Introduction

2023-2024 Winter Generator Readiness Seminar

Tom Turgeon

LEAD ANALYST, OPERATIONS TRAINING & PROCEDURES

AGENDA

1. Opening Remarks – Steve Gould
2. Winter Weather Outlook – Mike Fontaine
3. Capacity Outlook – Mike Knowland
4. Gas/Electric Coordination – Mike Knowland
5. OP-21 Surveys – Hannah Johlas
6. 21 Day Energy Assessment – Hannah Johlas
7. Emergency Procedure Review – Steve Gould
8. Generator Preparations – Stephen George
9. Conclusion and Key Takeaways - Steve Gould

Disclaimer

ISO New England (ISO) provides seminars to enhance participant and stakeholder understanding. Because not all issues and requirements are addressed by the seminar, participants and other stakeholders should not rely solely on this seminar for information but should consult the effective *Transmission, Markets and Services Tariff* ("Tariff") and the relevant *Market Manuals*, *Operating Procedures* and *Planning Procedures* ("Procedures").

Seminar examples are provided for illustrative purposes only. Company names and numerical values used are fictitious.

In case of a discrepancy between seminar content provided by ISO and the Tariff or Procedures, the meaning of the Tariff and Procedures shall govern.

WEBEX INFORMATION

Winter Weather Outlook

Mike Fontaine

OPERATIONS FORECASTING

Winter Temperature Outlook

Warmer than normal temperatures forecast for New England.

Winter Precipitation Outlook

Near normal precipitation forecast for central and northern New England, with a slight chance of above normal precipitation in parts of southern New England.

Boston Winter Temperatures

Average winter temperatures have been trending milder over the past couple of decades, however exceptional cold can occur at any time.

From late December 2017 through early January 2018 a major arctic outbreak occurred, even though the average for the winter was above normal

PRIMARY CLIMATE/WEATHER INDICES

WHICH IMPACT NEW ENGLAND WINTERS

Drivers For A Winter Forecast

El Niño-Southern Oscillation (ENSO)

The ENSO is a multi-part circulation pattern across the tropical Pacific Ocean.

In most years, high pressure dominates in the equatorial eastern Pacific Ocean, and general low pressure is observed in the western Pacific region, which results in the easterly trade winds causing warm ocean waters near the equator to accumulate in the west.

30 Year ENSO (El Nino Southern Oscillation) History

El Niño events (Red) often cause flooding in parts of the North America, while La Niña events (Blue) have caused historical flooding across portions of the West Pacific, particularly Australia

Main Driver For New England Winter Forecast

ENSO Forecast – El Niño is Predicted

El Niño Conditions

Creates An Active Pacific Jet Stream And Pattern Anomalies

El Niño Effects

Although snowfall may be variable in New England, an amplified Jet Stream increases the potential for more Nor'easter type storms.

El Niño Effects

Impacts In The Northeast U.S. With A Strong El Niño (Dec.1997-Feb.1998 as example).

THE POLAR VORTEX

A Major Weather Player in New England Winters

Polar Vortex: Very Important, but Low Predictability Skill

The Science Behind the Polar Vortex

The polar vortex is a large area of low pressure and cold air surrounding the Earth's North and South poles. The term vortex refers to the counterclockwise flow of air that helps keep the colder air close to the poles (left globe). Often during winter in the Northern Hemisphere, the polar vortex will become less stable and expand, sending cold Arctic air southward over the United States with the jet stream (right globe). The polar vortex is nothing new — in fact, it's thought that the term first appeared in an 1853 issue of E. Littell's *Living Age*.

Air pressure and winds around the Arctic switch between these two phases (Arctic Oscillation) and contribute to winter weather patterns.

Potential Weak Polar Vortex Impacts: Periods Of Below Normal Temperatures

Arctic Outbreak
Dec. 24, 2017 - Jan. 8, 2018: 14 Consecutive Days of Below Normal Temperatures Across New England!

Even With Above Normal Temperatures Forecast This Winter, A Weak Polar Vortex Can Cause Drastic Temperatures Swings

The 2017-18 Winter Mean Temperature was above normal; yet the season saw both record warmth *and* severe record cold

A Weak Polar Vortex Can Also Result in Blizzards & Nor'easters Across New England, Even Late In The Season

The 2023-2024 Winter Is Forecast To Be Warmer Than Normal, But Arctic Outbreaks, Cold Snaps And Even Severe Winter Storms Are All Possible.

Will You Be *WINTER READY?*

Capacity Outlook

Mike Knowland

MANAGER– FORECAST & SCHEDULING

Capacity Outlook – Peak Net Load Forecast

Prior years load, actual vs. 50/50 and 90/10 forecast

Peak Load Trends

Source: Forecast Data 2022 | *https://www.iso-ne.com/static-assets/documents/2022/04/forecast_data_2022.xlsx*

Preliminary Winter Capacity Outlook

- Operable capacity **surplus** on the 50/50 forecast and **deficiency** on the 90/10 forecast, using capacity supply obligation (CSO)
  - 50/50: Surplus **500** MW
  - 90/10: Deficient **1,222** MW
- Generator Economic Maximum offers are consistently above CSO; as a result, ISO anticipates adequate capacity for both the 50/50 and 90/10 loads
    - Can range from 1,500 to 4,000 MW
    - Approximately **3,000** MW difference between surplus on SCC vs. CSO

Operable Capacity Analysis

☐	2023-10 COO Report Summary of System and Market Operations for current reporting period, including supporting data. Presentation by Vamsi Chadalavada, Executive Vice President and Chief Operating Officer, ISO New England.	10/03/2023	PDF	5.62MB

Preliminary Winter 2023/24 Operable Capacity Analysis

50/50 Load Forecast (Reference)	Dec. - 2023[2] CSO (MW)	Dec. - 2023[2] SCC (MW)
Operable Capacity MW [1]	28,334	31,743
Active Demand Capacity Resource (+) [5]	522	329
External Node Available Net Capacity, CSO imports minus firm capacity exports (+)	958	958
Non Commercial Capacity (+)	223	223
Non Gas-fired Planned Outage MW (-)	2,200	2,378
Gas Generator Outages MW (-)	676	896
Allowance for Unplanned Outages (-) [4]	3,200	3,200
Generation at Risk Due to Gas Supply (-) [3]	1,692	1,356
Net Capacity (NET OPCAP SUPPLY MW)	22,269	25,423
Peak Load Forecast MW(adjusted for Other Demand Resources) [2]	19,464	19,464
Operating Reserve Requirement MW	2,305	2,305
Operable Capacity Required (NET LOAD OBLIGATION MW)	21,769	21,769
Operable Capacity Margin	500	3,654

[1]Operable Capacity is based on data as of **September 25, 2023** and does not include Capacity associated with Settlement Only Generators, Passive and Active Demand Response, and external capacity. The Capacity Supply Obligation (CSO) and Seasonal Claim Capability (SCC) values are based on data as of **September 25, 2023.**
[2] Load forecast that is based on the 2023 CELT report and represents the week with the lowest Operable Capacity Margin, week beginning **December 9, 2023.**
[3] Total of (Gas at Risk MW) – (Gas Gen Outages MW).
[4] Allowance For Unplanned Outage MW is based on the month corresponding to the day with the lowest Operable Capacity Margin for the week.
[5] Active Demand Capacity Resources (ADCRs) can participate in the Forward Capacity Market (FCM), have the ability to obtain a CSO and also participate in the Day-Ahead and Real-Time Energy Markets.

ISO-NE PUBLIC 121

Capacity Outlooks are Useful Planning Tools; Preparation is Critical Given That Unexpected Events Can Occur

- Operable capacity analysis is a forecasted scenario before unexpected events occur
- An example of an implementation of OP-4, Action During A Capacity Deficiency
  - The day began with over 1,900 MW of surplus capacity
  - After generator outages and load running over forecast, the deficiency was over 700 MW
- Always be prepared

H. Total Available Capacity (A+B-C-D+E-F-G)	25,035
I. Peak Load Forecast For Hour Ending 20	20,590
J. Total Operating Reserve Requirement	2,303
K. Capacity Required = I+J	22,893
L. Surplus = (+) Deficiency = (-) (H - K)	2,142
M. Replacement Reserve Requirement	160
N. Excess Commitment Surplus = (+) Deficiency = (-) (L - M)	1,982

NATURAL GAS & PIPELINE OUTLOOK

New England Natural Gas Infrastructure

Natural Gas Schedules to Generators vs. Non-Power Use - Winter 2022 - 2023

New England pipeline schedule data provided by Wood Mackenzie

Natural Gas Schedules to Generators vs. Non-Power Use - Winter 2021 - 2022

New England pipeline schedule data provided by Wood Mackenzie

Gas – Electric Coordination

Mike Knowland

MANAGER– FORECAST & SCHEDULING

New England Natural Gas Infrastructure

Normal Operating Conditions

- Collect Pipeline Bulletin Board Data
  - After the Reserve Adequacy Analysis (RAA) process is completed, run two nominations reports for the overlapping gas day and electric day (0000 - 1000 and 1000 - 2400)
    - DE for every generator that has **inadequate gas** scheduled to their meter **will be contacted** and requested to confirm if gas will be scheduled
    - Information provided in the reports, the information from the generator, and information gathered through communication with gas control will be used to determine if supplemental commitments are required to ensure reliability

Pipeline Bulletin Board Data

Plant	MWh Burned So Far	MWh Before Midnight	MWh After Midnight	MWh Scheduled	MWh Surplus	Gas Scheduled
1	2201	169	1932	4493	191	34600
2	777	0	663	0	(1440)	0
3	1910	0	901	2849	38	20700
4	2131	0	0	2736	605	20028
5	5903	403	0	7706	1400	53800
6	2369	0	798	3097	(70)	22500
7	1253	0	350	93	(1510)	1000
8	2402	185	1850	5129	692	45500
9	0	0	0	28	28	300
10	3	0	525	0	(528)	0
11	0	0	0	0	0	0
12	1	0	0	0	(1)	0
13	4	0	0	0	(4)	0
14	5077	389	2864	9591	1261	65621
15	3394	215	0	3347	(262)	25048
16	3554	550	6017	221	(9900)	1500
17	10639	797	4157	17418	1825	126540
18	7249	545	3892	11096	(590)	80813
19	972	45	1066	9	(2074)	100
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	6294	0	2476	1643	(7127)	17471
23	2758	0	1209	3944	(23)	30000
24	2400	250	1250	579	(3321)	5000
25	4998	0	2317	6917	(398)	52595
26	3208	250	1189	0	(4647)	0
27	2434	0	0	2747	313	23512
28	4222	0	0	5634	1412	42963
29	2121	0	0	2343	222	20000
30	0	0	0	0	0	0
31	1141	86	860	2344	257	27000
32	0	0	0	0	0	0
33	1071	0	3490	5037	476	38325

Follow Up

- If sufficient gas has not been nominated and scheduled to the generator meter (i.e. generator does not appear to have enough gas)
  - Assessments will be done to determine the impact on system operations
  - ISO Control Room will **call to inquire** as to whether the generator intends to secure the requisite gas supply to match its dispatch
- It is always the responsibility of the Designated Entities (DE) to communicate any changes in generator capability to the ISO-NE Control Room

Timeline – Daily Routine

ISO New England Activity	Time	Gas Procurement Schedule
Final Load Forecast Published	≤ 09:30	
DAM bidding window closes	**10:30**	
DAM results published Re-offer period opens	≤ 13:30	
Re-offer period closes RAA Process begins	14:00	Timely Cycle Nomination Deadline
RAA Process completed	≤ 17:00	
Intraday Re-offer window opens	18:30	
	19:00	Evening Cycle Nomination Deadline

PIPELINE COMMUNICATION INFORMATION POLICY

FERC Pipeline Communication/Info Policy

- ISO changed the Information Policy effective January 11, 2014 as approved by FERC
- Provides explicit authority to interstate natural gas pipelines and ISOs to share non-public, operational information with each other for the purpose of promoting reliable service or operational planning
- Permits transmission operators to share the information that they deem necessary to promote the reliability and integrity of their systems with each other
- Parties are subject to a No-Conduit Rule that prohibits subsequent disclosure of that information to an affiliate or third party

Sharing Fuel Burn Expectations

- Pipeline specific & resource specific
- Daily report provided to each pipeline operator
  - Hourly gas burn at each meter (converted to MMBtu)
  - Information is only shared with the associated pipeline
  - Electric day, not gas day

PIPELINE NAME Date: 7/21/2014 Note: Hourly Values Are in Dekatherms

Meter Name	Meter #	LDC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Plant A	700	N							562	1,748	2,372	2,541	2,541	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	1,178		48,978
Plant B	701	N	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,250	1,242	1,233	1,233	1,225	1,225	1,217	1,217	1,217	1,217	1,225	1,225	1,233	1,242	1,242	1,250	1,007	27,749
Plant C	702	N	5,122	5,122	5,122	5,122	5,122	5,122	5,122	3,698	5,122	4,352	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	5,122	120,730
Plant D	703	N	2,367	2,367	2,367	2,579	3,257	3,852	4,789	3,681	4,078	3,729	4,789	4,789	4,789	5,090	5,090	5,090	5,090	5,090	5,090	4,803	4,803	4,803	4,803	4,789	101,980
Plant E	704	N					71	212	354	495	637	707	707	707	707	707	1,061	1,061	1,061	1,061	859	859	707				11,973
Plant F	705	N	2,180	2,180	2,180	2,180	2,180	2,180	2,180	3,487	3,444	3,400	3,371	3,327	3,327	3,313	3,298	3,284	3,298	3,327	3,342	3,385	3,429	3,444	3,458	2,180	71,371
Plant G	706	N	1,489	1,489	1,489	1,489	1,489	1,498	1,489	1,064	1,064	1,064	1,454	1,445	1,436	1,427	1,427	1,427	1,427	1,427	1,436	1,445	1,454	1,462	1,471	1,480	33,839
Plant H	707	N							171	342	513	1,256	1,922	1,922	1,922	2,033	2,025	2,042	2,042	2,059	2,067	2,084	2,102	1,948	2,110	1,922	30,481
Plant I	708	N	3,689	3,689	3,689	3,689	3,689	3,689	3,689	3,683	3,689	3,683	3,689	4,205	4,205	4,205	4,205	4,205	4,205	4,205	4,205	4,205	4,205	2,096	2,096	2,096	88,905
Plant J	709	N									206	412	412	412	412	497	497	497	532	532	497	446	412	412			6,175
		Total	**15,854**	**15,854**	**15,854**	**16,066**	**16,814**	**17,560**	**19,363**	**19,447**	**22,365**	**22,376**	**25,241**	**26,612**	**26,603**	**27,069**	**27,400**	**27,402**	**27,451**	**27,506**	**27,301**	**27,040**	**26,933**	**23,986**	**21,489**	**18,596**	**542,183**

Sharing Generator Planned Outages

- Provide plant/meter specific outage information to individual pipelines associated with those units; this information is shared on a 6-month forward looking basis in the interest of outage coordination between all parties concerned
- ISO is actively coordinating pipeline and generator outages on a real-time and forward looking basis

Maintain Awareness and Communicate

- Generator operators and DEs should always know their specific gas (and other fuel supply) situation at all times, including alternatives as necessary
- Pipelines are being transparent and posting updates to the electronic bulletin boards
  - Be sure to follow the updated postings
- Communicate with the ISO whenever fuel supply situation changes so that the ISO has the information necessary to operate the system reliably

Electronic Bulletin Board Links

- Algonquin
  - https://infopost.enbridge.com/infopost/AGHome.asp?Pipe=AG
- Maritimes and Northeast
  - https://infopost.enbridge.com/InfoPost/MNUSHome.asp?Pipe=MNUS
- Tennessee
  - https://pipeportal.kindermorgan.com/portalui/DefaultKM.aspx?TSP=TGPD
- Iroquois
  - https://iolz.iroquois.com/infopost/Pages/Default.php
- Portland Natural Gas Transmission System
  - http://www.columbiapipeinfo.com/cpginfopost/

Review of OP-21 Surveys

Hannah Johlas

ENERGY SECURITY ANALYST, OPERATIONS

Overview of OP-21 Surveys

Natural Gas Critical Infrastructure Survey

(annual)

Generator Winter Readiness Survey

(annual)

Generator Fuel and Emissions Survey

(weekly/biweekly)

ISO shall treat all submitted responses as Confidential in accordance with the ISO-NE Information Policy

OP-21 Generator Surveys in AskISO

- AskISO (https://iso-ne.my.site.com/) is the platform for Fuel and Emissions Surveys AND Winter Readiness Surveys
- Survey submitters receive emails with link when new surveys are requested

See "Ask ISO User Guide" and "Generator Survey System in Ask ISO" User Guide at https://www.iso-ne.com/participate/support/user-guides

Additional materials at https://www.iso-ne.com/participate/support/participant-readiness-outlook/generator-survey-system-project-gss

WINTER READINESS SURVEY

Winter Readiness Survey: Overview

Who:

All non-Settlement-Only generators

When:

- Annual
- Available on AskISO since October 26
- **Due December 1**

What:

- Winter preparation activities
- Temperature limits on capabilities
- Protocols during extreme cold
- Training prior to cold weather

Why:

- Provide situational awareness of generator readiness during winter months

Winter Readiness Survey: What's New

- New clarifying question

General

Below what temp is the unit no longer able to start? (Deg F) *

Below what temp is the unit no longer able to remain online? (Deg F) *

Is this based on: *

- ○ Design Temperature
- ○ Historical Operating Temperature
- ○ Cold Weather Performance Temperature Determined by an Engineering Analysis

FUEL AND EMISSIONS SURVEY

Fuel and Emissions Survey: Overview

Who:

Generators operating on oil, coal, and/or natural gas

When:

- Due Tuesdays* at 10:00am ET
- Weekly* Dec – Mar (winter)
- Biweekly* Apr – Nov (non-winter)
  (*more often as needed)

What:

- Current and maximum fuel inventory
- Fuel procurement information
- Environmental/emission limits

Why:

- Input to regional energy assessment
- Identify potential reliability issues

Fuel and Emissions Survey: Access

Access through Ask ISO survey platform

Fuel and Emissions Survey: What's New

- Error/typo checks

Fuel and Emissions Survey: What's New

- Error/typo checks

Quick check: inventory change vs. burn

The values in this section are automatically filled based on your responses in previous sections.
To edit the values here, please change your responses in previous sections.

WARNING: Current inventory is much lower than expected. Please explain the missing fuel under the Additional comments **question.**

Inventory on last survey:		1500	gallons of oil
Sum of all generator burns since last survey:	-	100	gallons of oil
Implied replenishment *(based on other values)*:	+	-400	gallons of oil
Inventory on current survey:	=	1000	gallons of oil

Fuel and Emissions Survey: What's New

- Error/typo checks
- More hints

Please explain why the maximum capacity changed from the previous survey. *

Tank re-gauged, retired one tank, etc.

Additional comments

Any additional information that you would like to provide for this station? *(required based on above responses)* *

Deliveries received since previous survey, inventory sold, fuel burned for emissions test, etc.

Fuel and Emissions Survey: What's New

- Error/typo checks
- More hints
- [Updated user guide]

Fuel and Emissions Survey: What's New

- Error/typo checks
- More hints
- Updated user guide
- More flexibility in emissions answers

Emission limitations

Does the station have any environmental or emission limitations that might affect its ability to operate? *

(•) Yes ( ) No

#1 limiting emission

Emission with accumulated amount closest to limit. Exclude hourly and real-time limitations.

#1 limitation is on: * Runtime on oil

Amount remaining: * 100 hours

Limitation periodicity type: * Resets on date

Limitation will reset on: * 01/01/2024

Limitation duration: * days

Additional details, if necessary:

#2 limiting emission

Emission with accumulated amount second-closest to limit. Exclude hourly and real-time limitations.

#2 limitation is on: Gas consumption

Amount remaining: * 100 Bcf

Limitation periodicity type: * Rolling limit

Limitation duration: * days

Additional details, if necessary:

Fuel and Emissions Survey: What's New

- Error/typo checks
- More hints
- Updated user guide
- More flexibility in emissions answers

These new features will be released at the end of this week.

The first (regularly scheduled) survey with new features will be **due November 14, 2023**.

See memo emailed on October 25, 2023 for more details.

PUBLIC OIL DATA

From OP-21 Generator Fuel and Emissions Surveys

Public Oil Charts: Access

New this winter:

- <u>Single</u> file added weekly/biweekly
- Updated formatting

Depletion

(sample charts from July 11, 2023)

Inventory

(sample charts from July 11, 2023)

Burn/Refill (new)

(sample charts from July 11, 2023)

21-Day Energy Assessment

Hannah Johlas

ENERGY SECURITY ANALYST, OPERATIONS

ISO new england

November 29, 2022 – December 19, 2022

21 DAY ENERGY ASSESSMENT:

NORMAL CONDITIONS

****SAMPLE REPORT****

SYSTEM CONDITION: NORMAL

SYSTEM CONDITION: ENERGY ALERT

SYSTEM CONDITION: ENERGY EMERGENCY

Normal Conditions

There are no emergency actions forecasted in the upcoming 21 days

Energy Alert

Forecasted EEA 2 and/or Forecasted EEA 3 are anticipated in days 6 - 21

Energy Emergency

Forecasted EEA 2 and/or Forecasted EEA 3 are projected for 1 or more hours in the upcoming 5 days or controlled power outages are imminent in the 21 day study period

21-Day Energy Assessment

November 15th 2022 – December 5th, 2022

Alert Threshold	Start	Through

Emergency Threshold	Start	Through

Peak Forecasted Daily Energy Demand

Forecasted Peak Date[7]: 12/5/2022

Status Summary
Normal Conditions – No emergency actions forecasted.

Published: Nov. 16, 2022
Next Publication: Nov. 30, 2022*

****SAMPLE REPORT****

ISO-NE PUBLIC

****SAMPLE REPORT****

ISO-NE PUBLIC

****SAMPLE REPORT****

ISO-NE PUBLIC

****SAMPLE REPORT****

****SAMPLE REPORT****

ISO-NE PUBLIC

Fuel Oil Usable Inventory: Last 12 Months

Based on OP-21 generator surveys received from market participants

ISO-NE PUBLIC

Source: ISO New England

Oil Consumption Summary – November 29th – December 5th	
Fuel Type	**Gallons Consumed**
Residual Fuel Oil	181,987
Distillate Fuel Oil	106,693
Total Consumption	**288,680**

The oil consumption summary indicates the number of gallons of oil burned in the previous week as reported in the generator survey.

****SAMPLE REPORT****

ISO-NE PUBLIC

Appendix A

[1] **Overall System Health** – The overall system health represents the energy surplus in New England spanning the 21 day study period. The bounds to further define this status are, 10,000 MW, 5,000 MW and 2,300 MW. As surplus decreases, the weights associated with each threshold increases.

[2] **Consumer Demand** – Consumer demand represents hourly system load spanning the 21 day study period. The bounds to further define this status are, 19,000 MW, 22,000 MW and 24,000 MW. As hourly load increases, the weights associated with each threshold also increases.

[3] **Weather** – Weather represents the daily average temperature spanning the 21 day study period. The bounds to further define this status during the summer (April – November) are 80°F, 86°F, and 90°F. During the winter (December – March) the bounds are further defined as 32°F, 18°F, and 0°F. The weights associated with each threshold adjust based on the temperature and time of year.

[4] **Outages** – Outages is representative of generation forced outages throughout the 21 day study period. The bounds are further defined using the ISO-NE Op-Cap Analysis' most restrictive *Unplanned Outage MW Allowance*. Should the total forced outages achieve or exceed the identified allowance, the weight associated with the limits increase.

[5] **Pipeline Natural Gas Supply** – Gas supply represents the natural gas availability to generators and takes the Local Distribution Company (LDC) demand into consideration and spans the 21 day study period. The bounds are further defined by the daily Heating Degree Day (HDD), and are outlined as 40 HDD, 50 HDD and 60 HDD. As the daily HDD increases, the weights associated with each threshold also increases.

[6] **Stored Fuel Inventory** – Stored fuel inventory reflects the total usable fuel inventory in New England and is inclusive of oil coal. The position of the slider reflects the current capacity in the region based on weekly generator surveys.

[7] Summer peak daily energy demand of 561,878 MWh occurred on July 22, 2011. Winter peak daily energy demand of 434,214 MWh occurred on January 24, 2011

21-Day Energy Assessment is Available on ISO's Website

[ISO Newswire - 21 Day Energy Assessment]

ISO Emergency Procedure Review

M/LCC-2, OP-4, OP-21, OP-7

Steven Gould
DIRECTOR, OPERATIONS

Overview of Emergency Procedures

- M/LCC-2: Abnormal Conditions Alert
- OP-4: Action During a Capacity Deficiency
  - OP-4 Appendix A: Estimates of Additional Generation and Load Relief
- OP-21: Operational Surveys, Energy Forecasting & Reporting, and Actions During an Energy Emergency
- OP-7: Action in An Emergency

M/LCC-2 Alerts the Region When Abnormal System Conditions Exist or are Anticipated

- ISO will declare M/LCC-2, Abnormal Conditions Alert, when the reliability of the New England RCA/BAA is degraded
  - An LCC may also declare M/LCC-2 for its own local area of the system
- Possible conditions for declaration of M/LCC-2 include a forecasted or actual deficiency of operating reserves requiring implementation of OP-4 or OP-7; low transmission voltages and/or low reactive reserves, or a credible threat to power system reliability such as sabotage or an approaching storm
  - ISO most frequently declares M/LCC-2 for large storms and conditions where system capacity is low
- Actions are intended to reduce or eliminate the risk of losing equipment due to testing or other high risk activities whenever the system is stressed
- Market participants are expected to stop or postpone maintenance, construction or test activities that reduce the reliability or output of a resource or contribute to decreased reliability of the system (e.g. interruption of communications or reduced staffing levels)
  - If a maintenance, construction or test activities cannot be stopped and/or postponed; precautions shall be taken to prevent the activity from posing further risk to the power system

OP-4 Actions are Implemented When Load and Operating Reserve Requirements Exceed Available Resources

- ISO will implement actions of OP-4, Capacity Deficiency, when available resources are insufficient to meet the anticipated load plus operating reserve requirements
  - An LCC may also implement OP-4 actions for its own local area of the system
- Other system conditions resulting in OP-4 include; transmission facilities into a sub-area of the region are loaded beyond transfer capabilities, sub-area of New England is experiencing abnormal voltage and/or reactive conditions, or an external area is experiencing a capacity deficiency and has requested assistance resulting in operating reserves below the required levels
- Time permitting, ISO system operators take action in advance of OP-4. Available actions include; ordering on longer lead time resources, reduction of real-time only export transactions, scheduling priced import transactions
- The 11 actions of OP-4 provide ~1,920 – 4,020 MW of relief (as documented in OP-4, Appendix A)

OP-4 Actions

1. Implement a Power Caution
30-Minute Reserve Depletion
Resources with CSO prepare

2. Declare Energy Emergency Alert (EEA) 1

3. Request Voluntary Load Curtailment of MP facilities

4. Implement a Power Watch

5. Emergency cap/energy from MPs or neighboring RC/BAs
10-Minute Reserves

6. Implement Voltage Reduction (5% > 10 Min)
Declare EEA2

7. Resources w/o CSO voluntarily provide MWs

8. Implement Voltage Reduction (5% ≤ 10 Min)
Declare EEA2 *(if not done yet)*

9. Request Customer Generation & Voluntary Load Curtailment
(Large Industrial/Commercial)

10. Implement a Power Warning
Initiate Radio/TV Appeals
Declare EEA2 *(if not done yet)*

11. Request State Governor Appeals
Declare EEA2 *(if not done yet)*

Historical OP-4 Events

- Most recent OP-4 implementation on Wednesday, July 5, 2023 was caused by the trip of a tie line that resulted in the reduction of import energy into New England. At the time of the capacity deficiency, neighboring areas under delivered energy by 1,763 MW as compared to the 08:30 Morning Report.
- System conditions required implementation of Master/Local Control Center Procedure No. 2 (M/LCC2) and OP-4
  - M/LCC2: 18:30 – 22:00
  - OP-4, Actions 1, 2: 18:30 – 20:00
- These events led to a Capacity Scarcity Condition (CSC) under the Pay-for-Performance construct
  - a CSC is triggered by the approval of a single dispatch case that is violating one or more of the system reserve or local reserve zone constraints for one 5-minute interval

OP-21 Actions are Intended to Mitigate the Impacts of an Actual or Anticipated Energy Emergency

- An Energy Emergency, as defined in ISO's Operating Procedure No. 21, *Operational Surveys, Energy Forecasting & Reporting and Actions During an Energy Emergency*, is a system condition that may result in the shedding of firm customer load due to an actual energy deficiency

- In contrast to capacity deficiencies, which are typically short-duration over peak load hour(s) and are mitigated primarily through the actions of ISO's Operating Procedure No. 4, *Actions During a Capacity Deficiency* (OP-4), **Energy Emergency conditions are expected to last on the order of days or weeks, not hours**

- One or more of the following may contribute to or cause a regional energy deficiency:
  - extended periods of very cold weather regionally or nationally
  - prolonged disruption to one or more of the region's interstate natural gas pipelines
  - disruptions at one or more of the region's large LNG facilities
  - inability to replenish fuel oil supplies
  - prolonged disruption to one or more transmission facilities that import power into the region

OP-21 Energy Alert and Emergency Actions

Action	Normal	Energy Alert	Energy Emergency
ISO Data Collection Frequency (winter)	Weekly	**Daily**	**Daily**
ISO Forecasting & Reporting (winter)	Weekly	**Daily**	**Daily**
ISO Alert LCCs & RC/BAs	N	**Y**	**Y**
ISO Alert State Regulators & Officials	N	**Y**	**Y**
Report to DOE using DOE-417	N	N	**Y**
Request DF gen switch to fuel not in short supply (voluntary)	N	**N**	**Y**
Implement OP-4, excluding Governor Appeals	N	N	**Y (as needed)**
Implement OP-4, including Governor Appeals	N	N	**Y (as needed)**
Implement OP-7	N	N	**Y (as needed)**
Lead MPs (Fuel & Emissions)	N/A	**Evaluate**	**Evaluate**
Lead MPs & LCCs (Transmission Facilities)	N/A	Evaluate	Evaluate

OP-7 Action in an Emergency

- ISO will implement actions of OP-7, Action in an Emergency, in the event of an operating emergency involving unusually low frequency, equipment overload, capacity or energy deficiency, unacceptable voltage levels, or any other emergency that ISO deems appropriate
- The objectives of OP-7 actions are to protect reliable operation of the Eastern Interconnection, restore balance between customers' load and available generation in the shortest practicable time, minimize risk of damage to equipment, and to minimize interruption of customer service
- 50% of the New England load can be shed manually in 10 minutes or less, including the 30% that is shed automatically by underfrequency relays
  - Load shed instructions are communicated as an operating instruction from ISO to the LCCs verbally as a % of area load to be shed

Review of Recent Cold Weather Events and Generator Preparations for Winter

Stephen George

DIRECTOR, OPERATIONAL PERFORMANCE, TRAINING & INTEGRATION

Winter Storm Elliott

- Key findings from the FERC, NERC, and Regional Entity Joint Staff Inquiry into Winter Storm Elliott Grid Operations in December 2022 were similar to those from other recent extreme cold weather events
  - Significant levels of unplanned generator outages caused largely by mechanical/electrical, freezing, and fuel-related issues
  - Significant natural gas production decreases in some areas of the country
  - Significant natural gas LDC outages or near misses
- Over 1,700 individual generators experienced 3,500^{+} outages, derates, failures to start; 825 were natural gas-fired generators
- Several Balancing Authorities (BAs) in the southeastern U.S. shed firm load, in total exceeding 5 GW during extreme cold weather
- Recommendations include improvements to cold weather generator reliability, natural gas infrastructure reliability, grid operations reliability, and gas-electric coordination
- Fifth event in the past 11 years in which unplanned cold weather-related generation outages jeopardized bulk-power system reliability

Winter Storm Elliott Impacts to New England

- Impacts to New England from Winter Storm Elliott were minimal, with the exception of a short-duration capacity deficiency on December 24, 2022
  - M/LCC-2, Abnormal Conditions Alert: 16:00 – 21:00
  - OP-4, Actions 1, 2: 16:30 – 19:00
  - OP-4, Action 3: 16:45 – 19:00
  - OP-4, Action 5: 17:30 – 18:30
- In total, ~2,275 MW of generating capacity that was expected to be available for the peak hour became unavailable during the operating day for a variety of reasons
  - Net imports were less than the quantity that cleared the Day-Ahead Energy Market (~1,100 MW less at the time OP-4 actions were implemented)

Winter Storm Elliott Impacts to New England, cont.

- Several types of generation technologies and fuel types experienced outages or reductions
  - Dual fuel generators, residual fuel oil (RFO) generators, natural gas-only generators, and distillate fuel oil (DFO) generators comprised the bulk of the generating capacity reductions (MWs) on that day
  - A majority (~65%) of all generating capacity reductions were due to mechanical problems such as stuck valves, fuel pump failures, vibration, other unexpected equipment failures
  - Other factors contributing to generator outages or reductions included gas scheduling issues and emissions-related restrictions
- ISO System Operations staff was in close communication with neighboring Reliability Coordinators, BAs, Local Control Centers, and Generators ahead of and throughout the severe cold weather

NERC Cold Weather Reliability Standards

- "Project 2019-06 Cold Weather" Reliability Standards
  - These Cold Weather Reliability Standards were developed, in part, based on a recommendation from the joint FERC/NERC report, The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018
  - February 2021 Cold Weather Outages in Texas and the South Central United States contributed to an accelerated pace of standard development and approval
  - These standards require generators to implement plans to prepare for cold weather and require the exchange of certain generator cold weather operating parameters to enhance situational awareness
- The effective date of these Cold Weather Standards was April 1, 2023
  - ISO is collecting additional cold weather-related data via the OP-21 Winter Generator Readiness Survey in order to inform processes and development of operating plans

NERC Cold Weather Reliability Standards, cont.

- "Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination" Reliability Standards
  - Intended to address reliability related findings from the FERC, NERC, and Regional Entity Joint Staff Inquiry into the February 2021 Cold Weather Grid Operations
  - Project includes two phases; Phase 1 of the project addressed 4 Key Recommendations identified in the SAR and Phase 2 of the project is addressing the remaining Key Recommendations
    - Phase 1 includes standard requirements related to calculation of Extreme Cold Weather Temperatures (ECWT), as well as enhancements to freeze protection measure and cold weather plan requirements
  - Notably, the findings from the FERC, NERC, and Regional Entity Staff Report on Winter Storm Elliott report support the need for prompt development and implementation of the remaining standard revisions that were recommended in the February 2021 Cold Weather Outages report

NERC Generating Unit Winter Weather Readiness Reliability Guideline

- Provides a framework for effective winter weather readiness programs; consists of industry best practices related to enhancing generator reliability during severe cold weather
- Review of these best practices is highly encouraged
- Guideline describes that an effective winter weather readiness program includes:
  - Safety
  - Management roles & expectations
  - Processes and procedures
  - Evaluation of potential problem areas with critical components
  - Testing of Emergency and Backup Systems
  - Training
  - Communications

NERC Information Resources on Cold Weather Preparation

- Links to cold weather resources, including:
  - Reports on significant cold weather events
  - Lessons learned
  - Winter weather webinars from prior years
  - Annual winter reliability assessments

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Updated: 11/22/2021

NERC Information Resources on Cold Weather Preparation and BPS Impacts

NERC has collected and shared information on cold weather preparation and BPS impacts for years via Webinars, Special Reports, Lessons Learned, Failure Modes & Mechanisms, and other resources.

Here are links to some cold weather resources:

Reports on major BPS-impacting Cold Weather events

- Outages and Curtailments during the Southwest Cold Weather Event of February 1-5, 2011
- Winter Weather Readiness for Texas Generators, (2011)
- January 2014 Polar Vortex Review
- The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018 (There are a number of 'sound practices' from the industry, starting on page 100.)
- The Generating Unit Winter Weather Readiness Reliability Guideline Version 3 (Dec 2020) is a resource for helping develop generator cold weather preparation plans.
- FERC - NERC - Regional Entity Staff Report: The February 2021 Cold Weather Outages in Texas and the South Central United States
- Other Cold Weather Reports and Training Materials can be found on this site.

Cold weather related Lessons Learned:

- LL20110902 Adequate Maintenance and Inspection of Generator Freeze Protection
- LL20110903 Generating Unit Temperature Design Parameters and Extreme Winter Conditions
- LL20111001 Plant Instrument & Sensing Equipment Freezing Due to Heat Trace & Insulation Failures
- LL20120101 Plant Onsite Material and Personnel Needed for a Winter Weather Event
- LL20120102 Plant Operator Training to Prepare for a Winter Weather Event
- LL20120103 Transmission Facilities and Winter Weather Operations
- LL20120901 Wind Farm Winter Storm Issues
- LL20120902 Transformer Oil Level Issues During Cold Weather
- LL20120903 Winter Storm Inlet Air Duct Icing
- LL20120904 Capacity Awareness During an Energy Emergency Event
- LL20120905 Gas and Electricity Interdependency
- LL20180702 Preparing Circuit Breakers for Operation in Cold Weather (also 2018 Webinar w/FMM)
- LL20200601 Unanticipated Wind Generation Cutoffs during a Cold Weather Event
- LL20201101 Cold Weather Operation of SF6 Circuit Breakers

Winter Weather Webinars from 2012 – 2021 can be found on this site.

Annual Winter Reliability Assessments 2003/2004 thru 2021/2022 can be found on this site.

RELIABILITY | RESILIENCE | SECURITY

Key Takeaways

Steve Gould

DIRECTOR, OPERATIONS

Key Takeaways

- Warmer than normal temperatures and near normal precipitation are forecasted for most of New England; extreme cold weather can occur at any time, so advance preparations by ISO and by resources in the region are critical
- ISO is closely monitoring weather forecasts and fuel supplies in the region; monitoring of regional LNG storage inventories and routine surveys of oil, coal, and natural-gas fired resources enhance situational awareness and inform preparations
- Capacity is expected to be adequate this winter; fuel replenishment will greatly mitigate any potential for energy shortfalls under extreme conditions
- ISO's 21-day energy assessment provides early warning to the region should energy supplies become constrained; stakeholders should monitor this weekly report closely
- ISO's well-established emergency procedures are available for use should system conditions dictate; resource owners and operators should be aware of their roles and responsibilities should emergency conditions arise
- Communication and coordination is critical; ISO expects to be informed by resource owners of actual or anticipated concerns with the availability of generating resources

2023-2024 Winter Generator Readiness Seminar

1. Opening Remarks – Steve Gould
2. Winter Weather Outlook – Mike Fontaine
3. Capacity Outlook – Mike Knowland
4. Gas/Electric Coordination – Mike Knowland
5. OP-21 Surveys – Hannah Johlas
6. 21 Day Energy Assessment – Hannah Johlas
7. Emergency Procedure Review – Steve Gould
8. Generator Preparations – Stephen George
9. Conclusion and Key Takeaways - Steve Gould