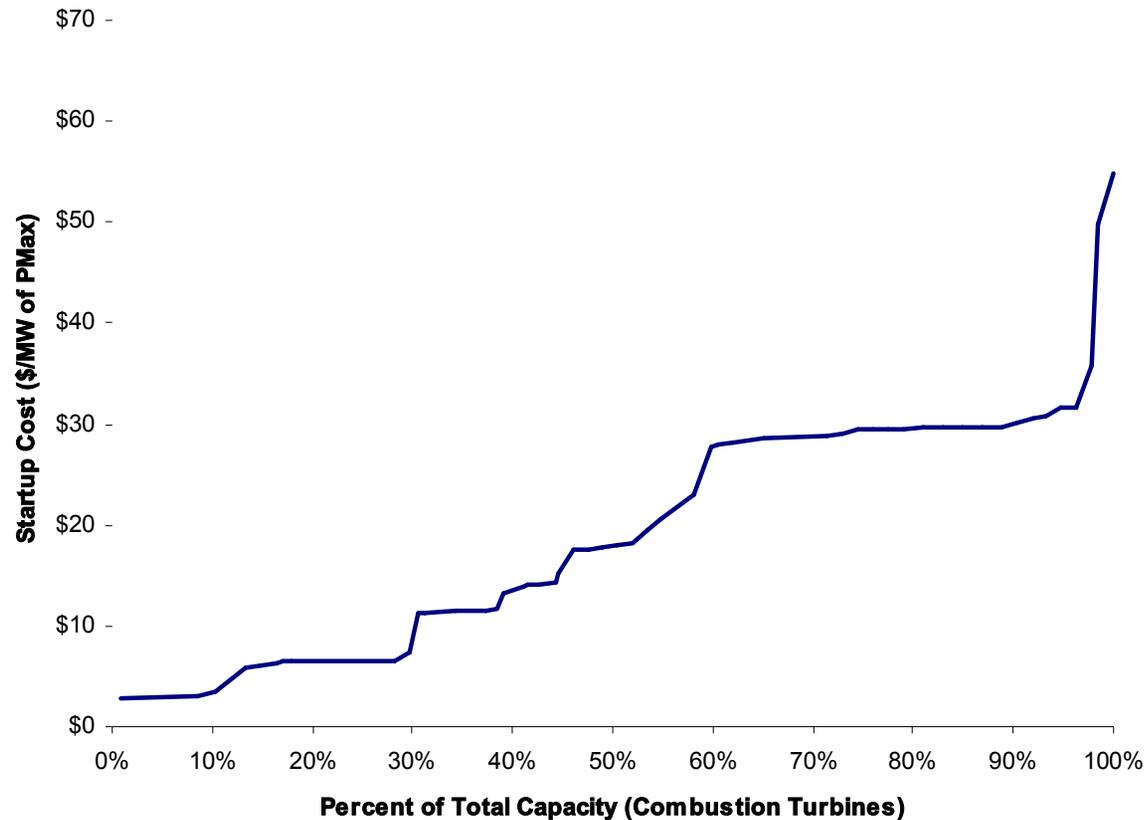
Start-up Bid Cap - Option C

- **Generator Technology-based / typical startup cost * 200%**

- **Startup Costs for each unit (u)**
 - Maximum $Bid_u = P_{max_U} \times Startup\ Cap_{UType}$
 - Where $Startup\ Cap_{UType} = Startup\ cost\ (\$/MW\ of\ P_{Max})\ of\ \underline{typical}\ unit\ within\ unit\ category\ (UType) \times 200\%$
 - Unit categories could be based on unit types and/or start times, e.g.:
 - CTs, Combined cycle and Steam Turbines Units



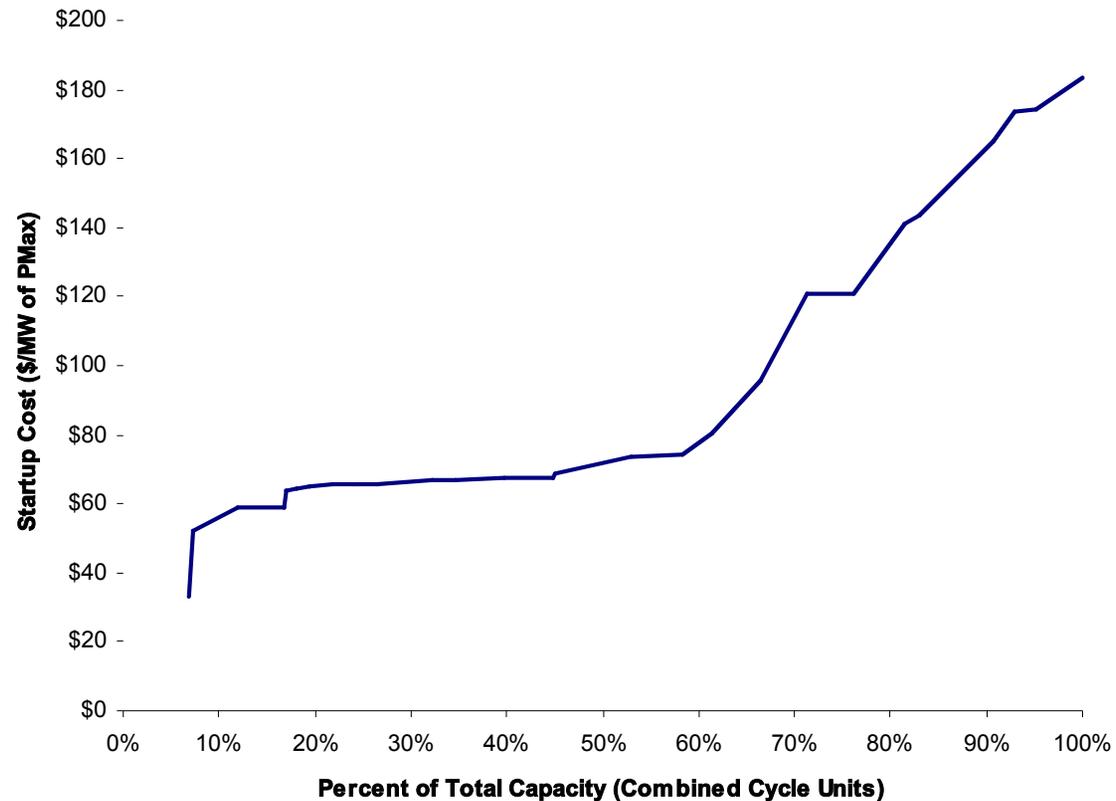
Option C: Start-up Cost Curve – Combustion Turbines Units



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price and \$85/MWh for auxiliary power.



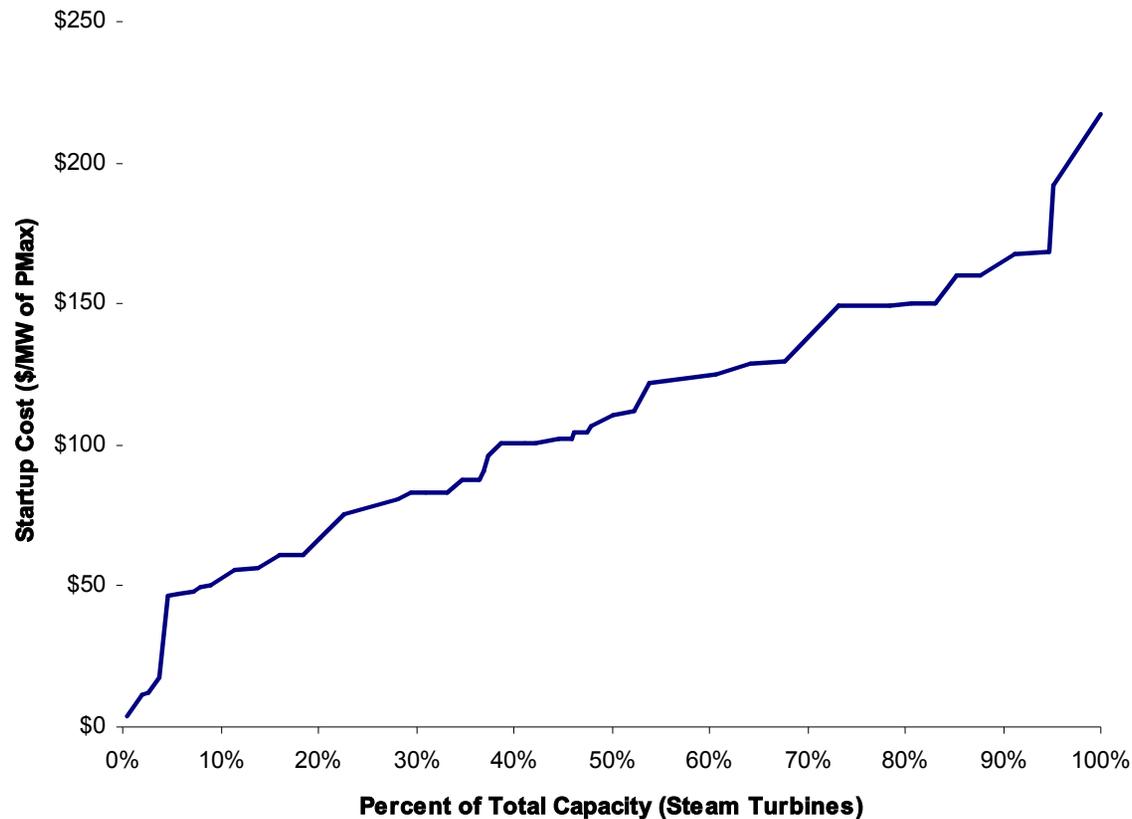
Option C: Start-up Cost Curve – Combined Cycle Units



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price and \$85/MWh for auxiliary power.



Option C: Start-up Cost Curve – Steam Turbines Units



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price and \$85/MWh for auxiliary power.



Summary of Options: Startup Bid Caps

Unit Category		Option A: Maximum Cost by Category	Option B: Actual Startup Cost x 200% (Weighted Average/ Maximum)	Option C: Cost for Typical Unit x 200%
Unit Start Time (Hours)	< 1 hour	\$60		
	1 to 8 hours	\$144		
	8 to 23 hours	\$174		
	>= 23 hours	\$217		
Generator Type	Combustion Turbine	\$55	\$38 / \$110	\$38 (89%)
	Combined Cycle	\$183	\$190/ \$396	\$190 (100%)
	Steam Turbine	\$217	\$225 / \$434	\$225 (100%)



Comparison of Option: Startup Bid Caps

Option Performance	Option A: Maximum Cost by Category	Option B: Actual Startup Cost x 200%	Option C: Cost for Typical Unit x 200%
Effectively Mitigation of Market Power	Medium to High	Medium to High	Medium to High
Limit Implementation Complexity	High	Medium	High
Avoid Over Mitigation and/or Need for Negotiated Option	High	Very High	High



Minimum Load Costs Bid Cap Options

■ Option A: Energy Bid Cap

- Maximum $Bid_u = PMin_u \times MinLoadCap$
- Where $MinLoad\ Cap = CAISO\ System\ Energy\ Bid\ Cap$ (e.g., \$500 → \$1,000)

■ Option B: Individual Unit's Actual Minimum Load Cost *200%

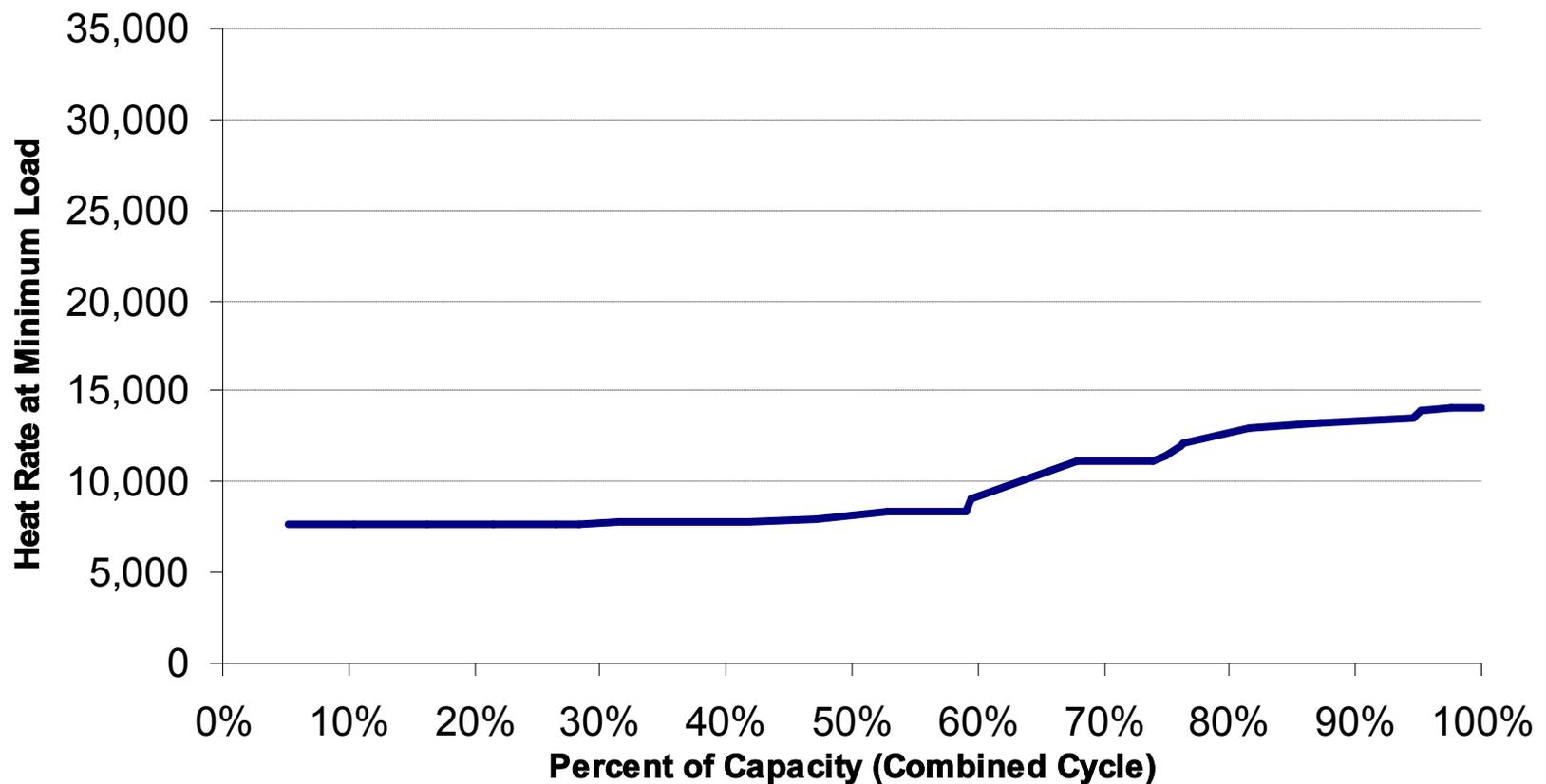
- Maximum $Bid_u = PMin_u \times MinLoadCost_u \times 200\%$
- Where $MinLoadCost_u = Cost\text{-based calculation of operating cost of unit } u \text{ at minimum load } (\$/MWh)$

■ Option C: Generator Technology-based Typical Unit's Minimum Load Cost * 200%

- Maximum $Bid_u = PMin_u \times MinLoadCap_{UType}$
- Where $MinLoadCap_{UType} = Operating\ cost\ of\ typical\ unit\ in\ unit\ category\ (UType) \times 200\%$



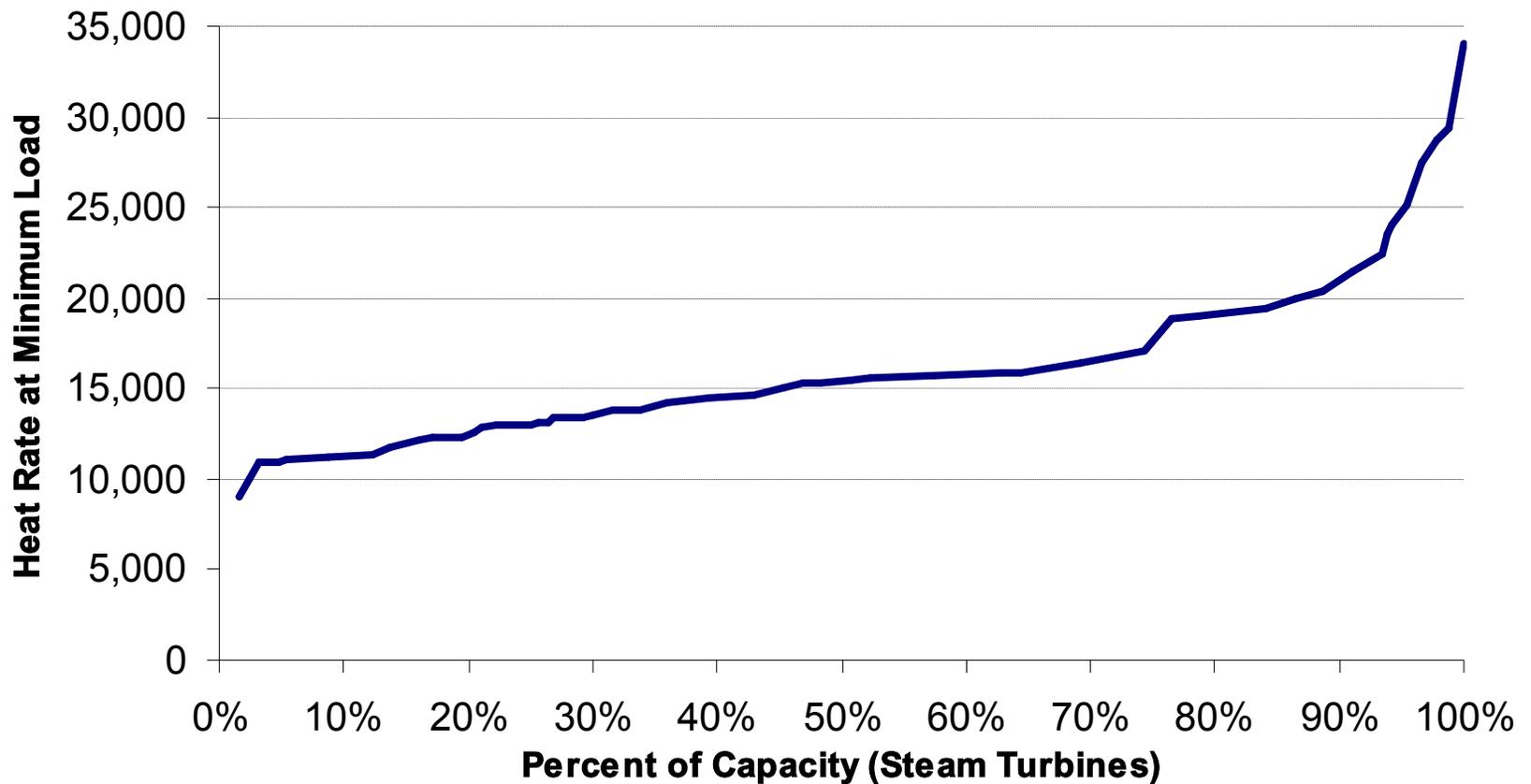
Option C: Minimum Load Heat Rates for Combined Cycle Units



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price.



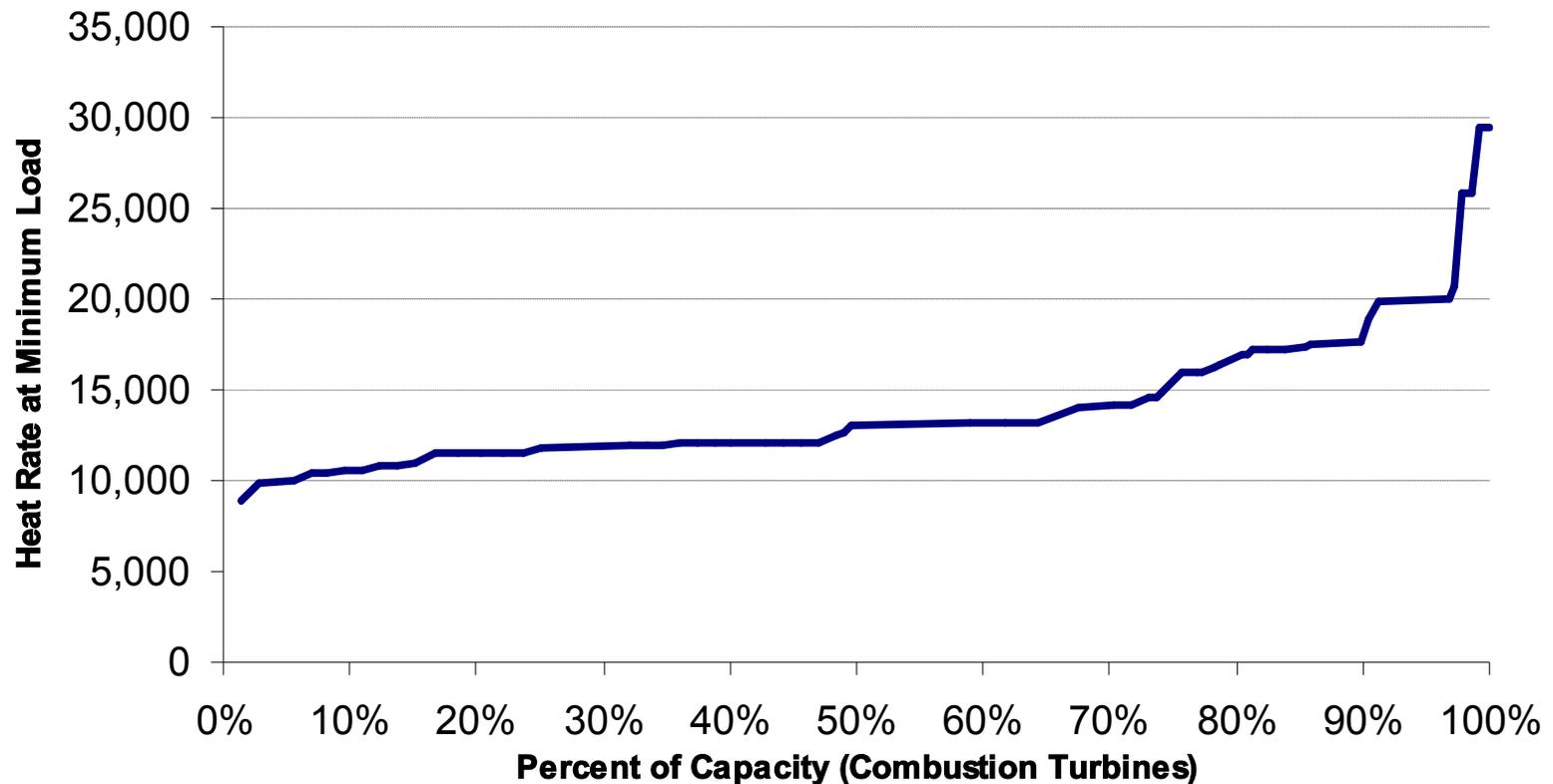
Option C: Minimum Load Heat Rates for Steam Turbine Units



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price.



Option C: Minimum Load Heat Rates for Combustion Turbine Units



Source: Preliminary calculations based on data in CAISO Master File, assuming \$8.5/mmBTU gas price.



Summary of Options: Minimum Load Bid Caps

Unit Category	Option A Energy Bid Cap	Option B Actual minLoad Cost x 200% (Weighted Average/ Maximum)	Option C Cost for Typical Unit x 200%
Combined Cycle	\$500 / \$1,000	\$152 / \$244	\$152 (100%)
Steam Turbine	\$500 / \$1,000	\$249 / \$582	\$249 (98%)
Combustion Turbine	\$500 / \$1,000	\$226 / \$506	\$226 (97%)



Comparison of Option: Minimum Load Bid Caps

Option Performance	Option A: Maximum Cost by Category	Option B: Actual minLoad Cost x 200%	Option C: Cost for Typical Unit x 200%
Effectively Mitigation of Market Power	Low	Medium to High	Medium to High
Limit Implementation Complexity	Very High	Medium	High
Avoid Over Mitigation and/or Need for Negotiated Option	High	High	Medium to High



MSC Inputs

- **Should MRTU include Bid Caps for start-up and minimum load cost bids ?**
- **Comments on options.**
- **Other options?**



Discussion & Next Steps

- **Opportunity for written response to white paper and any specific proposals will be provided**
- **If CAISO pursues proposals further, will schedule additional discussion via conference call and/or future stakeholder meeting**
- **CAISO Master File data may require further review to refine calculations under any specific option.**