

2.3.3.1 Capacity Resource Offer Rules

- Generators that are Capacity Resources and have an RPM or FRR commitment for the next Operating Day shall submit offers into the Day-ahead Market, even if they are unavailable due to forced, planned, or maintenance outages.
- Generators that are Capacity Resources and have an RPM or FRR commitment for the next Operating Day and are self-scheduling shall submit offer data in the event that they are called upon during emergency procedures. Such offers shall be based on the ICAP equivalent of the cleared UCAP capacity commitment.
- Generation Capacity Resources that have an RPM or FRR commitment shall submit a schedule of availability for the next seven (7) days and may submit non-binding offer prices for the days beyond the next Operating Day.
- Generation Capacity Resources that have notification or startup times that exceed twenty four (24) hours must submit binding price-based offer prices for the next seven (7) days.
- The set of offer data last submitted for each Generation Capacity Resource shall remain in effect for each day until specifically superseded by subsequent offers; however, cost-based incremental energy offers above \$1,000/MWh shall be capped at \$1,000/MWh when automatically carried forward to subsequent Operating Days.
- If a Generation Capacity Resource is not scheduled in the Day-ahead Market, it may revise its offer and submit into the Real-time Market or it may self-schedule the resource.
- Generation Capacity Resources that have notification plus startup times that exceed twenty-four (24) hours and have been called on by PJM dispatch in advance of the close of the Day-ahead Market bid period for the desired Operating Day must modify their notification and startup time prior to the close of the market bid period for that day in order to create the possibility for the unit to be committed in the Day-ahead Market.
- Intermittent Generation Resources, ~~Hybrid Resources~~ and Capacity Storage Resources that are committed Capacity Resources, except those that participating in the Energy Storage Resource Participation Model, shall meet the must offer requirement by either self-scheduling (Availability = Must Run) or may allow the Day-ahead Market to schedule by offering the unit as a dispatchable resource (Availability = Economic) equal to the level defined below.
- Intermittent Generation Resources meet their must offer requirement by offering Economic Maximum MW equal to or greater than their hourly forecast. If the Market Seller develops or procures forecast with different confidence levels, the Market Seller must use the one closest to the median value (e.g. P50). Forecasts can be adjusted to account for expected equipment availability. If the Market Seller does not have a forecast or has technical issues developing or receiving a forecast, the PJM developed forecast is available.
- Hybrid Resources and resources enrolled in the ESR participation model shall meet the must offer requirement by self-scheduling only.
- A Hybrid Resource comprised exclusively of inverter-based components meets its must offer requirement by offering Economic Maximum MW equal to or greater than their hourly forecast.
 - The hourly forecast of a Hybrid Resource comprised exclusively of generation components should equal the sum of the forecasted MW of each component, capped at the inverter size. The hourly forecast of storage-backed Hybrid

Resource must include the anticipated intermittent and battery output. The total offered energy over the course of 24 hours must be equal to or greater than the forecasted energy of the standalone intermittent component(s) when grossed up for the roundtrip efficiency of the battery.

- The Market Seller may use PJM's forecast for the intermittent component or develop/procure their own forecast following the requirements for Intermittent Generation Resources described above.
- The hourly Day-ahead self-scheduled values for Intermittent Resources, Hybrid Resources and Capacity Storage Resources may vary hour to hour from the capacity obligation value.
- Hydropower resources fall under the Intermittent Generation Resource category. Hydropower resources that are committed Capacity Resources, shall meet the must offer requirement by self-scheduling (Availability = Must Run).
- Pumped Storage Hydropower resources that are committed Capacity resources, shall meet the must offer requirement by either self-scheduling or may allow the Day-ahead Market to schedule by using the pumped storage optimization model, referred to in Attachment B of this Manual. They may also use the Energy Storage (ESR) Participation Model referred to in Section 2.3.4 of this Manual.

2.3.4C Mixed Technology Facility

This section describes how a Mixed Technology Facility can provide energy and ancillary services in the PJM marketplace.

Mixed Technology Facility is a facility that features multiple and distinct generation technology types behind the same point of interconnection. Individual technology types are referred to as components. There are alternate ways that the components of a Mixed Technology Facility can participate in PJM Markets, as either (1) Co-Located Resources, where the components are modeled and dispatched as two or more separate resources; or (2) an integrated Hybrid Resource, where components are modeled and dispatched as a single integrated resource. However, Two exceptions exist. Aa Mixed Technology Facility which features significant interactions between the generation and/or storage components are required to participate in markets as a single Hybrid Resource. An example of such a facility is one where the storage component was not studied to, and/or physically cannot, charge from the grid. Furthermore, a Mixed Technology Facility with a non-inverter generation component and an intermittent component is eligible to participate as Co-Located Resources only.

Co-Located Resources participate in the Capacity, Energy and/or Ancillary Services market(s) individually as separate resources and follow the relevant business rules for each modeled resource ~~accordingly~~. Hybrid Resources participate in accordance with Section 2.3.4C.1 below.

For a Mixed Technology Facility that is eligible to participate in capacity and energy markets as either a Hybrid Resource or as multiple Co-Located Resources, the modeling classification chosen for the energy market and capacity market participation must match for the applicable Delivery Year.

For a Mixed Technology Facility within the new resource queue process, the choice to participate in PJM's markets as a Hybrid Resource or as multiple Co-Located Resources must

be made as part of the new interconnection onboarding process managed by PJM Client Management no later than six (6) months in advance of its initial start in the Energy markets. Six months provides sufficient time for the modeling choice to be reflected in PJM's market systems and settlement systems. Please contact Member Relations-Client Management at custsvc@pjm.com with any questions.

For an existing Mixed Technology Facility that has no components that participate in the Capacity market, and that is eligible to participate in the energy markets as either a Hybrid Resource or as multiple Co-Located Resources, the modeling classification can be changed once per calendar year with notice to PJM Member Relations (custsvc@pjm.com) by no later than May 30 for the upcoming January 1 to December 31 participation months. An annual modeling classification change provides adequate flexibility to accommodate the business interests of the owners of such resources, while providing a stable basis from which to administer market outcomes. Once a modeling status is chosen, it remains until another request is received.

~~For an energy-only Mixed Technology Facility within the new resource queue process, the modeling choice must be made no later than six (6) months in advance of its initial start in the Energy markets. Six months provides sufficient time for the modeling choice to be reflected in PJM's EMS, markets system, and settlement systems.~~

For a Mixed Technology Facility that has components that participate in the capacity market, and that is eligible to participate in the capacity market as either a Hybrid Resource or as multiple Co-Located Resources, the modeling classification election must be indicated pursuant to the rules outlined in RAA, Schedule 9.2.

2.3.4C.1 Hybrid Resource

A Hybrid Resource is an Energy Resource or a Generation Capacity Resource composed of more than one component behind the same Point of Interconnection operating in the Capacity, Energy, and/or Ancillary Service market(s) as a single integrated resource, whereby each component is a separate generation and/or storage technology type. A Hybrid Resource forms all or part of a Mixed Technology Facility.

The Market Participant is to determine and indicate to PJM whether or not the unit will operate in the market as an open or closed-loop resource following the timelines and process described in section 2.3.4C. A Closed-Loop Hybrid Resource is a Hybrid Resource without a storage component, or that ~~charging does not operate by charging its storage component is physically or contractually incapable of charging~~ from the grid. An Open-Loop Hybrid Resource is a Hybrid Resource with a storage component that ~~operates by charging is physically or contractually capable of charging~~ its storage component from the grid.

For a Hybrid Resource that has no components that participate in the Capacity market, and that is eligible to participate in the energy markets as either a Closed-Loop or Open-Loop Hybrid Resource, the modeling classification timeline is the same as a Mixed Technology Facility.

A Hybrid Resource consisting ~~solely of inverter-based components with at least one generation component and at least one~~ storage component is eligible to participate in Energy and Ancillary Services markets using a similar approach as the Energy Storage Resource participation model

described immediately above in section 2.3.4B. A Hybrid Resource consisting solely of ~~non-storage~~-inverter-based generation components is eligible to participate in Energy and Ancillary Services markets using a similar energy market participation model as used by wind and solar resources. The operational modes are used as shown below in table 1. A Hybrid Resource does not have “ancillary-only mode” and “regulation only mode”. Closed-Loop Hybrid Resources that lack the Charge Maximum and Minimum parameters cannot submit offers for negative megawatts and do not have charge mode. Open-Loop Hybrid Resources must indicate to PJM the intervals in which the battery is idle (i.e., its output capability is solely a function of available non- storage energy) as Intermittent-Generation Mode.

Table 1. Hybrid Resource Operation Modes

	Hybrid Resource Type	
	Open-Loop Hybrid Resource	Closed-Loop Hybrid Resource
Continuous	Yes	N/A
Discharge	Yes	Yes
Charge	Yes	N/A
<u>Intermittent-Generation</u>	Same as discharge	Same as discharge

4.2.1 Reserve Market Eligibility

In general, Generation, Hybrid Resources, Energy Storage Resources, and Economic Load Response resources are eligible to provide Synchronized Reserves, Non-Synchronized Reserves, and Secondary Reserves except if:

- The resource is not within the metered boundaries of PJM
- The entire output is offered as Emergency Only
- The resource type includes: Nuclear, Wind, ~~or~~-Solar, or a Hybrid Resource comprising exclusively of wind and solar components, unless an exception is requested and approved
- The resource is not available to provide energy or reduce load

In addition, the following resources are not eligible to provide Non-Synchronized Reserves:

- Economic Load Response
- Hybrid Resources
- Energy Storage Resources enrolled in the ESR participation model
- Pumped hydro resources that are not participating in the PJM optimized pumped storage model in the Day-ahead market and if Initial MW is greater than zero in the Real-time market