



# Manual 14-D

## Generator Operational Requirements

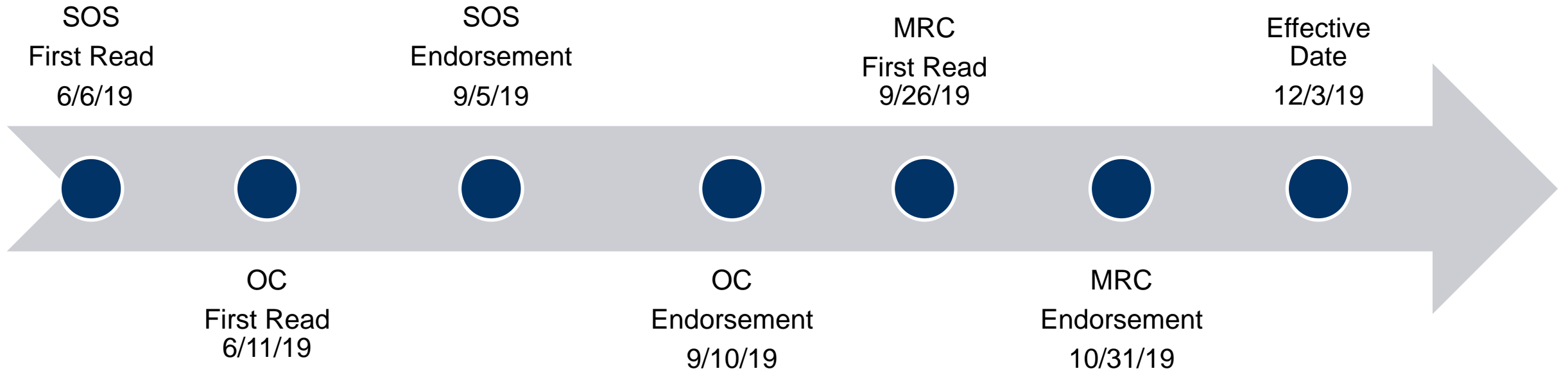
### Revision 49

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Sr. Lead Engineer, Generation  
System Operations Subcommittee  
Operating Committee  
June, 2019

Action Required	Deadline	Who May Be Affected
<p>Compliance with new manual requirements as they apply to Energy Storage Resource model participants</p>	<p>12/3/2019</p>	<p>ESR / Generation Owners</p>



# Manual 14-D, Rev 49 Review / Approval Timeline



## Changes specific to Energy Storage Resource (ESR) participation model

- Driven by FERC Order 841 Compliance Filing

## Changes unrelated to Energy Storage Resource (ESR)

- Changes for consistency with M-13, Emergency Operations
- Cover to cover review
- Administrative changes
- Clarifying changes
- DRAFT Changes related to Non-Retail Behind the Meter Generation covered separately

## Changes specific to Energy Storage Resource (ESR) participation model

- Driven by FERC Order 841 Compliance Filing

## New section titled Definitions and Applicability

- including OATT definitions of:
  - Energy Resource
  - Capacity Resource
  - Energy Storage Resource
  - Capacity Storage Resource
- Added language to clarify applicability of M-14D requirements to generation and storage resources

## Definitions and Applicability (cont'd)

- Added definition of Generating Facility
  - Definition included in PJM Compliance filing related to FERC Order 845 (not 841), *Reform of Generator Interconnection Procedures and Agreements*
  - Will become Tariff-defined term if / when accepted by the FERC

## Section 4.1.7: SCADA - Supervisory Control and Data Acquisition

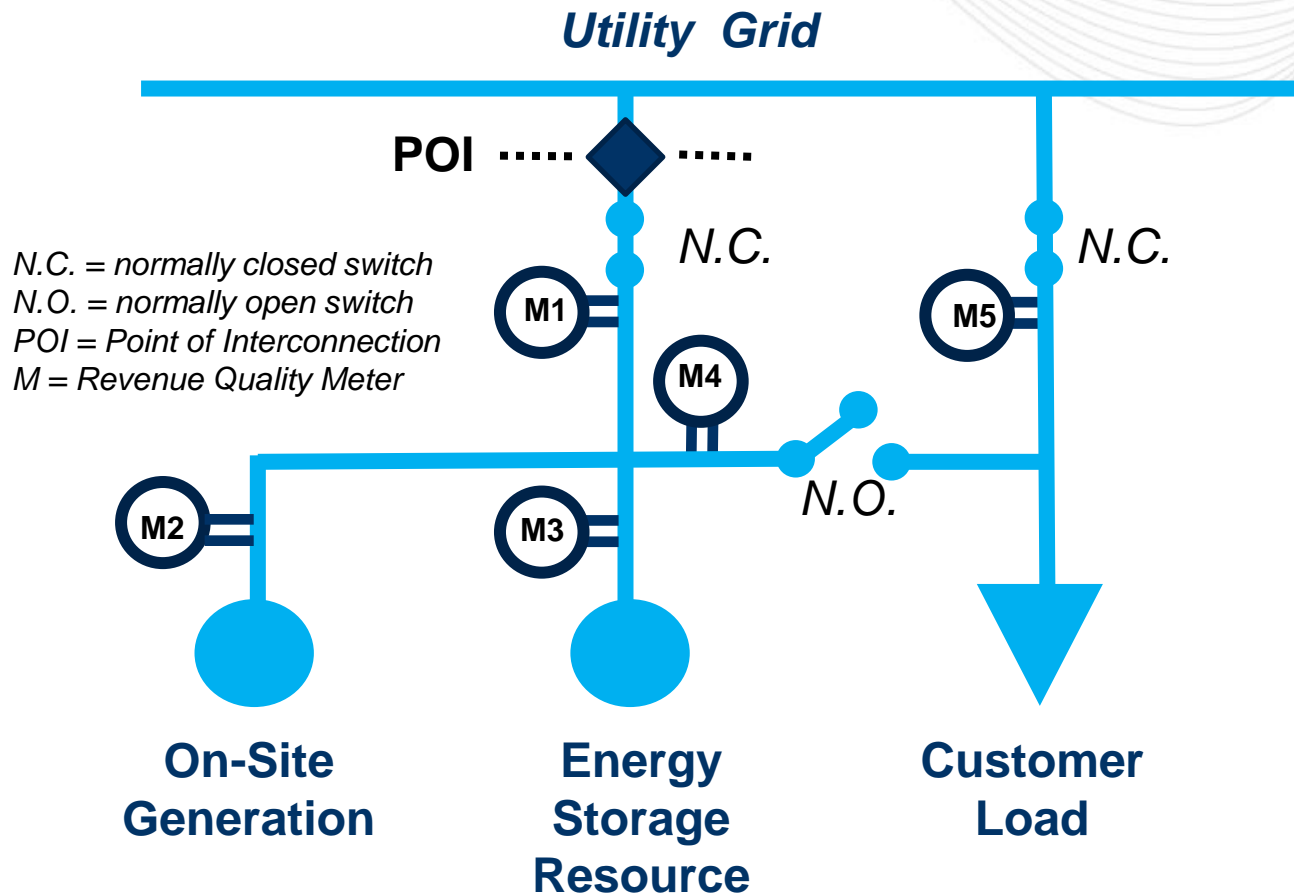
- Updated Exhibit 6 to include telemetry of State of Charge for Energy Storage Resource Model Participants

## Section 4.2.3: Metering for Individual Generators

- Added metering requirements specific to Energy Storage Resources
- Metering requirements vary based on implementation of ESR



# M-14D – Changes Specific to ESR Participation Model - Metering

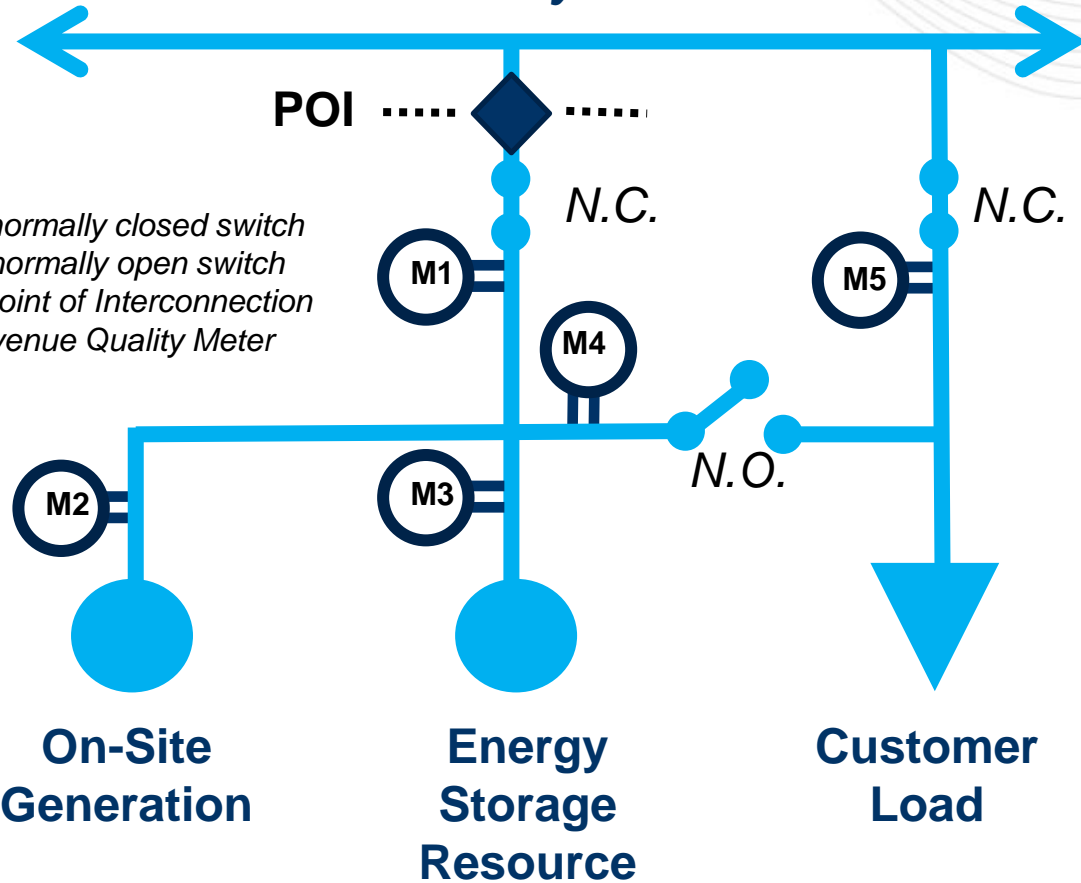


Number and location of measurement devices required will vary depending on how ESR operates

Energy Storage Resources that are co-located with end use load that is not Station Power shall provide a device for measurement of MWh located directly on the Energy Storage Resource terminals (M3 in diagram at left.)

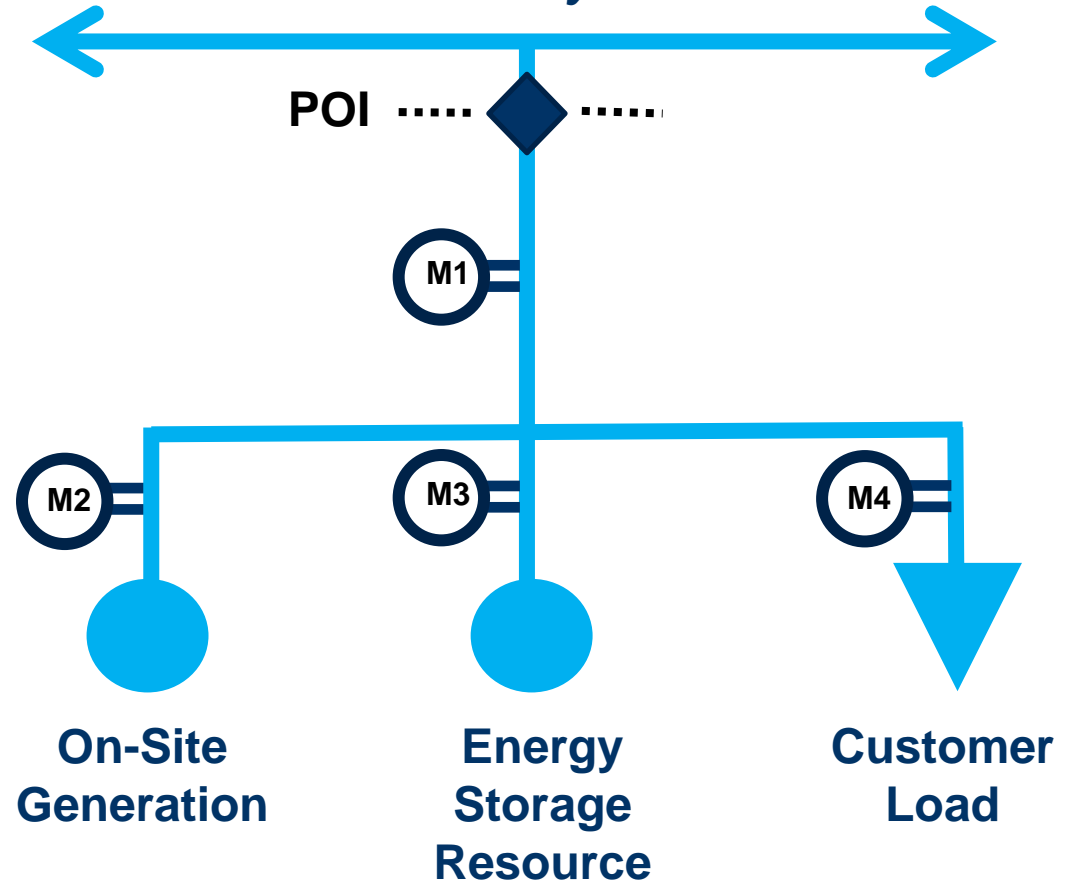
# M-14D – Changes Specific to ESR Participation Model - Metering

**Case 1**  
*Utility Grid*



N.C. = normally closed switch  
 N.O. = normally open switch  
 POI = Point of Interconnection  
 M = Revenue Quality Meter

**Case 2**  
*Utility Grid*

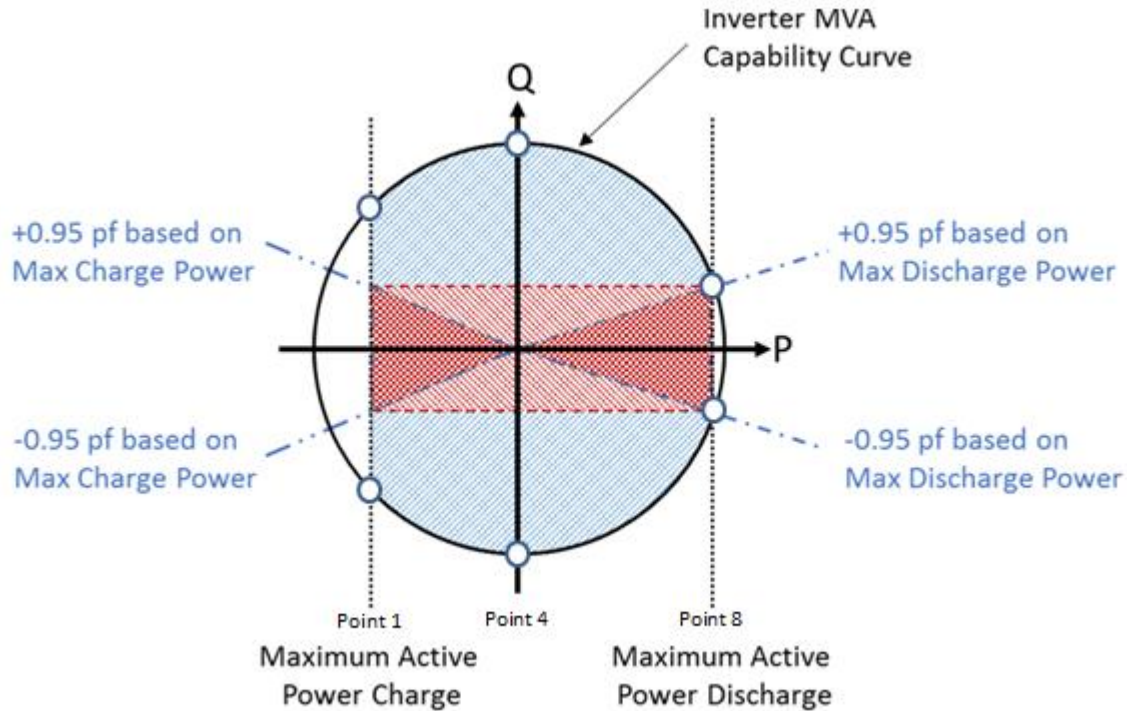


## Section 7.3: Critical Information and Reporting Requirements

- Added Energy Storage Resource outage reporting requirements
- Charging or lack of charge alone does not require an eDART ticket

## Attachment D: PJM Generating Unit Reactive Capability Curve Specification and Reporting Procedures

- Updated to include Energy Storage Resources
- Updated stand-alone document containing “D-curve” examples
- See example on next slide



**For inverter-based Energy Storage Resources, the reactive capability should be based on Inverter MVA Capability Curve.**

Consistent with NERC Guideline on Reactive Capability for Inverter-based Energy Storage Resources

Example of an Inverter-based Energy Storage Resource

	MW	Minimum MVAR	Maximum MVAR	Comment
Point 1	-20	-22	22	Maximum Active Power CHARGING (Min MW)
Point 2	-14	-26	26	
Point 3	-7	-29	29	
Point 4	0	-30	30	Inverter MVA Capability Curve Rating
Point 5	6	-29	29	
Point 6	12	-27	27	
Point 7	18	-24	24	
Point 8	25	-17	17	Maximum Active Power DISCHARGING (Max MW)

## Attachment E: PJM Generator, Energy Storage and Synchronous Condenser Reactive Capability Testing

- **Updated to include Energy Storage Resources**
  - Individual generating units and **inverter-based Energy Storage Resources** with a gross nameplate rating greater than 20 MVA and directly connected to the Bulk Electric System
  - Generating plants/facilities with a gross aggregate nameplate rating greater than 75 MVA including **inverter-based Energy Storage Resources**, and variable resources such as wind, solar, run of river hydro, etc.



# M-14D – Changes Specific to ESR Participation Model

UNIT TYPE	MW OUTPUT	MVAR OUTPUT	TEST DURATION
<b>FOSSIL, HYDROELECTRIC &amp; BLACKSTART</b>	MAX	MAX LAG	ONE HOUR
	MAX	MAX LEAD	WHEN LIMIT REACHED
	MIN	MAX LAG	WHEN LIMIT REACHED
	MIN	MAX LEAD	WHEN LIMIT REACHED
<b>SYNCHRONOUS CONDENSER or GENERATOR THAT OPERATES IN THE SYNCHRONOUS CONDENSING MODE TO PROVIDE REACTIVE SUPPORT</b>	-	MAX LAG	ONE HOUR
	-	MAX LEAD	WHEN LIMIT REACHED
<b>NUCLEAR</b>	MAX	MAX LAG	ONE HOUR
	MAX	MAX LEAD	WHEN LIMIT REACHED
<b>VARIABLE (E.G. WIND AND SOLAR)</b> (Testing done with at least 90% of turbines or inverters on line)	VARIABLE	MAX LAG	WHEN LIMIT REACHED
	VARIABLE	MAX LEAD	WHEN LIMIT REACHED
<b>INVERTER-BASED ENERGY STORAGE RESOURCES</b>  Max MW Output = fully discharging Min MW Output = fully charging	MAX	MAX LAG	WHEN LIMIT REACHED
	MAX	MAX LEAD	WHEN LIMIT REACHED
	ZERO	MAX LAG	WHEN LIMIT REACHED
	ZERO	MAX LEAD	WHEN LIMIT REACHED
	MIN	MAX LAG	WHEN LIMIT REACHED
	MIN	MAX LEAD	WHEN LIMIT REACHED

## TESTING REQUIREMENTS SUMMARY



## Changes unrelated to Energy Storage Resource (ESR)

- Changes for consistency with M-13, Emergency Operations
- Cover to cover review
- Administrative changes
- Clarifying changes
- DRAFT changes related to Non-Retail BtMG covered in separate presentation

## Section 7.3.5: Fuel and Emissions Reporting

- Replaced references to Supplementary Status Report (SSR) with references to Resource Limitations page in Markets Gateway
- Added guidance for Resource Limitations consistent with language added to M-13, Emergency Operations



# M-14D – Administrative Changes Unrelated to ESR Participation Model

Performed periodic cover to cover review

Replaced references to Client Manager with Member Relations throughout

Corrected typos and capitalized terms where appropriate

- Generator Owner, generation resource owner, generation owner, generator's owner/operator replaced with Generation Owner for consistency

Section 1.2 - Generator Commercial Naming Convention

- Replaced Performance Compliance with Operations Analysis and Compliance

# M-14D – Administrative Changes Unrelated to ESR Participation Model

## Section 3.2.4 - Control Center Staffing Requirements

Remove reference  
to Section 6 as it  
relates to training  
and certification  
requirements

## Section 10.2.3 – Implications for Terminating Black Start Units

Updated to cross-  
reference correct  
section – Section 9

## Attachment N - Cold Weather Preparation Guideline and Checklist

Remove outdated  
link to Polar Vortex  
presentation

## Appendix A – Behind the Meter Generation Business Rules

Added reference to  
Manual 13 –  
Emergency  
Operations