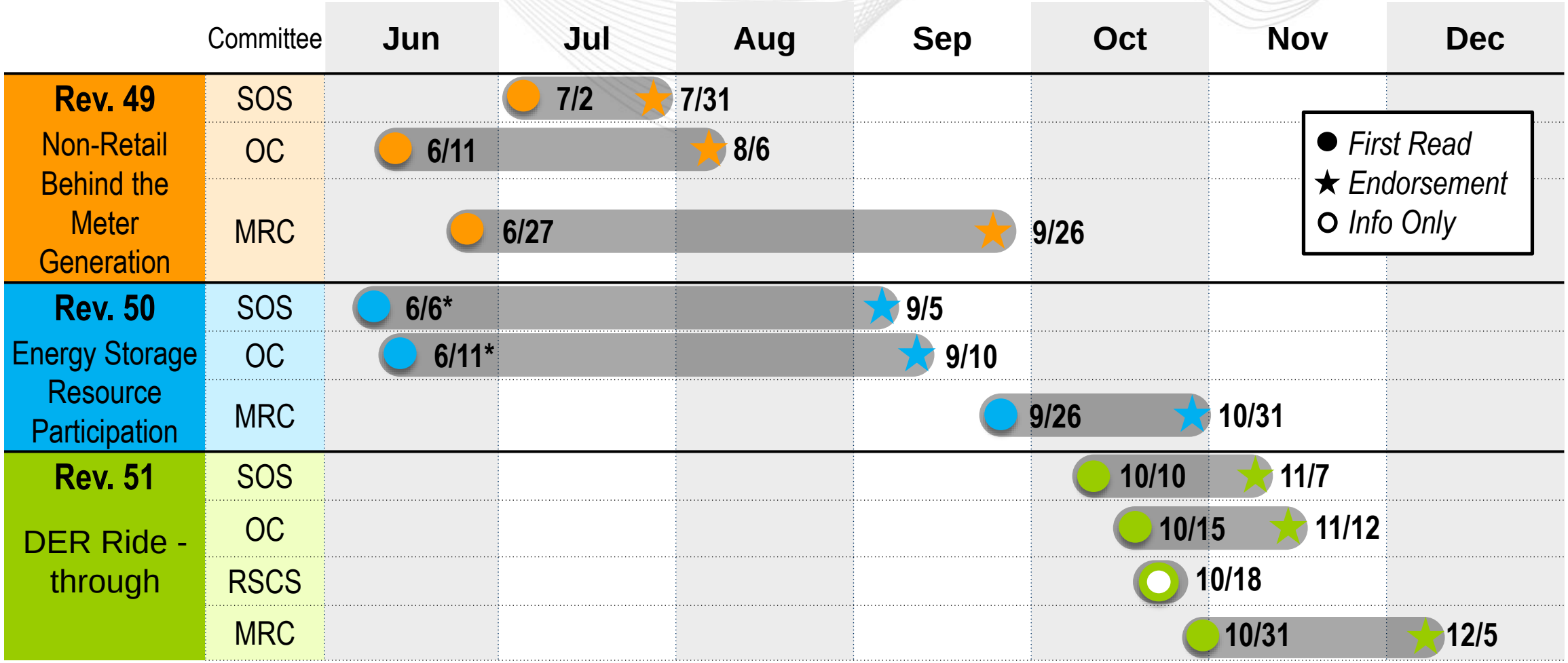
# Manual 14-D
# Generator Operational Requirements
# Revision 50

Vince Stefanowicz
Sr. Lead Engineer, Generation

Markets and Reliability Committee

September 26, 2019

# Manual 14-D, Generator Operational Requirements




*Initially presented as Rev. 49*

# M-14D Requirements for Energy Storage Resources

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


# Manual 14-D – Overview of Changes

## 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

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

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

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

## 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

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

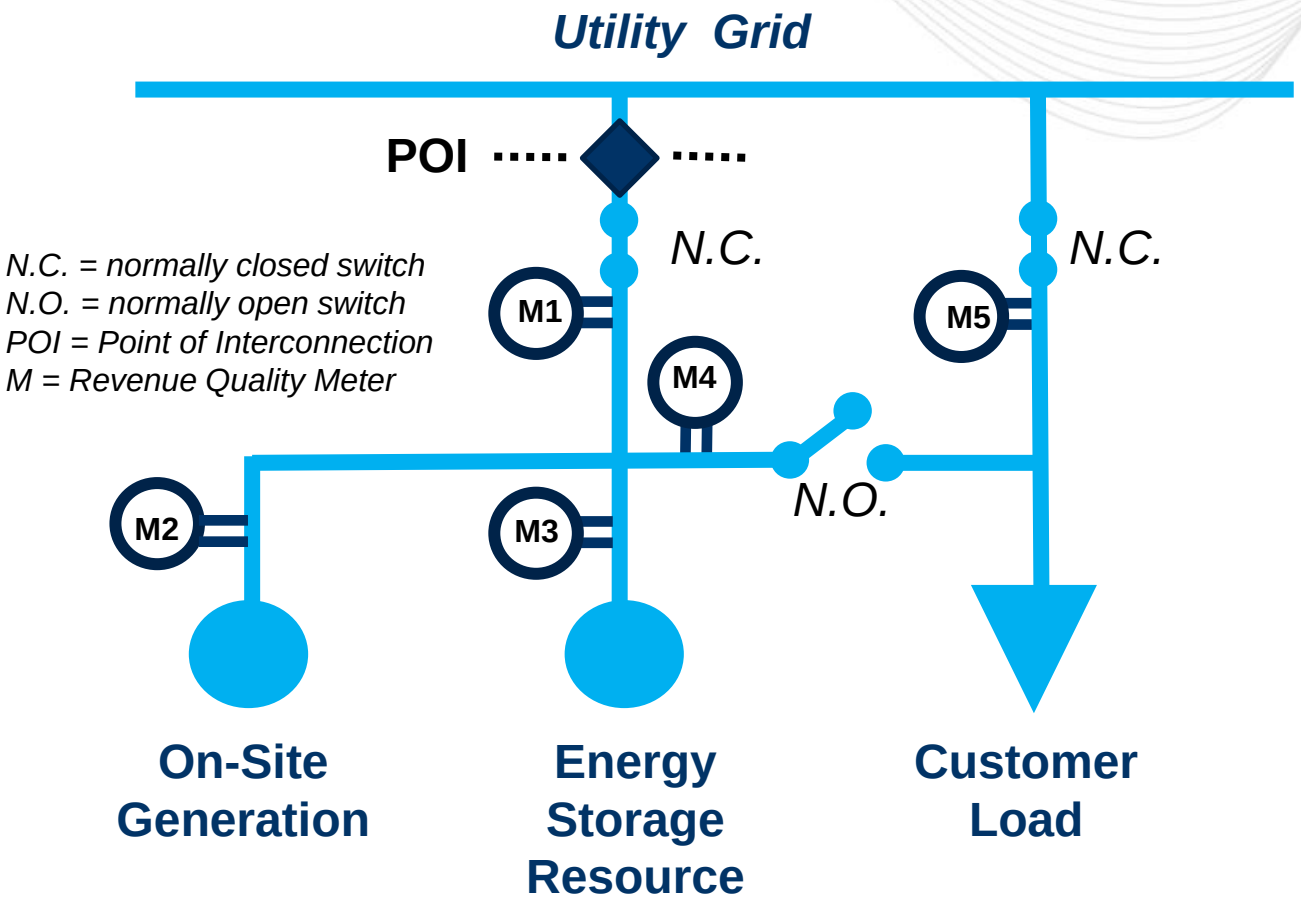
## Section 4.1.7: SCADA - Supervisory Control and Data Acquisition

- 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 implementation of ESR

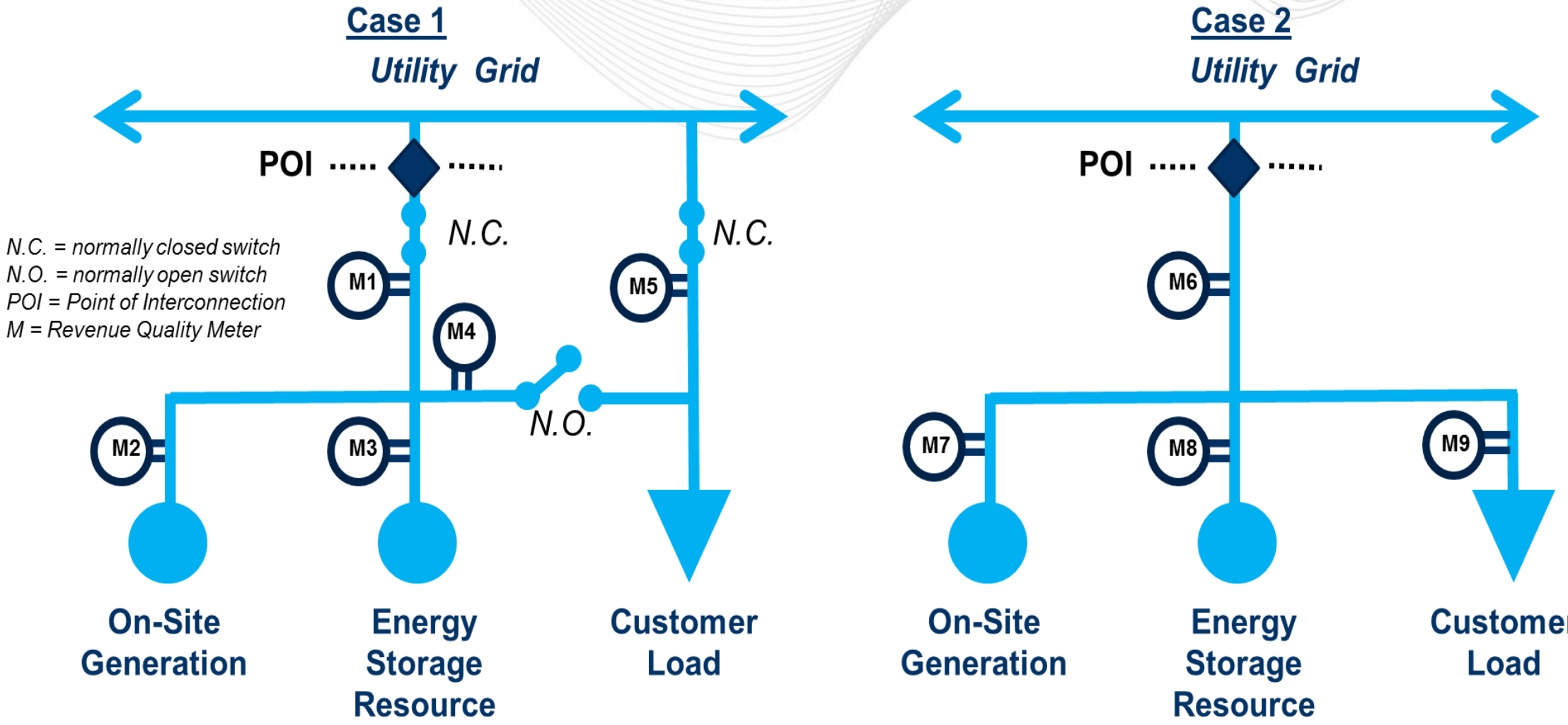
# M-14D – Changes Specific to ESR Participation Model - Metering




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



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

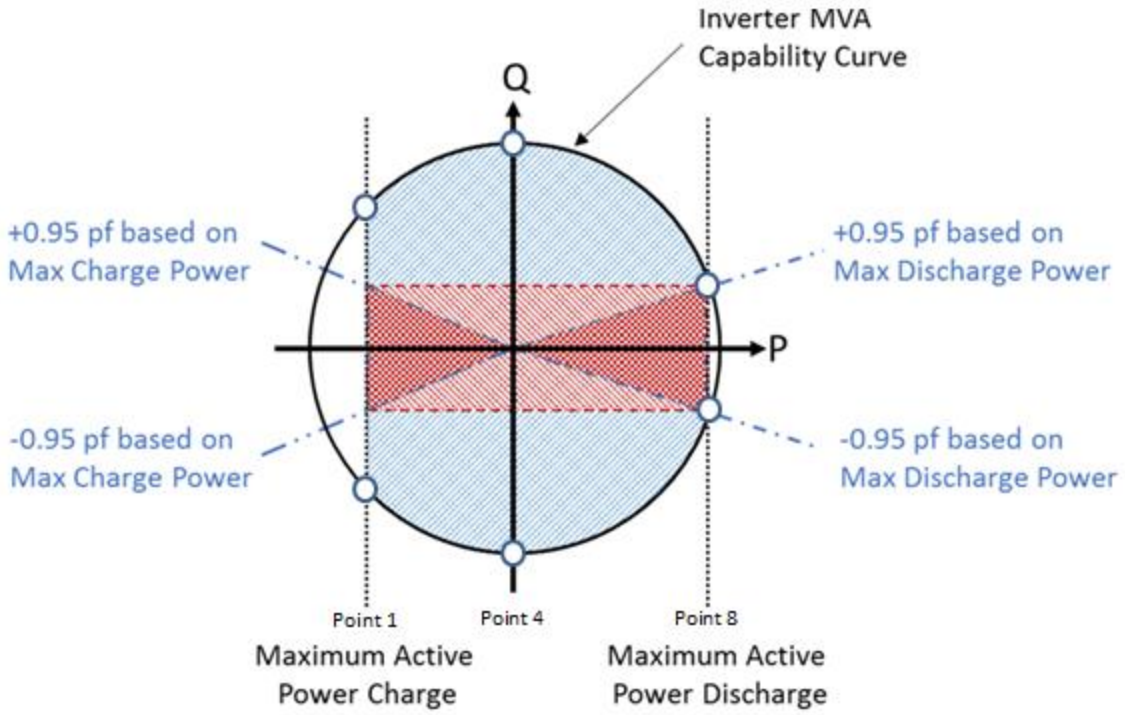
## Section 7.3: Critical Information and Reporting Requirements

- 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

# M-14D – Changes Specific to Inverter based ESR




**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) |

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

## 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

TESTING REQUIREMENTS SUMMARY

| UNIT TYPE | MW OUTPUT | MVAR OUTPUT | TEST DURATION |
|---|---|---|---|
| **FOSSIL, HYDROELECTRIC & BLACKSTART** | MAX | MAX LAG | ONE HOUR |
| | MAX | MAX LEAD | WHEN LIMIT REACHED |
| | MIN | MAX LAG | WHEN LIMIT REACHED |
| | MIN | MAX LEAD | WHEN LIMIT REACHED |
| **SYNCHRONOUS CONDENSER or GENERATOR THAT OPERATES IN THE SYNCHRONOUS CONDENSING MODE TO PROVIDE REACTIVE SUPPORT** | - | MAX LAG | ONE HOUR |
| | - | MAX LEAD | WHEN LIMIT REACHED |
| **NUCLEAR** | MAX | MAX LAG | ONE HOUR |
| | MAX | MAX LEAD | WHEN LIMIT REACHED |
| **VARIABLE (E.G. WIND AND SOLAR)** (Testing done with at least 90% of turbines or inverters on line) | VARIABLE | MAX LAG | WHEN LIMIT REACHED |
| | VARIABLE | MAX LEAD | WHEN LIMIT REACHED |
| **INVERTER-BASED ENERGY STORAGE RESOURCES** 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 |

# Manual 14-D – Overview of Changes

## 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

# Manual 14-D, Rev 50 Review / Approval Timeline