Market Monitor Report

MC Webinar

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Combined Cycle Start Cost

- **In Manual 15 (Section 5.4) the CC start cost equation includes two short run marginal costs:**
  - **Start Fuel.**
  - **Station Service.**

Start Fuel

- **The start fuel includes:**
  - **Fuel from first CT fire to ST breaker close.**
    - For any additional CT, fuel from CT fire to HRSG/ST pressure match.
  - **Fuel from last breaker open to fuel valve close.**
    - (Shut down)

Station Service

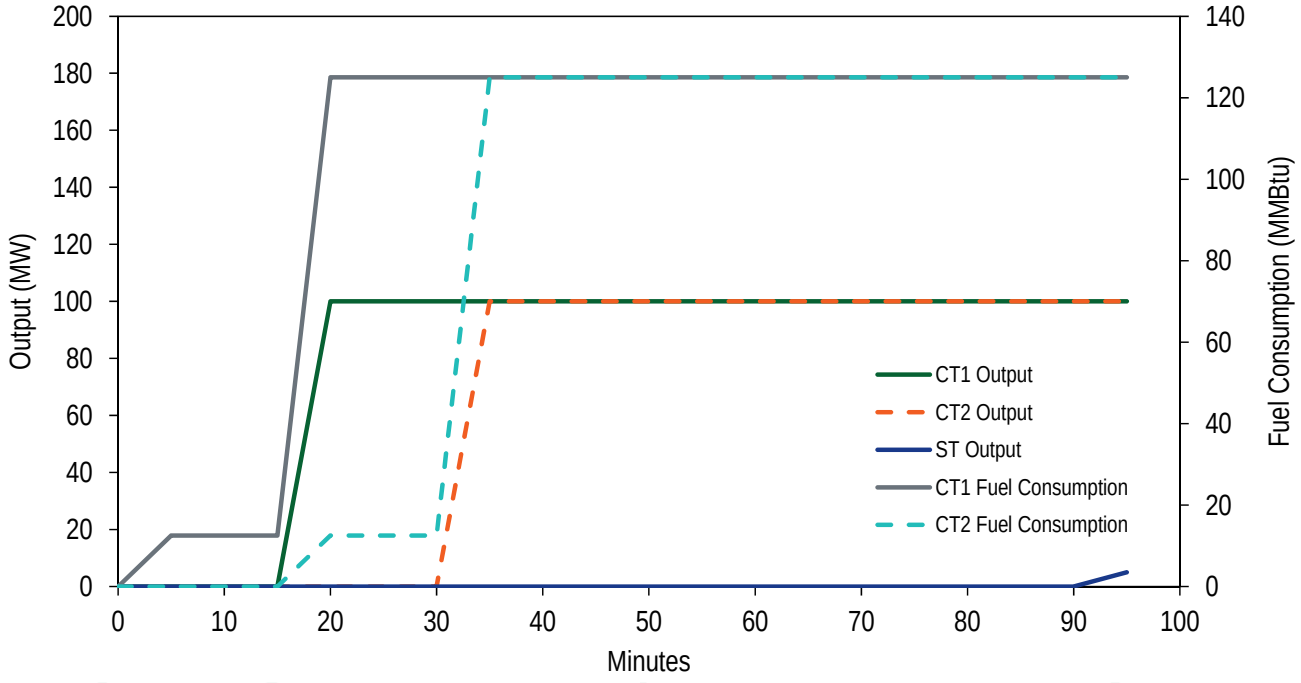
- **The station service includes:**
  - **Station load beyond normal load (shutdown) from start sequence to ST breaker close. Priced at station service rate.**
  - **Station load beyond normal load (shutdown) from last (unit) breaker open. Priced at station service rate.**
  - **Minus net generation from first CT to ST breaker close. Priced at actual cost of the unit.**
    - For any additional CT, net generation from CT breaker close to HRSG/ST pressure match.
  - **Minus net generation during shutdown period. Priced at actual cost of the unit.**

Problem

- **The IMM has identified that a large number of combined cycles do not account for the net generation produced during the CC start in their start cost. This results in overstated start costs.**
- **The start cost must be discounted by the value ($) of the net generation (MWh) produced during the start.**
- **Manual 15 states that the net generation must be "priced at the actual cost of the unit".**

Example

- **2x1 CC Start:**



Example

- **All times from first fire to:**
  - **CT1 synchronized: 15 minutes.**
  - **CT2 synchronized: 30 minutes.**
  - **ST synchronized: 90 minutes.**
- **Fuel consumed: 3,700 MMBtu.**
- **Net generation produced: 242 MWh.**

- **If only the fuel consumed is accounted for, the start cost is overstated by 242 times X, where X is the cost of the unit in dollars per MWh.**

MMU Recommendation

- **Determine the "actual cost" by calculating the implied MMBtu to produce the net generation MWh. The implied MMBtu will be determined using the unit's heat input curve.**

Example

- **The unit produced 242 MWh in 90 minutes. Equivalent to 161 MW on average.**
- **Heat input curve: $0.0001X^2 + 4.5X + 500$.**
- **161 MW consume 1,228 MMBtu/hour.**
- **161 MW over 90 minutes, consume 1,841 MMBtu.**
- **The start cost should be equal to:**
  - **Start Fuel x Fuel Cost + Station Service x Station Service Rate – Net Generation Fuel Equivalent x Fuel Cost.**
  - **Simplified: (Start Fuel - Net Generation Fuel Equivalent) x Fuel Cost + Station Service x Station Service Rate.**

Example

- **Gas Cost: $3/MMBtu**
- **Without accounting for net generation:**
  - **Start Cost = 3,700 MMBtu x $3/MMBtu = $11,100**
- **Accounting for net generation:**
  - **Start Cost = (3,700 MMBtu – 1,841 MMBtu) x $3/MMBtu**
  - **Start Cost = $5,576**
- **Note: Both start costs include station service cost.**

Example

- **Example shows 2X overstatement when net generation is not accounted for.**
- **Preliminary results from units in PJM show similar results.**
- **Data from new 7HA 2x1 CC show 5.6X overstatement if net generation is not accounted for.**

Next Steps

- **The Market Monitor has been contacting and will continue to contact generators in order to request that generators revise all start cost assumptions.**
- **Generators should be proactive and start gathering source of data.**
  - **Start Heat Input (MMBtu).**
  - **Start Times (CT, ST, HRSG pressure match).**
  - **Net Generation (MWh).**
- **Start cost definition should be revised with the implementation of soak time.**

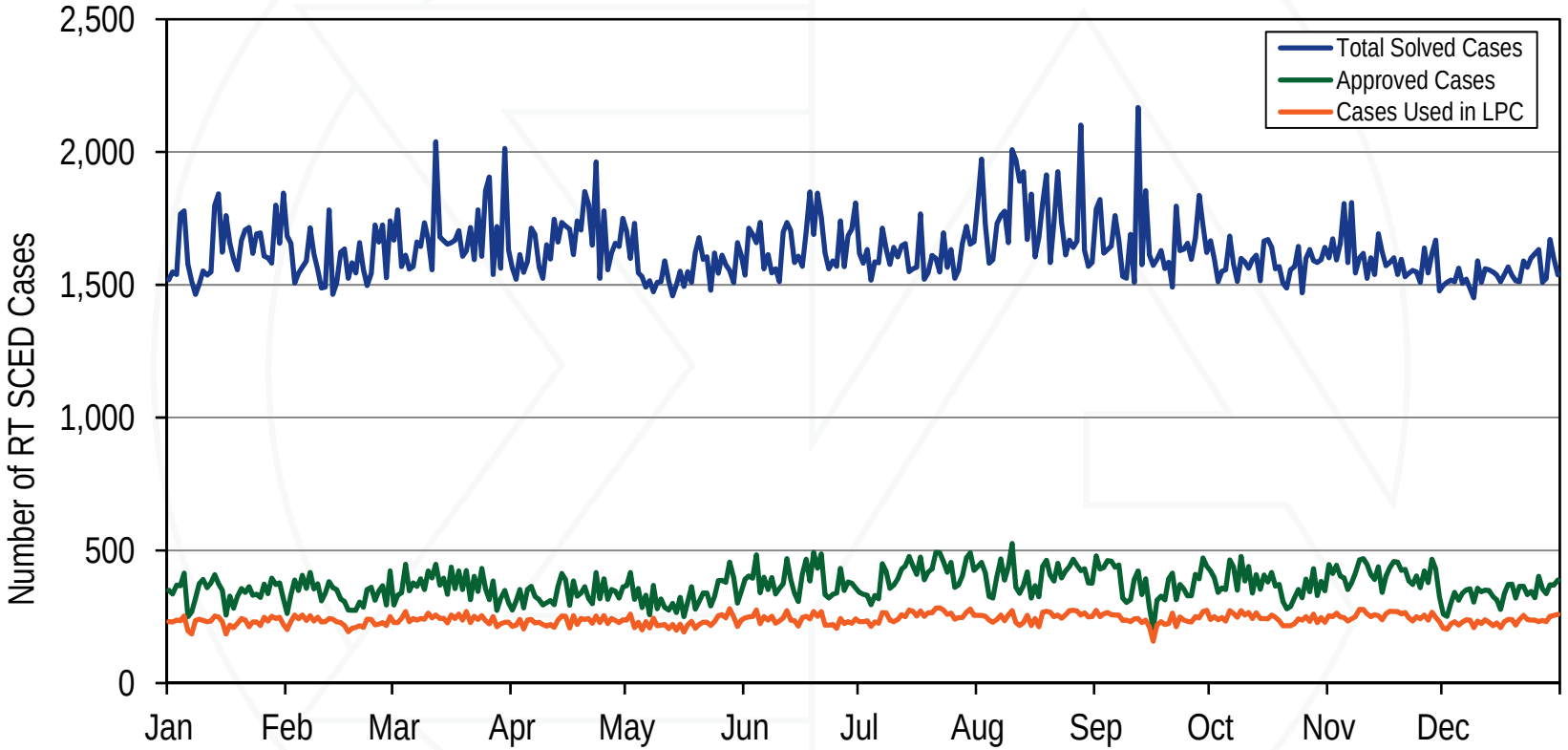
Real Time Dispatch and Pricing

- **PJM Real-Time Energy Market applications:**
  - **Ancillary Services Optimizer (ASO)**
  - **Real Time Security Constrained Economic Dispatch (RT SCED)**
  - **Locational Pricing Calculator (LPC)**
- **RT SCED cases are executed at instances that occur approximately every three minutes.**
  - **Three RT SCED cases are executed at each instance, with different levels of load bias in each.**
  - **RT SCED cases solve for a five minute target interval approximately 10 to 14 minutes ahead of that interval.**

Real Time Dispatch and Pricing

- **A subset of solved RT SCED cases are approved to send dispatch signals to generators.**
- **A subset of approved RT SCED cases are selected to be used in LPC.**
- **LPC produces real time five minute energy and ancillary service prices.**
- **PJM can rerun LPC and recalculate five minute prices.**
- **All real time energy transactions settled on five minute prices since April 1, 2018.**
  - **Settled on hourly average prices prior to April 1, 2018.**

RT SCED Cases Daily: 2018



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RT SCED Case Approval

- **The criteria for selecting RT SCED cases to approve are not defined in PJM Market Rules.**
- **The criteria for selecting RT SCED cases to use in LPC are not defined in PJM Market Rules.**
- **2018 statistics:**
  - **105,120 total five minute intervals**
  - **3,776 intervals with at least one solved RT SCED case with reserve shortage**
  - **1,865 intervals with more than one solved RT SCED case with reserve shortage**
  - **3 intervals with five minute shortage pricing in LPC**

RT SCED Reserve Shortage: 2018

Month	Number of Five Minute Intervals	Number of Intervals With At Least One Solved SCED Case Short of Reserves	Percent Intervals With At Least One Solved SCED Case Short of Reserves	Number of Intervals With Multiple Solved SCED Cases Short of Reserves	Percent Intervals With Multiple Solved SCED Cases Short of Reserves	Number of Intervals With Five Minute Shortage Prices in LPC	Percent Intervals With Five Minute Shortage Prices in LPC
Jan	8,928	300	3.4%	174	1.9%	0	0.0%
Feb	8,064	150	1.9%	73	0.9%	0	0.0%
Mar	8,916	358	4.0%	174	2.0%	0	0.0%
Apr	8,640	597	6.9%	290	3.4%	0	0.0%
May	8,928	354	4.0%	166	1.9%	0	0.0%
Jun	8,640	128	1.5%	65	0.8%	0	0.0%
Jul	8,928	285	3.2%	152	1.7%	0	0.0%
Aug	8,928	262	2.9%	133	1.5%	2	0.0%
Sep	8,640	292	3.4%	141	1.6%	1	0.0%
Oct	8,928	405	4.5%	184	2.1%	0	0.0%
Nov	8,652	393	4.5%	199	2.3%	0	0.0%
Dec	8,928	252	2.8%	114	1.3%	0	0.0%
Total	105,120	3,776	3.6%	1,865	1.8%	3	0.0%

Recommendation

- **Recommendation in the 2018 State of the Market report (SOM):**
  - **The MMU recommends that PJM clearly define the criteria for operator approval of RT SCED cases used to send dispatch signals to resources, and for pricing, to minimize operator discretion and implement a rule based approach.**
- **Critical issue now that PJM settles on five minute basis using five minute prices from LPC.**
- **Additional details and data in the SOM: Section 3, Page 203[1]**

1. https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018.shtml

Next Steps

- **Problem statement drafted to:**
  - **Educate stakeholders about process**
  - **Identify areas to document in OA or Manuals**
  - **Identify areas to streamline process**
- **PJM and MMU meeting to finalize the draft problem statement.**

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