

# Reliability Committee Questions on Voltage Reduction and Operating Reserves for ICR

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# Questions From 3/13/18 Reliability Committee ICR Discussion

- What type of reductions were observed from the latest voltage reduction test?
- How often is the system at a 37% threshold for Ten Minute Synchronized Reserve? How often are the requirements higher and how often are they lower?
- How often is the largest single contingency greater than 1400 MW and what are the associated Reserve Requirements?



# Review of the Voltage Reduction Assumption

- Assumed load relief from the implementation of a 5% voltage reduction is used in the development of the ICR
  - Consists of Actions 6 & 8 of ISO-NE Operating Procedure No. 4, *Actions During a Capacity Deficiency (OP4)*
  - Includes both voltage reduction that can be achieved  $\leq 10$  minutes (Action 8) and  $> 10$  minutes (Action 6)
- ISO-NE conducts tests to verify a 1.5% reduction in system load from 5% voltage reduction and is documented in ISO-NE Operating Procedure No. 13, *Standards for Voltage Reduction and Load Shedding Capability*
  - The 1.5% benchmark has been used by ISO-NE System Operations in the past to estimate the MW value of load relief obtainable from Actions 6 & 8 of OP4
  - ISO-NE uses this value to calculate the MW reduced as a result of a 5% voltage reduction assumed in the ICR model
    - Calculated as [90/10 peak load (Net of BTM PV) – all Active & Passive Qualified Demand Resources] \* 1.5%
- Based on the changing nature of system loads, ISO-NE System Operations has observed that the 1.5% benchmark reduction may no longer be appropriate to assume in the ICR model, as the MW reduction associated with voltage reduction can degrade quickly and can not be sustained as it was in the past



# Voltage Reduction

- Historically a 5% voltage reductions in New England obtained greater than 1.5% load relief when implemented
- The penetration of energy efficient loads have resulted in the implementation of a voltage reduction being less effective than in the past
  - It is becoming more difficult to obtain the 1.5% load relief
- In addition, load relief obtained from a voltage reduction tends to erode the longer the voltage reduction has been implemented
  - This is due to the loss of load diversity and increasing penetration of energy efficiency



# Voltage Reduction, cont.

- Even though the load relief obtained from a voltage reduction continues to decrease with greater penetration of energy efficient loads, ISO-NE System Operations wants to maintain this load relief option within OP4
- Recommendation is to maintain the test threshold for voltage reduction at 1.5% but within the ICR calculation only take credit for 1.0%



# Questions From 3/13/18 Reliability Committee ICR Discussion

- What type of reductions were observed from the latest voltage reduction test?



# Latest Voltage Reduction Test Results

## Less Than 10 Minutes VR Test

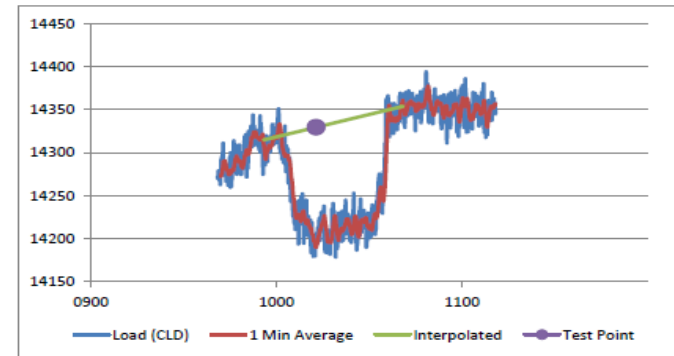
10/26/2017

Start Date / Time	10/26/2017 10:01:00
Average 10 min prior (L <sub>0</sub> )	14316
End Date / Time	10/26/2017 10:36:00
Type of Load Calculation	Interpolate
Average 10 min after (L <sub>1</sub> )	14349
Load Delta (>50=Interpolate)	33

<b>Interpolation</b>	
Load Rate (per minute)	0.866666667
Average 5 min prior (L <sub>0</sub> )	14315
Average 5 min after	14354

<b>VR Results</b>	
50/50 Forecast	26482

Test Date / Time	10/26/2017 10:12:56
Load Reduction	140
Percentage	0.980000019
Normalized	259
OP 4A estimated value	265
	Compare to the OP4A value
	265



## More Than 10 Minutes VR Test

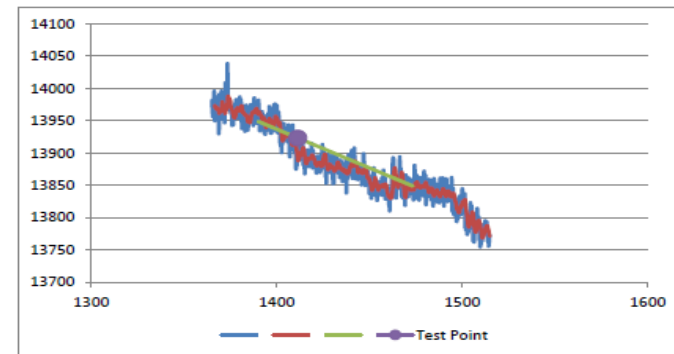
10/26/2017

Start Date / Time	10/26/2017 13:59:00
Average 10 min prior (L <sub>0</sub> )	13954
End Date / Time	10/26/2017 14:39:00
Type of Load Calculation	Interpolate
Average 10 min after (L <sub>1</sub> )	13849
Load Delta (>50=Interpolate)	105

<b>Interpolation</b>	
Load Rate (per minute)	-2
Average 5 min prior (L <sub>0</sub> )	13949
Average 5 min after	13849

<b>VR Results</b>	
50/50 Forecast	26482

Test Date / Time	10/26/2017 14:06:56
Load Reduction	35
Percentage	0.25
Normalized	67
OP 4A estimated value	132
	Compare to the OP4A value
	132



# Review of the Minimum Operating Reserve Assumption

- Historically, the ICR calculation has assumed a minimum level of operating reserve of 200 MW system-wide
  - This level was established in 1980 with a different resource mix
  - At that time there were more synchronous machines capable of fast response
  - Also did not have the limited energy variable resources now on the system
- This assumes that during peak load conditions, under extremely tight capacity situations, ISO-NE System Operations will maintain a minimum level of 200 MW of operating reserves for transmission system protection, ACE balancing and and Tie control prior to invoking manual load shedding procedures
- This assumption was previously discussed at the Reliability Committee (RC) in 2010 as part of the review of the tie benefits methodology\*
  - Members of the PSPC asked ISO-NE to review this assumption during the stakeholder discussions of ICR for FCA 12
- In light of changing system conditions this assumption is too low and is no longer appropriate

\*[https://www.iso-ne.com/static-assets/documents/committees/comm\\_wkgrps/relbly\\_comm/relbly/mtrls/2010/aug252010/a2\\_iso\\_ne\\_tie\\_benefits\\_operational.ppt](https://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/relbly_comm/relbly/mtrls/2010/aug252010/a2_iso_ne_tie_benefits_operational.ppt)



# Review of the Minimum Operating Reserve Assumption, cont.

- NERC Reliability Standards have evolved over time
- NPCC Requirements have evolved over time
- Concern about the declining frequency response on the Eastern Interconnection
- A review of current requirements and potential operating conditions suggests that 200 MW of reserves would be inadequate in actual operations



# NERC Reliability Standards

- BAL-001-2 – Real Power Balancing Control Performance
  - To control Interconnection frequency within defined limits
    - Frequency & external tie-line regulation
- BAL-002-2 – Disturbance Control Standard – Contingency Reserve for Recovery from a Balancing Contingency Event
  - Ensure the Balancing Authority balances resources and demand and returns the Control Error to defined values following a Contingency
    - Measures the ability to activate operating reserves



# NPCC Reserve Requirements

- NPCC Directory 5 - Reserve
  - Operating capacity is required to meet forecast demand, including an allowance for error, to provide protection against equipment failure which has a reasonably high probability of occurrence, and to provide adequate regulation of frequency and tie line power flow
  - Each Balancing Authority shall have ten-minute reserve available to it that is at least equal to its first contingency loss
  - Must plan for and deploy adequate reserve
- NPCC Directory # 2 - Emergency Operations
  - Provides actions to address transmission or capacity emergencies
  - If a Balancing Authority can not maintain frequency regulation or tie-line flow may need to shed firm load



# NPCC – Synchronized Reserves

- NPCC requires synchronized reserves as a portion of a Balancing Authority's ten-minute operating reserves
  - The requirements starts at 100%
  - Can be reduced based on demonstrated performance but not less than 25%
- Currently New England maintains 37% of the ten-minute reserve requirement as synchronized
  - Provides inertia and governor response to arrest and control frequency deviation



# Ten-Minute Spinning Reserves & AGC

- ISO-NE currently utilizes 1400 MW as the largest first contingency
  - Spin requirement 520 MW
- The 2017 average largest contingency was 1467 MW
  - Spin requirement 540 MW
- The 2017 Ten-Minute Average requirement was 1760 MW
  - 20% non-performance factor for ten-minute reserves
  - Spin requirement 650 MW
- In addition New England utilizes approximately 150 MW+ for frequency and tie line regulation (AGC)



# Minimum ICR Operating Reserve Assumption

- A Balancing Authority must always be able to regulate frequency and control tie-line flows
  - ISO-NE utilizes its operating reserves and AGC to meet this obligation
  - Synchronized reserves and AGC requirements are between 670 MW - 850 MW
- A source loss greater than the remaining depleted ten-minute reserve would require load shedding
  - If available Simultaneous Activation of ten-minute Reserve (SAR) would provide the Operators up to 30 minutes to shed load; if not available would need to be shed within 10 minutes
- Recommend utilizing at least 700 MW as the requirement in the ICR calculation
  - Still requires carrying the balance of the reserves on load shedding
  - Balances interconnection reliability risk
  - Provides ISO-NE System Operations with the resources to prevent being a burden on the interconnection and control ACE

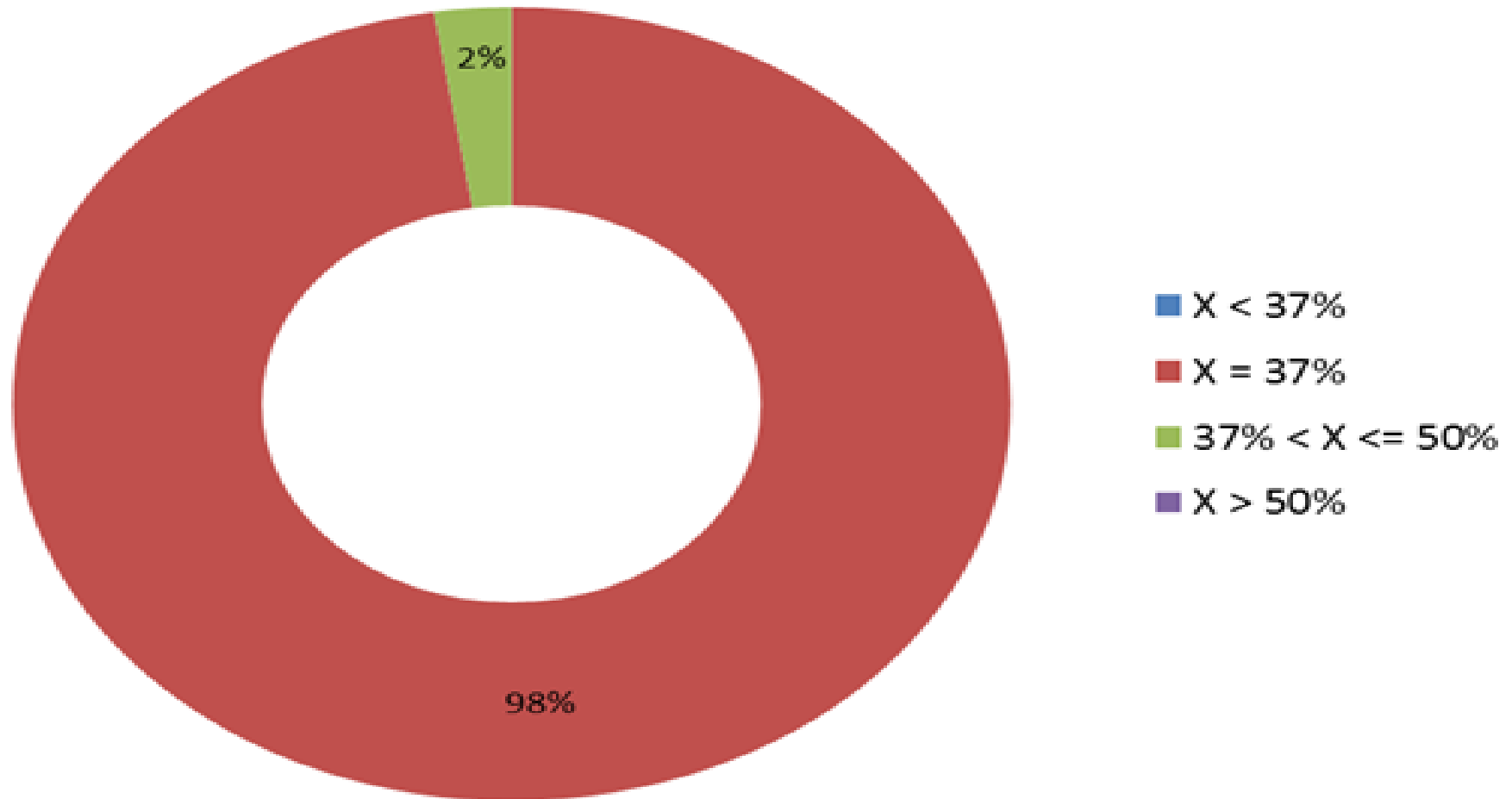
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- How often is the system at a 37% threshold for Ten Minute Synchronized Reserve? How often are the requirements higher and how often are they lower?
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# 10-Min Sync Requirement %

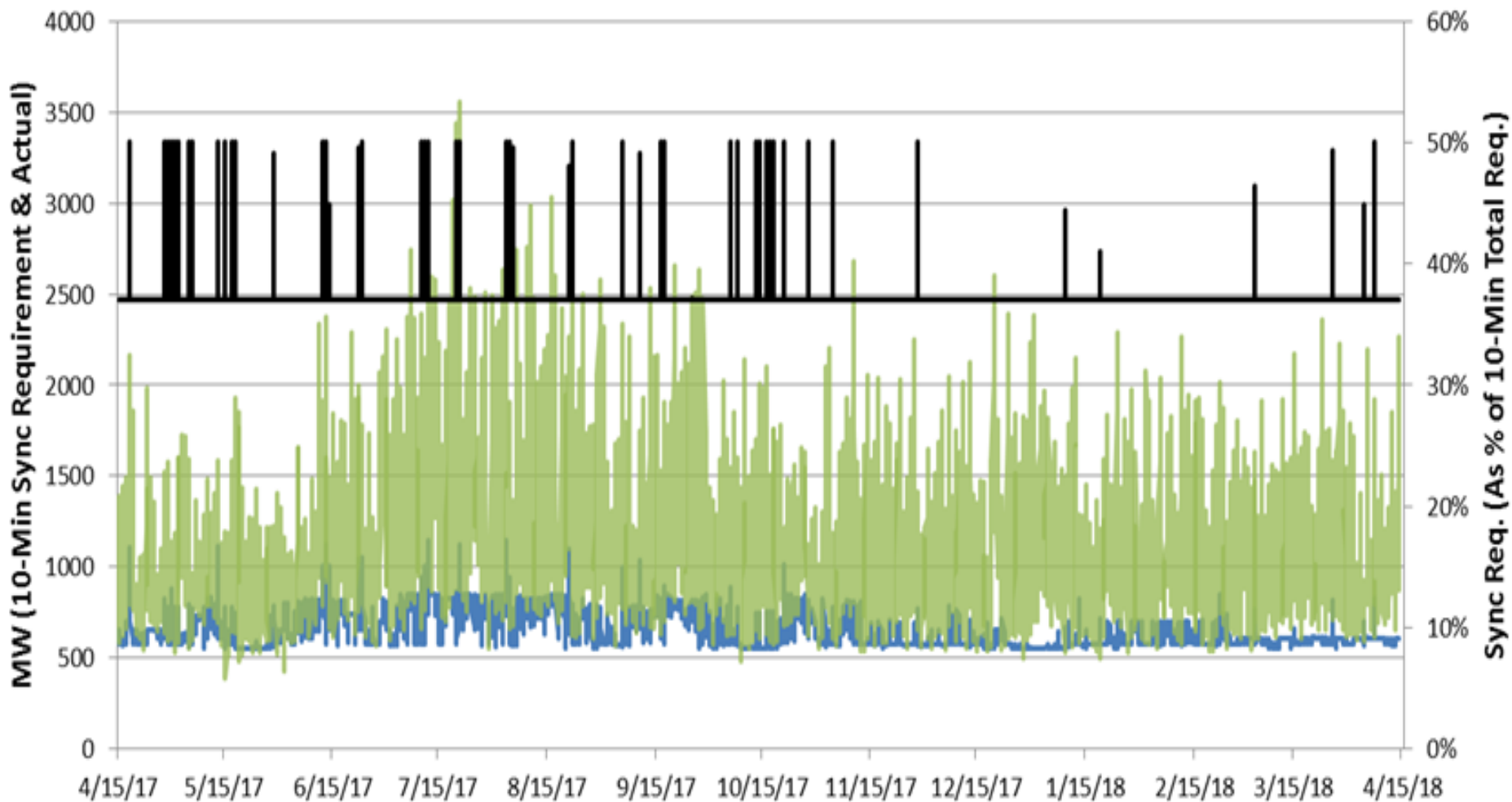
*Compared to 10-Min Total Requirement*





# Ten Minute Synchronized Reserve Actual vs Ten Minute Synchronized Reserve Required

10 Minute Sync Requirement    10 Minute Sync Actual    Sync Req. (As % of 10-Min Total Req.)



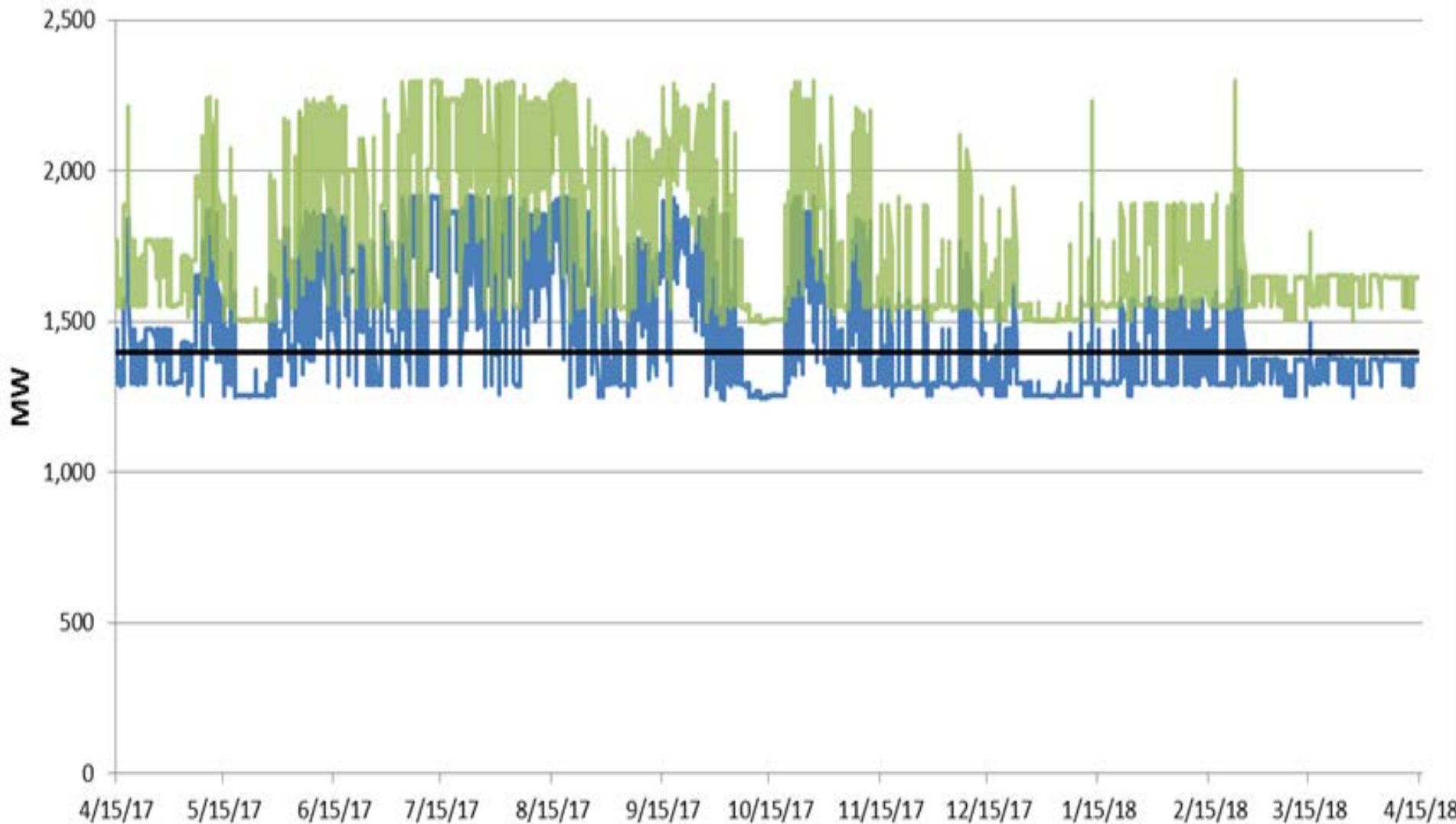
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- How often is the largest single contingency greater than 1400 MW and what are the associated Reserve Requirements?



# Largest Credible Contingency vs 10 Minute Reserve Requirement

MSSC MW    10 Minute Total Requirement    1,400



# Summary

- Recommend utilizing at least 700 MW as the requirement in the ICR calculation
  - Still requires carrying the balance of the reserves on load shedding
  - Balances interconnection reliability risk
  - Provides ISO-NE System Operations with the resources to prevent being a burden on the interconnection and control ACE
- Recommendation is to maintain the test threshold for voltage reduction at 1.5% but within the ICR calculation only take credit for 1.0%
  - For the most recent ICR calculation (FCA 12), the assumed load relief from 5% voltage reduction was 431 MW summer and 317 MW winter
  - Under this proposal, the assumption would be 288 MW summer and 212 MW winter



# Questions

