ISO/RTO Market Participation of Storage and Hybrids

NERC/NAGF/ESIG Workshop on Battery Storage, Hybrid Resources, Frequency Response and Grid Services

Wednesday, September 18, 2019

Purpose & Key Takeaways

Purpose

Overview of Market Modeling and Participation Issues for Hybrid Resources in MISO

Key Takeaways

- Order 841 improves storage participation and provides a pathway to separate modeling of Hybrid Resources
- Hybrid Resources present challenges to existing Capacity, Energy, and Ancillary Services Participation Models

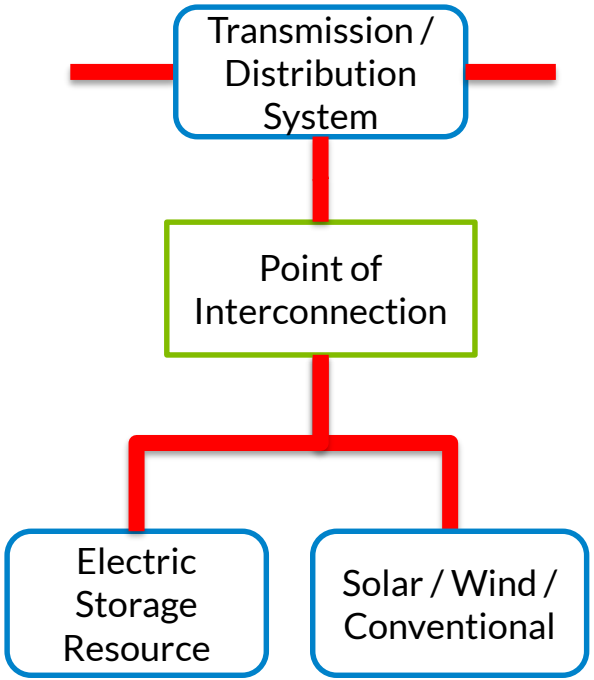
What is a Hybrid Resource?

- MISO's Energy Storage Task Force developed a working description of Hybrid Resources

  Market Participation as a single asset for a Generating Facility with Interconnection Service that is less than the total Generating Facility Capacity and that has multiple energy production devices that have more than one Fuel Source

Storage and Variable Energy Resources

- Current Systems technically support separate modeling of individual Resources at the same Point of Interconnection
- Solar or Wind register as Dispatchable Intermittent Resources (DIR) with Offer Curves limited by forecasted Economic Maximum Values 10 minutes ahead
- Conventional or Storage Resources may utilize Real-Time Offer parameter Over-rides, Offer Curve can not be updated intra-hour
- Individual Resource subject to Capacity Accreditation rules

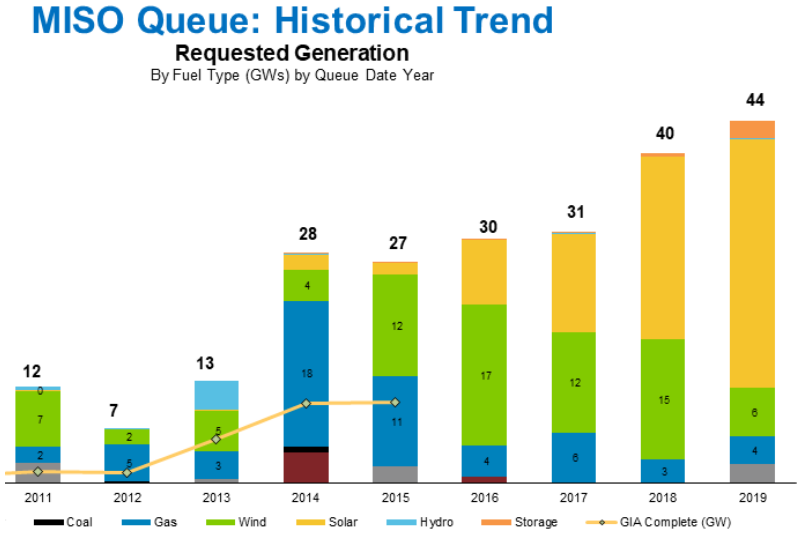


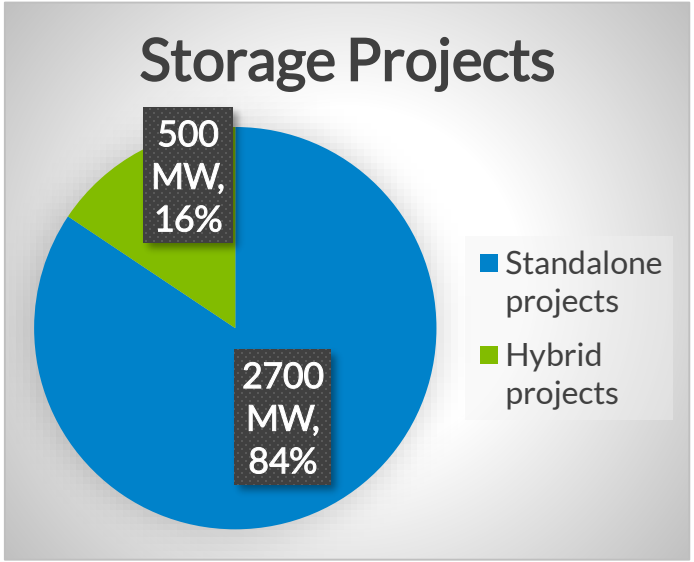
State of Storage In MISO

Pumped Hydro Storage	Short-Term < 1 hour (e.g. Flywheel/Battery)	Short-Term ≥ 1 hour (e.g. Battery)	Order 841 Compliance

• 2.7 GW
• Use/Energy limited Generation scheduled/optimized over 24 Hrs in Day-Ahead Market
• Pumping scheduled virtually
	• Stored Energy Resource - Type I (2009)
	• Regulation Only
	• Regulation Deployment logic considers state of charge
		• Stored Energy Resource - Type II (2018)
		• Energy, Ancillary Services, and Capacity
		• Recent development that will be replaced with Order 841 compliance
			• Electric Storage Resources
			• Operating Modes
			  • Charging
			  • Discharging
			  • Continuous
			• State of Charge Limits and Management by Market Participant

State of Hybrids in MISO





MISO has less than 50 MW of storage in service with another 3,200 MW in the Interconnection Queue. There are 2,700 MW of Hybrid Projects in the Interconnection Queue, with 500 MW of storage embedded in those projects.

Energy and Ancillary Services Market Issues

- Managing Offers to prevent exceeding Interconnection Limits
- Forecasting Resource output (DIR) and State of Charge and reflecting in Unit Offers
- Unit Commitment and Utilization under current optimization capabilities
- Metering, Settlement and Resource Energy Accounting
- Identifying unique Bid Parameters and determination of Resource State (i.e. Hot, Cold, Intermediate)
- Participating in Ancillary Service Markets

Capacity Market Issues

- Developing Capacity Accreditation Rules for separate or combined Resources at Hybrid location
- Meeting Must Offer obligations with multiple Resources
- Establishing Deliverability for Hybrid Resources

Appendix

Net Zero vs Hybrid

Net Zero is a type of interconnection service, which is dependent on Interconnection Service of an Existing Generating Facility. Independent of fuel source. For Example, a CT can have Net Zero Interconnection Service with an Existing CC, a wind farm can have NZIS with existing CT. Requires a Energy Displacement Agreement and coordination.

Hybrid Interconnection is a type of Generating Facility which utilizes more than one fuel source for inject at the Point of Interconnection. For Example, Wind + Storage, Gas + Wind. Hybrid facility can have Net Zero Interconnection Service or can have ERIS/NRIS.

Example:

1) Hybrid with ERIS

   80 MW of Gas + 20 MW of Wind can have 100 MW of ERIS

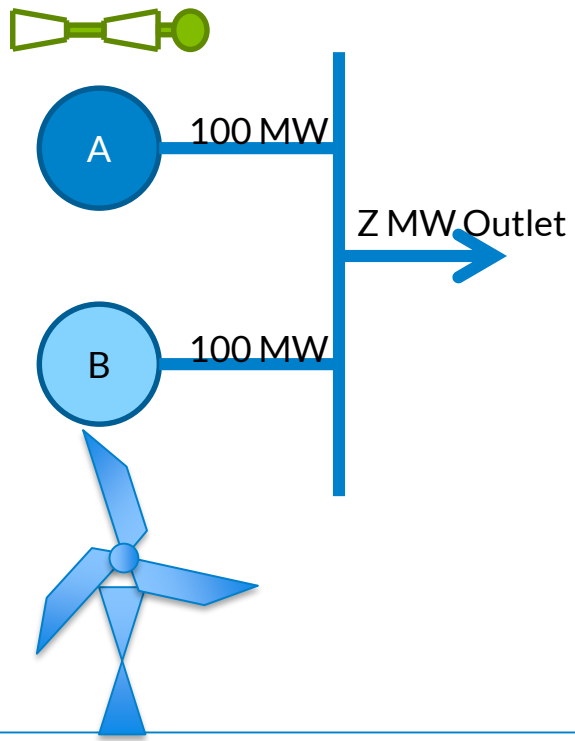
2) Hybrid with ERIS and NZIS

   80 MW of Gas with ERIS + 20 MW of Wind with 20 NZIS.

Modeling Options

Resource Model	Pros	Cons
Two Separate Resources	• Simplified Offer curve development • Use of Forecasted EconMax for Dispatchable Intermittent component • Optimized Dispatch	• Interconnection Rights not enforced by MISO dispatch, needs to be managed by Market Participant(s) • Conflicting offers/must offer
Single Aggregated Resource	• Optimized by UDS as able • Must offer tracking • Self-manage State of Charge for ESR piece	• Limited capability to reflect characteristics of multiple resources in single offer • Forecasted capability may not only impact Econmax and price/MW pairs in offer

Net Zero Interconnection Example



Generator A is the existing Resource, Capacity is 100 MW

- [Expensive, Low Utilization]

Generator B comes executes Net Zero Interconnection for 100 MW

- [Renewable, Intermittent Utilization]

By agreement, A shares interconnection capacity with B

- Z must be no more than 100 MW