



FERC Order 841 – Electric Storage Resource

Compliance Straw Proposal Overview

**Market Subcommittee
Planning Advisory Committee
Reliability Subcommittee
Resource Adequacy Subcommittee**

June 6, 2018

Purpose & Key Takeaways



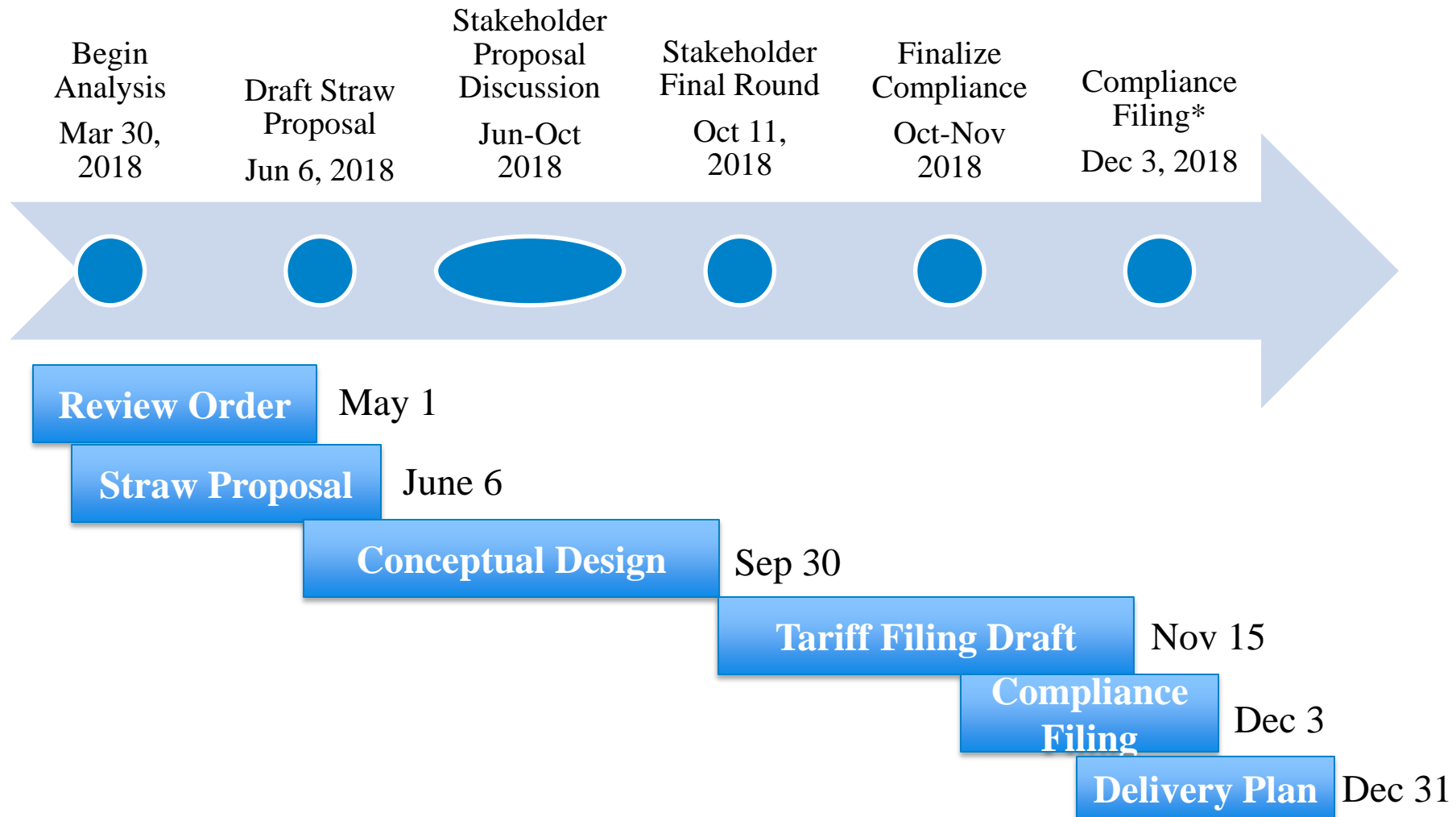
Purpose:

Overview FERC Order 841 Compliance
Straw Proposal

Key Takeaways:

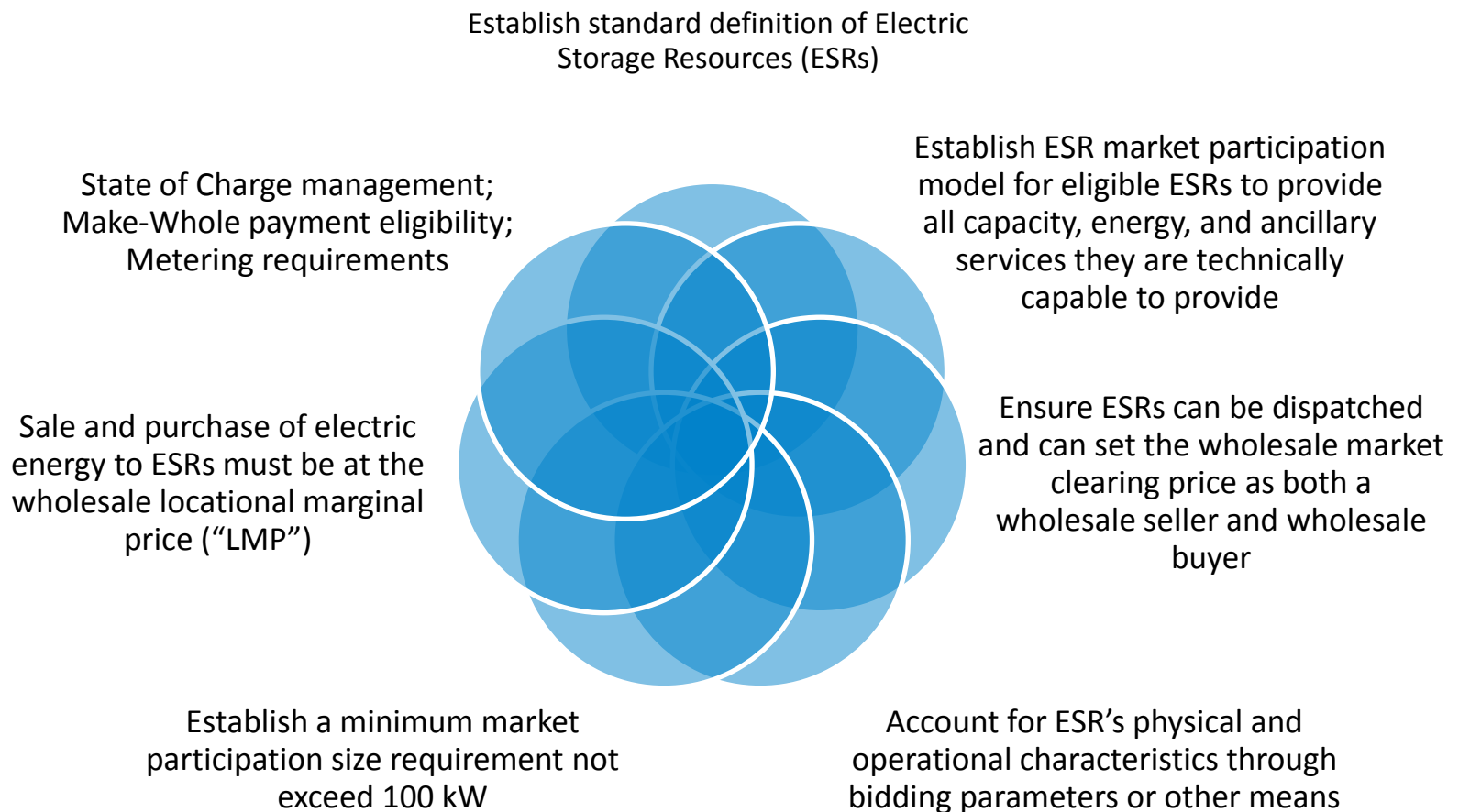
- Electric Storage Resources can participate under four modes (Configurations):
 - Charging,
 - Discharging,
 - Continuous Operations,
 - Outage/Offline
- Market Participant manages state of charge

Order 841 Compliance Timeline



*Requested Clarification that implementation period will be adjusted by the Commission if warranted by DER Final Rule's ESR-related requirements.

FERC Order 841 Requirement Overview



Overall Approach

- Target is compliance with all Order 841 requirements
- Holding discussions with other RTOs
- Incorporate Stakeholder input from stakeholder committees as appropriate and able
- Improve the Stored Energy Resource – Type II design
- Incorporate concepts from Enhanced Combined Cycle efforts as appropriate and able

Order 841 Requirement Categories (Agenda Items) [Assigned Committee]

- (3) - Definition, Elements, and Modeling Including Minimum Size Requirement [MSC]
- (4) - Market Participation: Bid Parameters, Offers, Commitment and Dispatch [MSC]
- (5) - State of Charge Measurement and Management [MSC]
- (6) - Market Participation: Eligibility, Seller and Buyer [MSC]
- (7) - Metering and Accounting [MSC]
- (8) - Settlements (Make Whole Payments, Compensation, Performance, Penalties) [MSC]
- (9) - Reliability (Qualification) and non-Market Products [RSC]
- (10) - Capacity and Resource Adequacy Administration [RASC]

Participation Model Overview

Electric Storage Resource (ESR) Participation Model

What is in scope

- Order 841 Requirements
- ESRs meeting definition
- Distribution connected ESRs
- Remove barriers to participation for ESRs
- Includes eligibility to receive existing compensation for non-market based services
 - Reactive Supply and Voltage Control
 - Blackstart

What is out of scope

- RTO State of Charge management
- Optimization/Commitment across modes/configurations (including Pumped Hydro)
- Thermal Storage
- Hybrid Resources
- Distributed Energy Resources (DERs) including DER aggregation

Participation Model Requirements

- ESR eligible to provide capacity, energy, and ancillary services in MISO markets when technically capable
- ESR can be dispatched and can set price as wholesale buyer and seller
- Must account for physical and operating characteristics of ESRs through bidding parameters or other means
- Minimum size of 100 kW
- Charging energy for later injection pays LMP

Proposed Participation Model

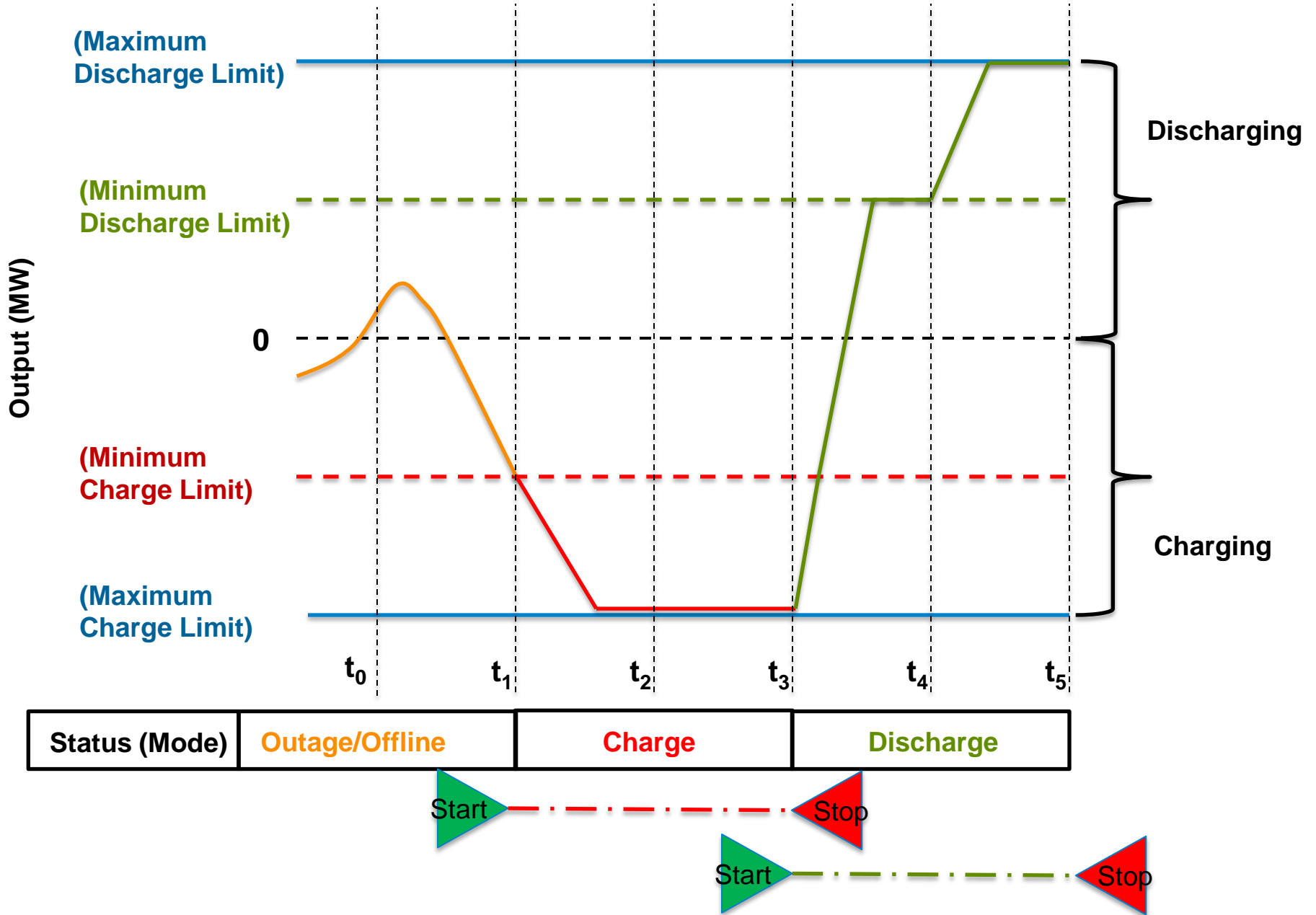
- Market Participant manages State of Charge (SOC)
- Order 841 Bid Parameters accommodated in four operating modes (configurations)
 - Discharging
 - Charging
 - Continuous Operations
 - Outage (Offline)
- Modes are specified by Market Participant for individual Dispatch Intervals
- Online modes are must run commit status

Proposed Participation Model (cont.)

- Optimization of ESR to be developed after implementing Market System Enhancement
 - Order 841 does not require optimization and associated complex modeling
- ESR manages SOC and other bid parameters
 - charge/discharge time, charge/discharge limits, minimum and maximum state of charge and transition times between charging and discharging where applicable

Discharge Mode

- Unit Dispatch System (UDS) dispatches energy and operating reserves between **Minimum/Maximum Discharge Limits** set by MP
 - Will clear at **Minimum Discharge Limit** plus additional MW based on Economic Offer
- ESR in Discharge mode treated like must run
 - Day-Ahead Market Commitment, Forward Reliability Assessment Commitment (FRAC), Reliability Assessment Commitment (RAC), and Look Ahead Commitment (LAC)
- Ramp Up/Down and Ancillary Services – eligible based on qualification, participation, economic offer and available dispatch

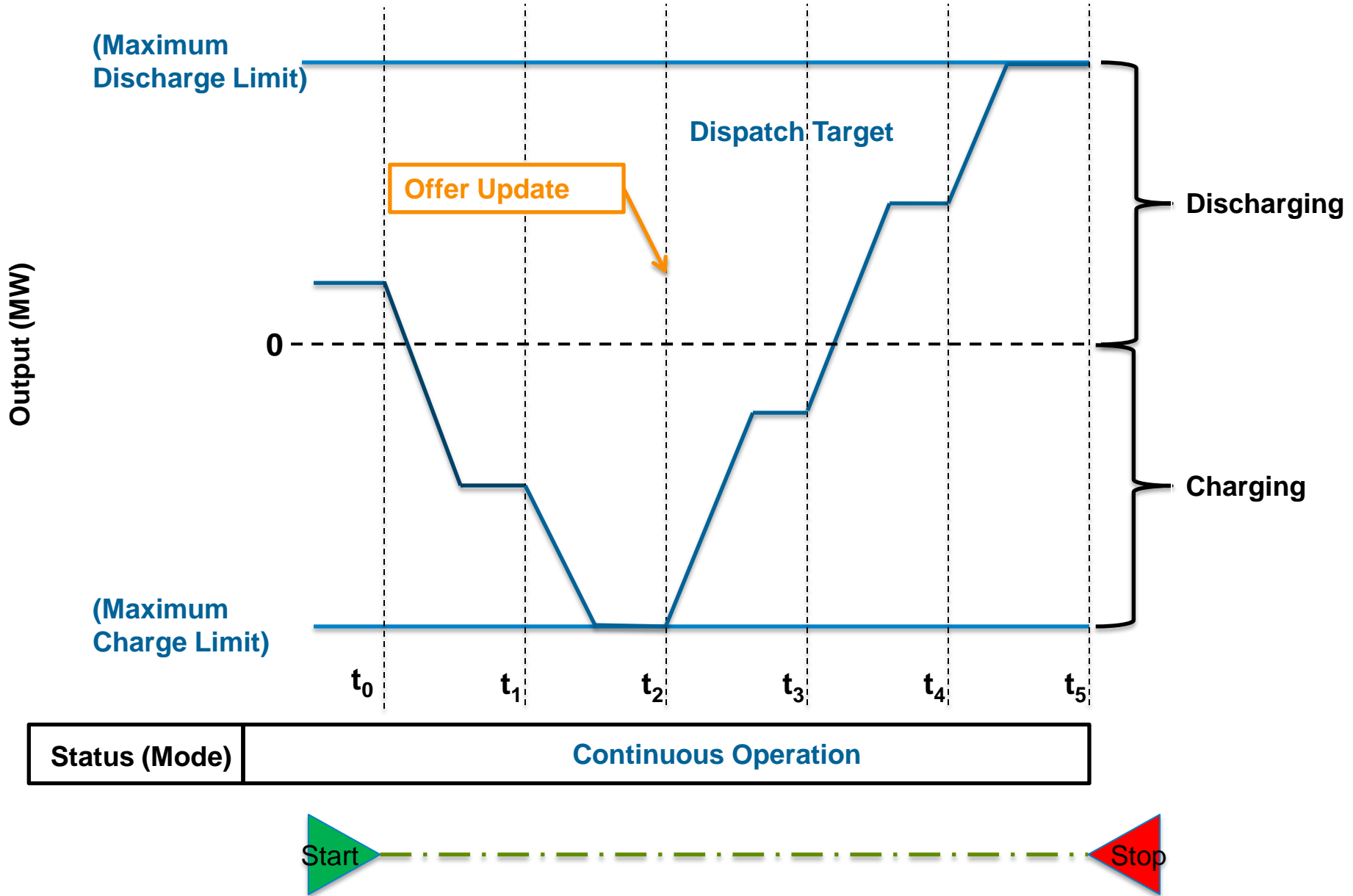


Charging Mode

- Unit Dispatch System (UDS) dispatches energy and operating reserves between **Minimum/Maximum Charge Limits** set by MP
 - Will clear at **Minimum Charge Limit** plus additional MW based on Economic Offer
- ESR in Charge mode treated like must run
 - Day-Ahead Market Commitment, Forward Reliability Assessment Commitment (FRAC), Reliability Assessment Commitment (RAC), and Look Ahead Commitment (LAC)
- Ramp Up/Down and Ancillary Services – eligible based on qualification, participation, economic offer and available dispatch

Continuous Operations Mode

- ESRs in continuous operations mode can be cleared for energy and operating reserves between **Maximum Charge/Discharge** Limits set by MP
 - Treated similar to Demand Response Resource Type II. UDS will setpoint the resource per its economic offer (hourly bid parameter)
 - Additional volumes based on economic offer
 - Considering Continuous (Bi-Directional Self-Schedule amount/penalty price)
- Desired operating points are specified in Resource Offer (Price/MW pair)
- ESR in Continuous Operation mode is must run
- Market Offers – ESR provides single incremental energy offer curve from Max Charge (Pmin) to Max Discharge (Pmax)
 - Potential for SOC-dependent offer curve
- Ramp Up/Down and Ancillary Services – eligible based on qualification, participation, economic offer and available dispatch



Outage (Offline) Mode

- ESRs in Outage Mode will be treated similar to other resources
 - Will not be dispatched by UDS
 - Setpoints are last observed output

ESR Mode Overview

Continuous Operation

Max Limit: Maximum Discharge Limit

Min Limit: Maximum Charge Limit

Ramp Rate: Min (Charge Ramp Rate, Discharge Ramp Rate)

State of Charge Constraint: Minimum State of Charge and Maximum State of Charge

Discharge

Max Limit: Maximum Discharge Limit

Min Limit: Minimum Discharge Limit

Ramp Rate: Discharge Ramp Rate

State of Charge Constraint: Minimum State of Charge

Charge

Max Limit: Minimum Charge Limit

Min Limit: Maximum Charge Limit

Ramp Rate: Charge Ramp Rate

State of Charge Constraint: Maximum State of Charge

Offline (Outage)

N/A

State of Charge

- MISO will **not** manage State of Charge for ESRs
- Market Participants are responsible for informing MISO of the State of Charge through available offer parameters and telemetry
- State of Charge management by Market Participant will be facilitated through bid parameters and other limits
- Existing State of Charge dispatch and deployment consideration capabilities from Stored Energy Resource (Type I) and AGC Enhancement (2019) may be included in ESR participation model

Metering and Accounting

- ESR injections will be treated the same as Actual Energy Injections from other Resource types, includes injections and withdrawals
- All energy entering and exiting ESR is measured for reliability and settlement purposes (“Buy-All/Sell-All”)
- Wholesale Charging Energy Settlement Exemption to prevent paying twice

Settlement And Make-Whole Payments

- Actual Energy Injections at ESRs, both injections and withdrawals will be settled at the appropriate LMP for the Commercial Pricing Node of the ESR per the terms of Module C
- Day-ahead purchases or sales associated with the ESRs cleared energy schedules will be settled at the appropriate LMP for the Commercial Pricing Node of the ESR per the terms of Module C
- Day-ahead purchases and any Real-Time Energy Purchases, including efficiency losses will be settled at the appropriate LMP for the Commercial Pricing Node of the ESR per the terms of Module C
- ESRs will be eligible for appropriate make-whole payments based on commitments and dispatches ordered by MISO consistent with other Resource types
- ESRs representing Distributed Energy Resource aggregations across multiple Elemental Pricing nodes will not be accommodated in the initial ESR participation model

Capacity and Resource Adequacy

- Participation Model allows ESR to qualify as a Capacity Resource for Resource Adequacy, Planning Resource Auction participation, including replacement resources
- All Capacity Resource requirements apply
 - Qualification
 - Testing
 - Must Offer
- ESRs qualify as Use Limited Resources

Questions

Contact Information

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Advisor, Market Design

Appendix

Definition of Electric Storage Resource

“A resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid.”

“definition is intended to cover ESRs [], regardless of their storage medium (e.g., batteries, flywheels, compressed air, and pumped-hydro)”

“ESRs located on the interstate transmission system, on a distribution system, or behind the meter fall under this definition

MISO's clarification request

March 19, 2018

MISO
submitted a
request for
clarification

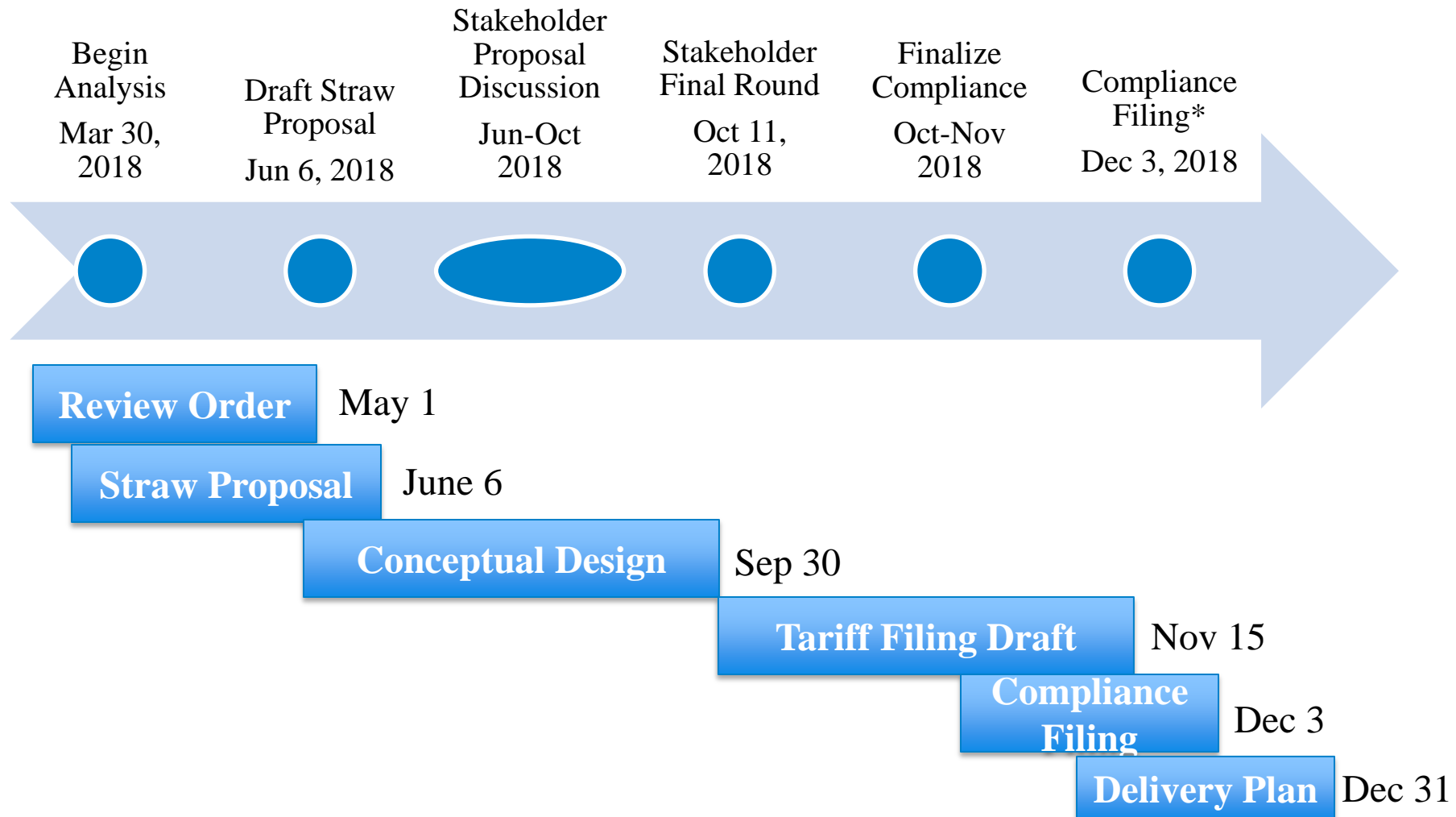
- Minimum size – Phased approach with limited number of small ESRs (50 -1st year, 150 -2nd year)
- State of Charge and Bid Parameters
- Implementation time frame
- A six-month extension for ESR aspects related to DER issues still pending

Timeline and Next Steps

Issues for further consideration

- Self-scheduling in Continuous Operation mode
- Additional limits and bid parameters
 - Regulation Min/max charge/discharge limits
 - Emergency Min/max charge/discharge limits
 - Start up/No load costs
- Commitment, Dispatch, and Performance Thresholds for small ESRs (less than 5 MW)
- Stored Energy and AGC Enhancement state of charge regulation deployment considerations
- Prevention of double payment for wholesale charging energy
- Modeling and optimizing non-convexities in unit commitment engine non-continuous storage
 - Transition time constraints, minimum/maximum charge/discharge time constraints

Order 841 Compliance Timeline



Upcoming Stakeholder Meetings

Date	Description
6/1/2018	Straw Proposal Overview
6/6/2018	Joint MSC, PAC, RSC, RASC Order 841 Meeting
6/27/2018	Energy Storage Task Force
7/1/2018	Straw Proposal Detailed review
7/11/2018	Resource Adequacy Subcommittee
7/12/2018	Market Subcommittee
8/1/2018	Stakeholder Feedback and Discussions
8/2/2018	Reliability Subcommittee
8/8/2018	Resource Adequacy Subcommittee
8/9/2018	Market Subcommittee
9/1/2018	Stakeholder Feedback and Discussions
9/12/2018	Resource Adequacy Subcommittee
9/13/2018	Market Subcommittee
10/1/2018	Stakeholder Final Round
10/2/2018	Reliability Subcommittee
10/10/2018	Resource Adequacy Subcommittee
10/11/2018	Market Subcommittee
10/15/2018	Draft Compliance
11/1/2018	Finalize Compliance
11/8/2018	Market Subcommittee
12/3/2018	Compliance Due (270 Days, next Business Day) for Order 841

Next Steps

- Stakeholder feedback on Straw Proposal requested by June 22nd
- Continue drafting conceptual design and tariff compliance
- Additional proposal discussions at stakeholder forums in July, August, and September

Feedback Request

- MISO seeks stakeholder feedback on Straw Proposal by June 22nd including:
 - Feedback on specific aspects of proposal
 - Parameter Survey
 - Unit or technology specific constraints not listed in Parameter Survey/Order 841
 - Use of Modes by different technology/unit types

Feedback Request

- Please reference Order 841 and/or Energy Storage Task Force issue where applicable

<https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14831775>

<https://cdn.misoenergy.org/20180524%20ESTF%20Item%2002e%20Potential%20Issues%20List203787.xlsx>

- ## Contacts

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