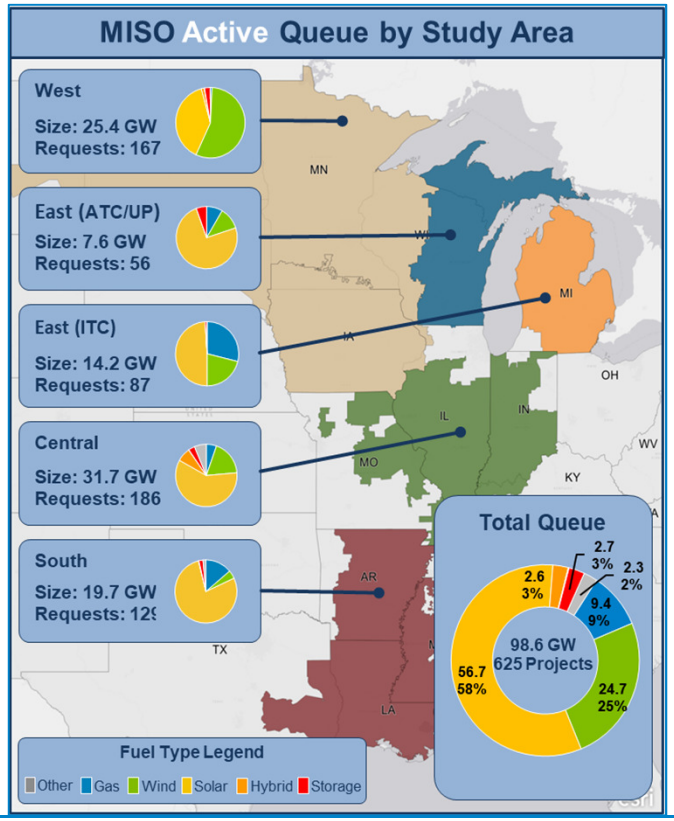
MISO Interconnection Queue Overview – Storage, Hybrid Resources

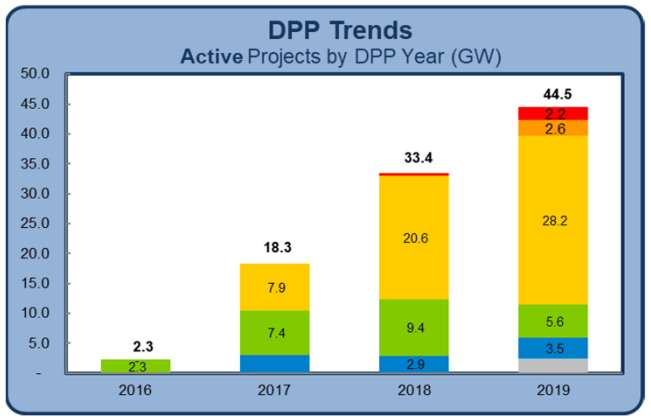
Workshop on Battery Storage, Hybrid Resources, Frequency Response and Grid Services

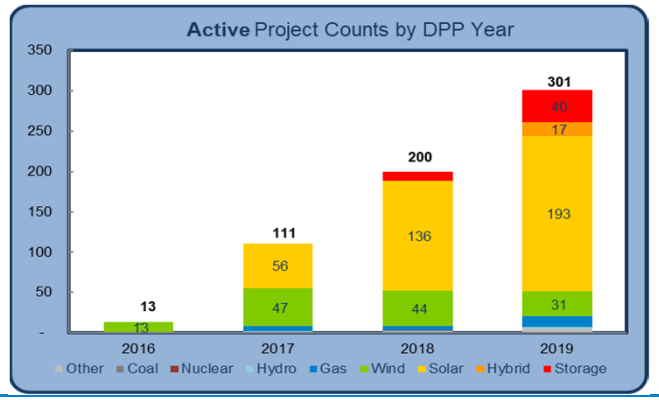
September 17, 2019

Generator Interconnection: Overview

*The current generator interconnection active queue consists of **625** projects totaling **98.6** GW*







Historic trends indicate growth in development of renewable energy

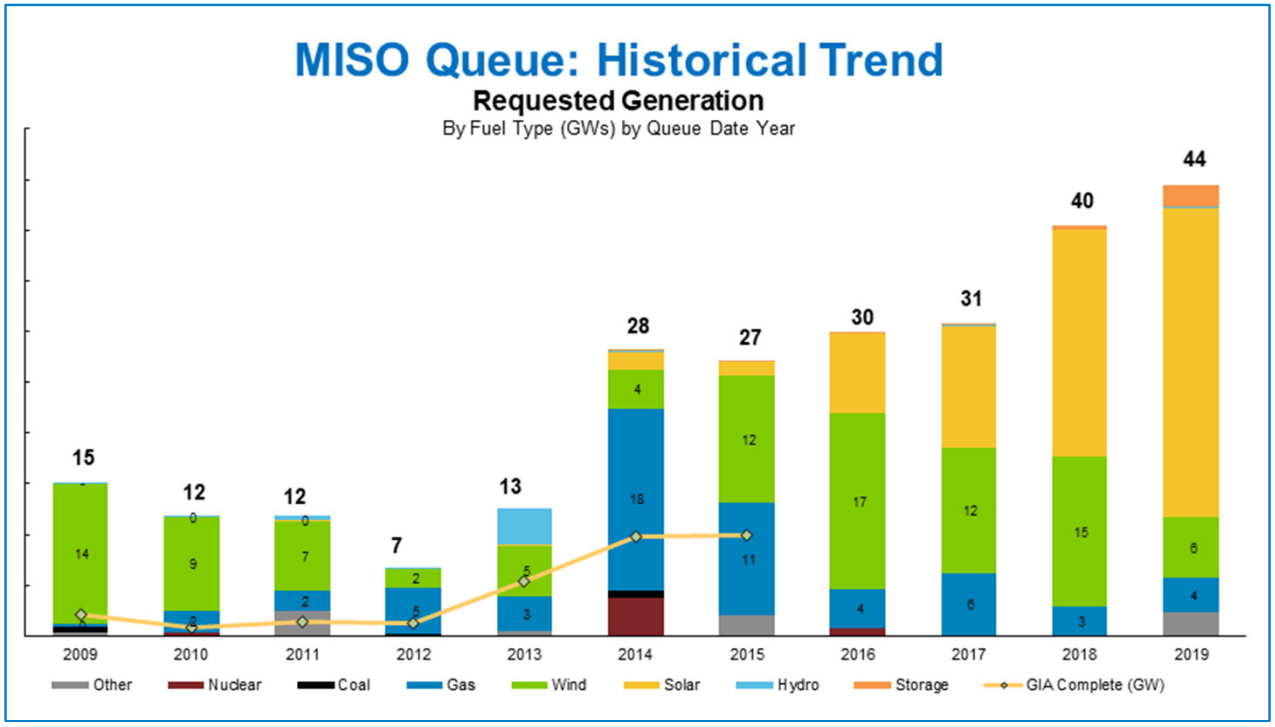
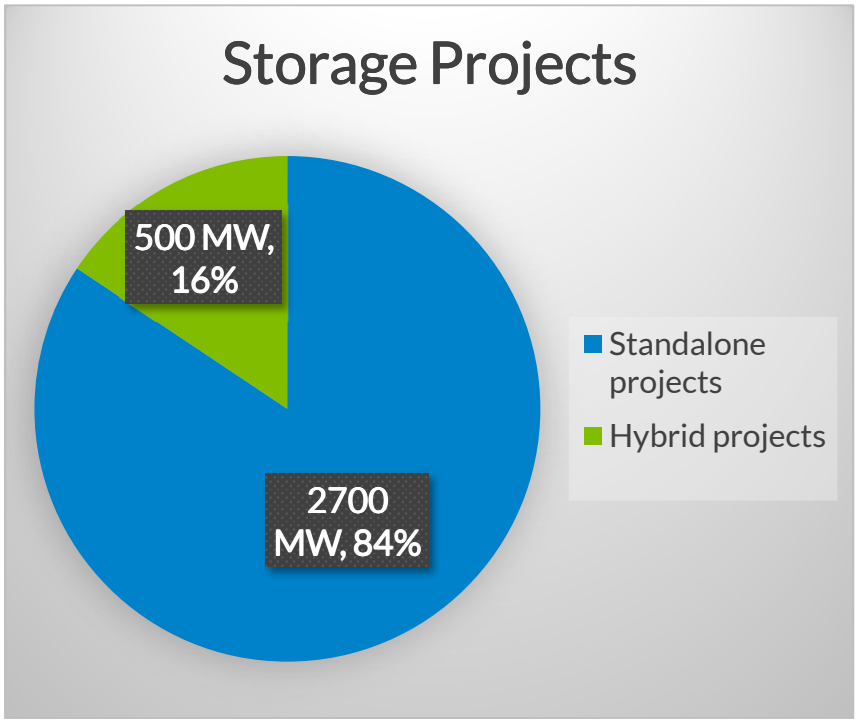
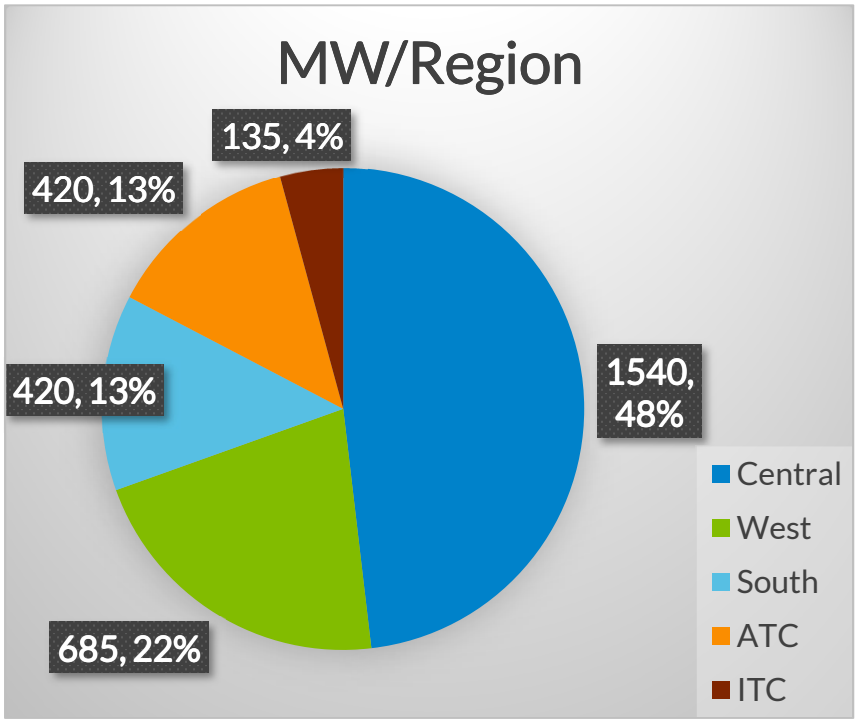


Chart values per MISO's interconnection queue database (by date processed into the queue)

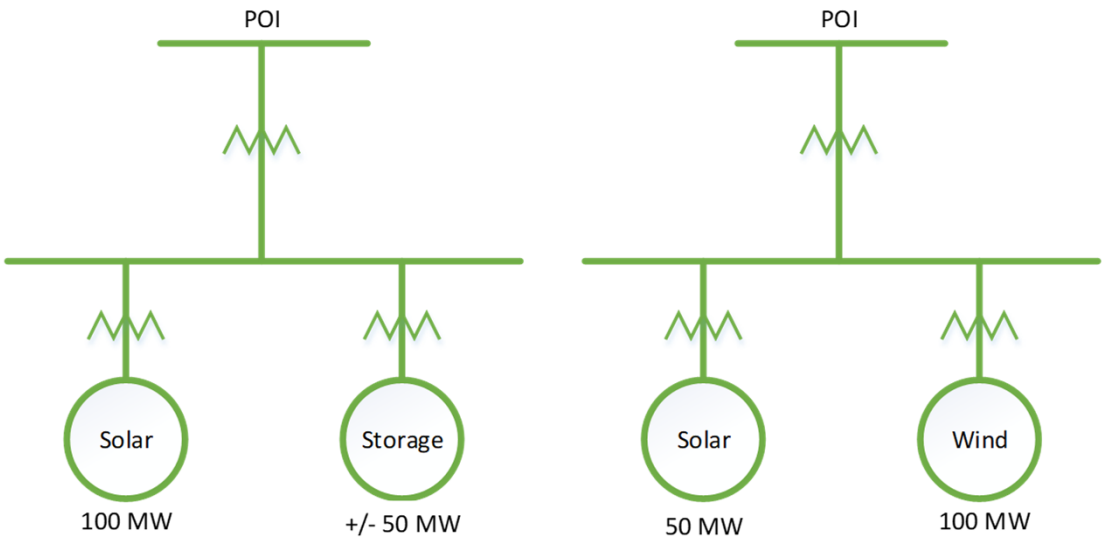
Storage in MISO



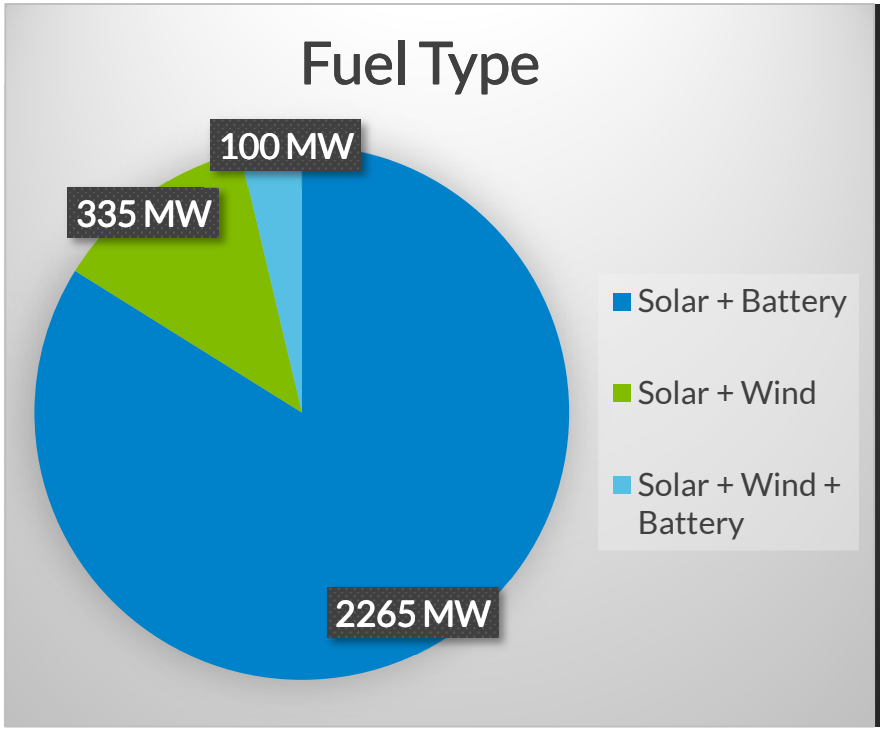


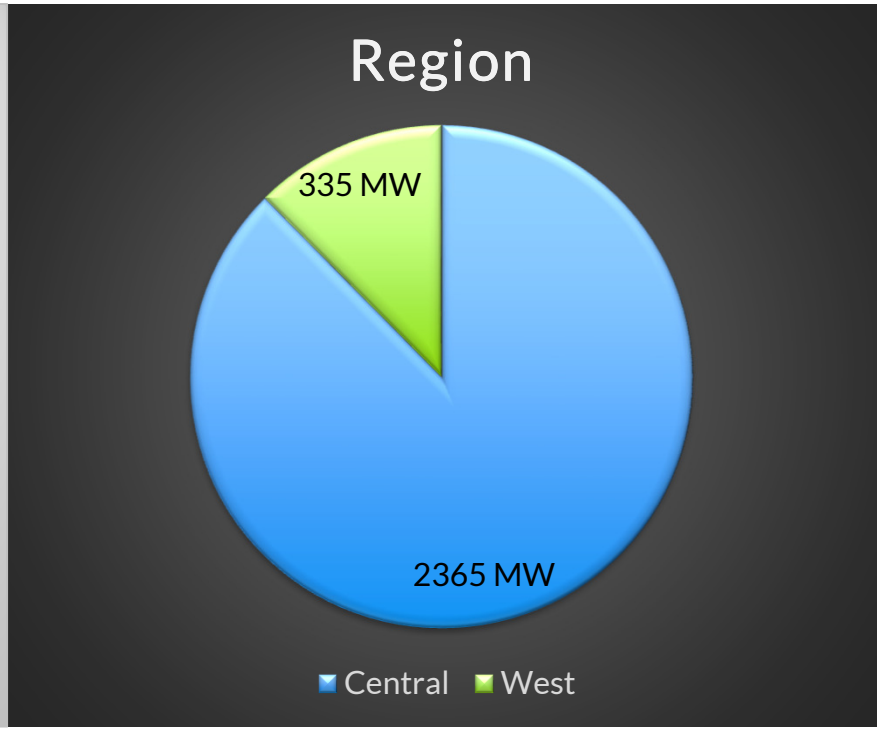
What is a Hybrid Interconnection?

- A Generating Facility that utilizes more than one fuel source to inject power on to the Transmission System



Hybrid Interconnections





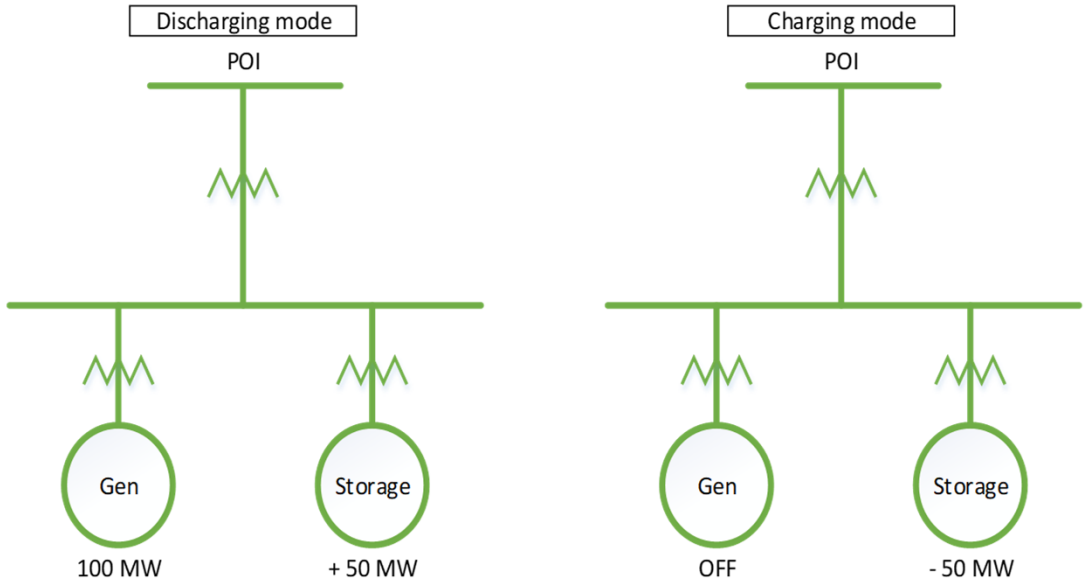
Modeling of Storage in MISO

Generator Interconnection Studies

- Interconnection Studies model Energy Storage as positive and negative generators
- Study at +/-100% output in both summer peak and shoulder peak study models
- Modeling assumptions are discussed at MISO stakeholder forums (PSC)

Long-term Planning (MTEP)

- Storage with Interconnection Service will be dispatched up to its NR (Network Resource) level based on the economics in the base dispatch



Generator Interconnection Dispatch

Fuel Type	Summer Peak Dispatched as % of Interconnection Service	Shoulder Peak Dispatched as % of Interconnection Service
Combined Cycle	100%	50%
Combustion Turbine	100%	0%
Diesel Engines	100%	0%
Hydro	100%	100%
Nuclear	100%	100%
Steam – Coal	100%	100%
Oil	100%	0%
Waste Heat	100%	100%
Wind	15.6%	100%
Solar	100%	50%
Battery	+/- 100%	+/- 100%

Hybrid Interconnection Dispatch

Scenario	Wind	Solar	Storage	MWs Requested	Storage Mode	Steady State (Shoulder Peak)				Steady State (Summer Peak)				NRIS or Deliverability (Summer Peak)			
						Wind	Solar	Storage	Hybrid Output	Wind	Solar	Storage	Hybrid Output	Wind	Solar	Storage	Hybrid Output
1	100	50	0	120	Discharging	96	24	0	120	15.6	50	0	65.6	80	40	0	120
					Charging	N/A											
2	100	50	0	150	Discharging	100	50	0	150	15.6	50	0	65.6	100	50	0	150
					Charging	N/A											
3	100	0	50	120	Discharging	80	0	40	120	15.6	0	50	65.6	80	0	40	120
					Charging	0	0	-50	-50	0	0	-50	-50	N/A			
4	100	0	50	150	Discharging	100	0	50	150	15.6	0	50	65.6	100	0	50	150
					Charging	0	0	-50	-50	0	0	-50	-50	N/A			
5	0	100	50	120	Discharging	0	50	50	100	0	80	40	120	0	80	40	120
					Charging	0	0	-50	-50	0	0	-50	-50	N/A			
6	0	100	50	150	Discharging	0	50	50	100	0	100	50	150	0	100	50	150
					Charging	0	0	-50	-50	0	0	-50	-50	N/A			

Study Practices for Storage – Charging

- Energy storage requests that are expected to charge from MISO Grid:
  - Storage requests will be studied as “negative generation” in both summer peak and shoulder peak scenarios at full output in the DPP studies
- Storage devices :
  - are considered as a generation asset if they are requested through the GI queue; NERC TPL 001-4 standard will be applied as if the storage device is a generator and not a load,
  - have the capability to make offers for charge and discharge in the markets similar to other generators, and
  - will be responsible for Network Upgrades coming out of GI studies, where the GI study criteria can be applied consistently if they are studied as negative generation in DPP studies.

Study Practices for Storage – Charging

- Storage devices are required to have Transmission Service to withdraw energy from the Grid
- Obtaining a GIA does not grant Transmission Service
- IC can either:
  - be an independent Load Serving Entity (LSE) and Market Participant (MP), and directly request for new transmission service (NITS or Point to Point) from MISO, or
  - work with another existing MP/LSE service to obtain transmission service

Distribution-connected Interconnections

- Coordination is required for interconnection requests with facilities connecting to distribution system (non-MISO)

- If MISO and the affected TO believe there is potential for reliability issues, parties will engage the interconnection customer and perform a system impact study and if upgrades are needed a facility study

MISO References

- MISO Website
  - www.misoenergy.org
- MISO Generation Interconnection
  - https://www.misoenergy.org/planning/generator-interconnection/
- Interconnection Process Working Group
  - https://www.misoenergy.org/stakeholder-engagement/committees/interconnection-process-working-group/

Questions?

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