



Combined Cycle Unit Pseudo Modeling Guidelines

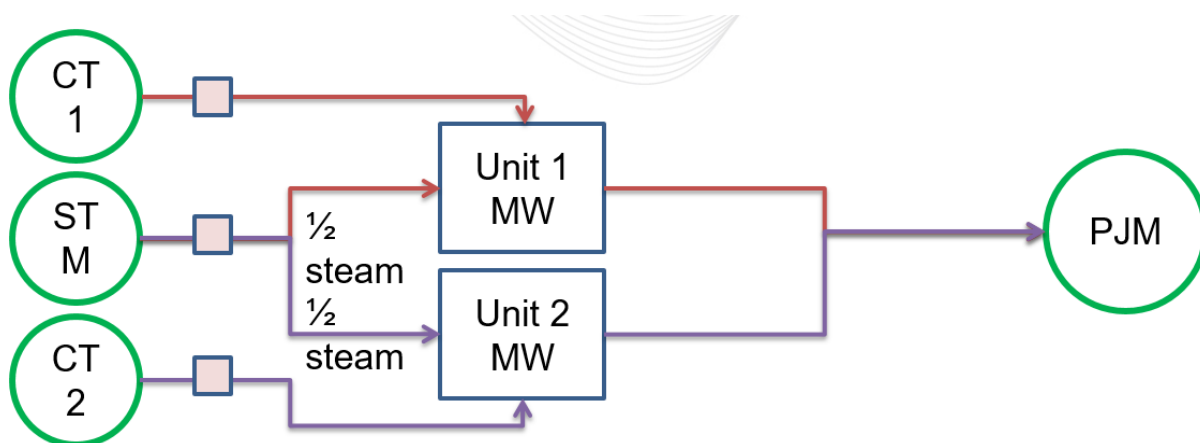
PJM Interconnection Version 0: 6/30/2021

For Public Use

INTRODUCTION

Combined cycle units consist of a combination of gas turbine generator(s) and steam turbine generator(s). The gas turbine drives a generator and the gas turbine exhaust is turned into steam via a heat recovery steam generator (HRSG). The steam is then used to power a steam turbine generator. Combined cycles can consist of multiple gas turbine generators with the associated HRSG steam powering one or more steam turbine generator. If a combined cycle has two gas turbines and one steam turbine, it is typically referred to as a 2 X 1 configuration. If there are three gas turbines and two steam turbines it is a 3 x 2 configuration. Operation of the combined cycle unit does not require all the gas turbines to be operating at the same time. Combined cycles can operate with only one gas turbine and one steam turbine and this is called 1 x1 operation.

Combined cycles can be modeled in PJM with all the gas turbines and steam turbines combined as a single market unit or split into multiple pseudo market units with a single gas turbine and a fraction of the steam turbine as shown below.

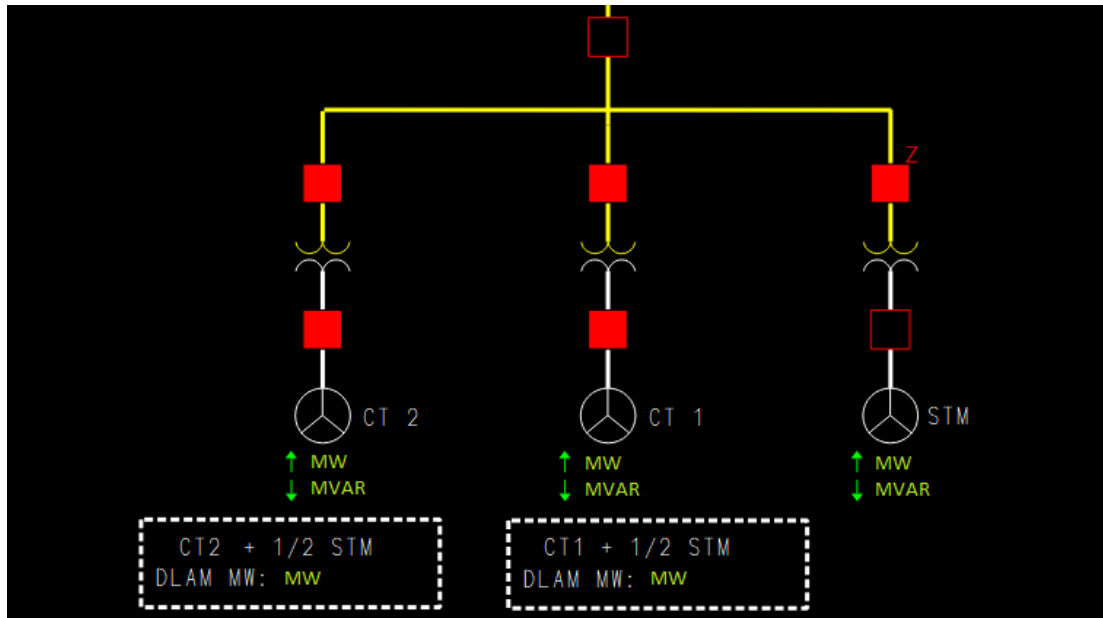


This document is intended to provide general guidance on market rules and requirements for Market Sellers that choose to model their combined cycle units as separate blocks or Pseudo models in PJM.

EMS MODELING

NETWORK MODELING

Combined cycles that are currently modeled as a single market unit may need network modeling changes to reflect the pseudo model configuration. Market Sellers should email [Client Management](#) to initiate a Market Remodel request . This could result in ICCP/TNA/Network model changes. If so, then the cutover date will need to be after the next scheduled EMS model change.



MARKETS

The following paragraphs provide guidance for offering pseudo unit combined cycles into PJM's markets.

Markets Gateway

Pseudo model units enter the same generating unit information as a non-pseudo modeled generating unit into Markets Gateway:

- 1) Schedules
 - a. Cost
 - b. Price
 - c. Price based PLS
- 2) Energy Offers into the Day Ahead and Real Time Energy Markets
 - a. Start up
 - b. No-Load
 - c. Incremental Energy
- 3) Operating Parameters
 - a. Ramp rates
 - b. Eco Minimum
 - c. Eco Maximum
 - d. Notification Time
 - e. Hot, Intermediate, and Cold Start-Up Times
 - f. Minimum Run Time
 - g. Minimum Down Time
 - h. Maximum Starts per Day and per Week
- 4) Ancillary Service Offers
 - a. Synchronized Reserve
 - b. Regulation

Fuel Cost Policy

Using a pseudo model of a combined cycle unit should have minimal impact on a Market Seller's Fuel Cost Policy. Market Seller may need to update the numerical example and/or the IMM's MIRA's Cost Offer Assumption Module data like heat rate coefficients, start-up cost, etc.

Parameter Limited Schedules

Initially, when a Market Seller remodels an existing single market unit combined cycle unit as separate pseudo model units all the existing approved unit specific parameter limit will be reset to the proxy values posted on PJM.com (<https://www.pjm.com/-/media/committees-groups/committees/elc/postings/20150612-june-2015-capacity-performance-parameter-limitations-informational-posting.ashx>) for the combined cycle unit technology type. Market Sellers may request a unit specific parameter adjustment request no later than February 28 for a June 1 effective date or outside those dates submit a persistent exception request to unitspecificpls@pjm.com to obtain adjustment or exception to the proxy values.

DISPATCH/OPERATIONS

The following paragraphs provide guidance for dispatching and operation of pseudo modelled combined cycles.

Dispatch

Combined cycle units that are modeled as pseudo units will be dispatched as separate market units. Each Market unit will receive its own AGC basepoint. Market Sellers should take care to offer pseudo units into the market with similar bids and operating parameters to prevent un-balanced operation of the unit. This can also apply to pseudo units that have a peaking step like duct firing where all pseudo units must operate in the peaking step at the same time. Market Sellers should offer the MWs of that step into the real time energy market with identical price/cost offers. Failure to do so could result in one unit being dispatched into the peaking segment while another is not. Pseudo units that fail to follow PJM dispatch could be subject to deviations or logged on for company.

Regulation

If Market Sellers choose to offer pseudo modeled units into the regulation market, they will first need to qualify each individual unit in accordance with M12 Section 4.5. Once qualified, the units will be offered individually and will be dispatched individually based on market clearing and economic operations.

To minimize the frequency of unbalanced regulation market awards, Market Sellers should submit identical MW offers for pseudo modeled combined cycle units in both the regulation and energy markets. This will align the offer prices as well as the LOC component of the regulation offer.

Understanding that regulation is a performance-based market, another large piece of the offers is the performance score. Because of the potential differences in performance scores between the individual pseudo modeled units, PJM suggests setting up and utilizing the performance group option in M12 Section 4.5.7. All resources within the group that have been awarded MWs for any one given operating hour will be awarded the same score.

It is possible that even after each of these precautions that one pseudo unit will clear and other pseudo may not. In this case, Market Sellers should contact PJM dispatch to decommit the resource for the hour.

PJM practice is to decommit the regulation assignment for the committed pseudo unit. Another possibility is unbalanced awards across all pseudo units that could potentially cause operational issues at the plant. In this case, Market Sellers should contact PJM dispatch to lower the awards to be equal across all pseudo units or to a level that the plant can safely perform to.

METERING & SETTLEMENTS

BILLING METERING

Revenue quality metering will be required for all components of the combined cycle.

Power Meter

Unit owners must submit MWs for each pseudo modeled unit which includes its respective portion of the steam turbine MWs into Power Meter.

Settlements

Note that for pseudo modeled combined cycles, PJM Settlements will only use the CT bus nodes for Settlement calculations. The ST(steam) node become irrelevant to settlement.

eDART

Pseudo modeled combined cycle units should have all the component pieces (CTs and STs) modeled in eDART in accordance with the requirements of Manual 14D. Outages should be reported for each separate component. If a combustion turbine in a 2x1 pseudo modeled combine cycle is unavailable, the corresponding outage should also be entered for the steam turbine.

REVISION HISTORY

Revision 0 (06/30/2021)
Author: Thomas Hauske