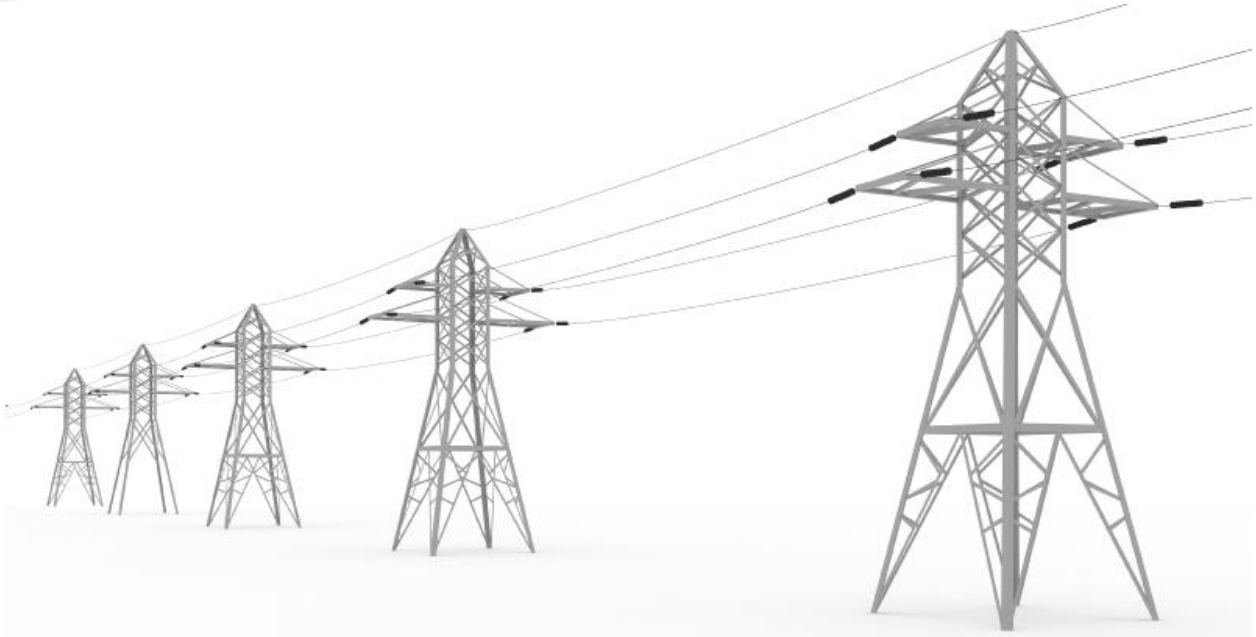
Office of Energy Policy and Innovation



NETL Energy Storage Hybrid Panel Discussion

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The Regulatory Landscape

- Order No. 841 – Storage Participation in RTO/ISO Markets
  - Must provide one or more "participation models" for storage
  - Must allow storage to provide all services they are technically capable of providing
- Order No. 845 – 2018 Interconnection Reforms
  - Allows "supplemental interconnection" of storage at same site as existing generator
  - Clarifies applicability of interconnection process to storage
- Order No. 2222 – Distributed Energy Resource Participation
  - Allows various resource types (e.g., storage, generation, demand response) to participate in RTO market as single aggregation

July 2020 Hybrid Conference

- Commission staff held a technical conference with 22 speakers (AD20-9)
- Already significant interest in interconnecting hybrid resources
  - For example, approximately 40% of resources in the CAISO queue are hybrid
  - Vast majority of interest is pairing storage with renewables

Region	Percentage of Proposed Generators Hybridizing in Each Region		
	Wind	Solar	Nat. Gas
CAISO	50%	67%	0%
ERCOT	3%	13%	0%
SPP	1%	22%	0%
MISO	2%	17%	0%
PJM	0%	17%	1%
NYISO	1%	5%	4%
ISO-NE	6%	0%	0%
West (non-ISO)	6%	50%	0%
Southeast (non-ISO)	0%	6%	0%
TOTAL	**4.8%**	**27.7%**	**0.6%**

Source: Berkeley Lab review of interconnection queues

- Most RTOs/ISOs considering rule changes to better accommodate hybrids
- According to EIA, currently 10 operational fossil + storage projects totaling 2,414 MW with 91 MW of storage

Key Takeaways - Opportunities

- Significant savings from sharing same point of interconnection
- Storage brings abilities consistent with stand alone-operation
  - Energy arbitrage
  - Enhanced ability to provide ancillary services
- Pairing with generation can also provide additional benefits
  - Ability to offer more flexible operating parameters
  - Can increase capacity value of resource, allowing higher capacity payments
  - Mitigate risk of non-performance penalties (e.g, capacity performance)

Key Takeaway - Challenges

- Hybrids pose novel challenges for interconnection – how to study?
- Two approaches for registration and modeling – two separate resources (co-located or 2R) or one combined resource (hybrid or 1R)
  - 1R approach can allow greater efficiency through co-optimization
  - 1R approach also introduces linked constraints that can present modeling difficulties
- Resource adequacy valuation – Is the resource adequacy value whole greater than the sum of the parts?
  - Some panelists thought penetration of hybrids could drive major changes in capacity valuation and resource adequacy metrics generally.