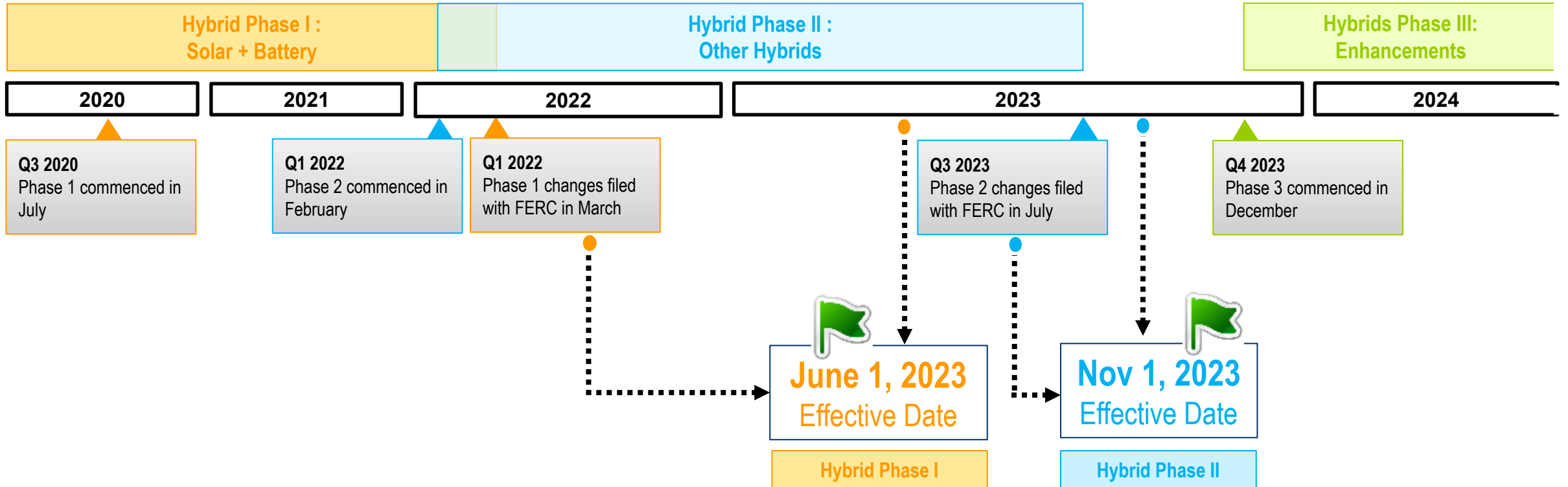


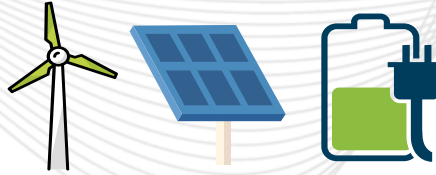


Hybrid Resources in PJM Markets

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Market Design & Economics

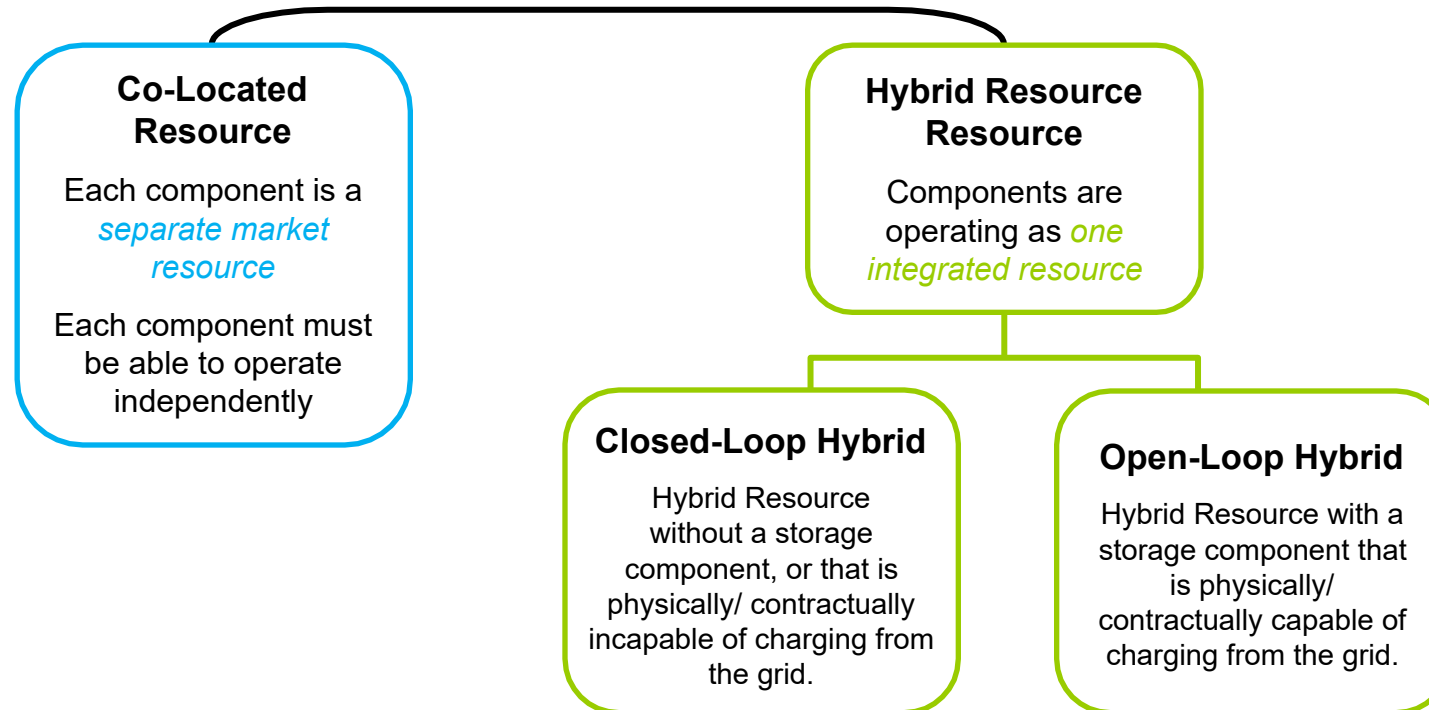
DISRS
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Mixed Technology Facility

A facility that features multiple and distinct technology types behind the same point of interconnection



- Each component in a Mixed Technology Facility is represented in markets as either a **Co-Located Resource** or as part of a **Hybrid Resource**.
- A Mixed Technology Facility with significant interactions between the generation and/or storage components (i.e., these cannot operate independently) is required to participate in PJM's Markets as a single Hybrid Resource.
- A Mixed Technology Facility with components that can operate independently may select to participate as *either* a Hybrid Resource or as multiple Co-Located Resources.
- Selecting and updating classification:
 - *Capacity resources*: classification can be changed every 5 years to match the frequency with which a technology may change its ELCC resource classification.
 - The same classification must be chosen in both the capacity and energy markets for an applicable delivery year.
 - *Energy market only*: classification can be changed 1x per calendar year with notice to PJM by May 30 for the upcoming Jan 1 to Dec 31 participation months.

- **Co-Located Resources:** These resources participate in the PJM's markets individually and follow the relevant business rules for the standalone technology type.
- **Hybrid Resources:**
 - Hybrids that, in isolation, would be Intermittent Resources or Capacity Storage Resources are exempt from the capacity must offer requirement.
 - Hybrid Resource are accredited using resource-specific ELCC ratings, as described in [Manual 21A](#).
 - Hybrid resources must seek a resource-specific MOPR value determined in accordance with the process outlined in [Manual 18](#).

- **Co-Located Resources:** These resources participate in PJM's Markets using status quo rules for the corresponding standalone technology type.
- **Hybrid Resources:** The Hybrid Resources Participation Model intended to create as much overlap as is reasonable between the rules for the integrated hybrid resource and those applicable to the individual component if it were operating independently.
 - A Hybrid Resource consisting solely of inverter-based components with ***at least one storage component*** is eligible to participate in Energy and Ancillary Services markets using an approach that is very similar to the ***Energy Storage Resource participation model***.
 - A Hybrid Resource consisting ***solely of non-storage inverter-based components*** is eligible to participate in Energy and Ancillary Services markets using a model similar to that used by ***wind or solar resources***.

Offer Rules:

- Hybrid Resources with a capacity commitment have an energy must offer requirement. This requirement can be met by self-scheduling only.
- Hybrid Resources may offer values that vary hour to hour from the capacity commitment.
- When self-scheduling a Hybrid with a storage component, the Market Sellers must specify the hourly mode of operation.
- The maximum cost-based offer is \$0 as described in [Manual 15](#).

Mode of Operation:

- *Continuous*: Includes both negative and positive MWs (i.e., the resource can continually and immediately transition from withdrawing MWs to injecting MWs onto the grid).
- *Charge*: Includes negative MWs only (i.e., the resource is only withdrawing MWs from the grid).
- *Discharge*: Includes positive MWs only (i.e., the participant is only injecting MWs onto the grid).
- *Intermittent*: Similar to Discharge Mode and indicates that the storage component is absent or is not actively managing the resource's output.

Mode	Hybrid Resource Type	
	Open-Loop Hybrid Resource	Closed-Loop Hybrid Resource
Continuous	Yes	N/A
Discharge	Yes	Yes
Charge	Yes	N/A
Intermittent	Same as Discharge	Same as Discharge

- *Closed-Loop Hybrids* can self-schedule *positive MWs only* (they do not have charge mode).
- *Open-Loop Hybrids* can self-schedule *both positive and negative MWs*, in accordance with the selected mode of operation.
- Hybrid Resources with a storage component must indicate to PJM the intervals in which the battery is idle (i.e., output is solely a function of available non-storage energy) as Intermittent Mode.

- Hybrid Resources must have: 1) telemetry at the POI for MW and MVAR, and 2) revenue metering at the POI for MWh, consistent with any other generation resource.
- Each component of a Hybrid Resource is required to provide real-time MW output.
 - PJM requires direct sub-metering of at least one component. Telemetry values for the other component may be inferred as the difference between the POI telemetry and the directly-metered component telemetry (corrected for losses to the POI).
- Entering State of Charge information in Markets Gateway is currently optional and will only be used for PJM research purposes.
- Hybrids with a storage component are responsible for managing their own State of Charge.

Information on this slide added as of 1/30/2024

- Hybrid Resources are eligible to provide regulation and reserves.
- Reserve offer rules:
 - Hybrids with a capacity commitment **must offer** such reserves.
 - Hybrids are not considered available by default, and must submit specific reserve offers to be considered.
 - The reserves quantity is determined by the Market Seller, not by PJM.
 - Hybrids cannot provide non-synchronized reserves.

A Hybrid Resource will not be able to operate in “ancillary services-only” and “regulation services-only” modes available in the Energy Storage Resource Participation Model because, unlike storage, a hybrid resource with a generation component is expected to have positive output in many hours of the day, and so must have an energy schedule.

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