Introduction

2022-23 Winter Generator Readiness Seminar

AGENDA

1. Opening Remarks – Steve Gould
2. Winter Weather Outlook – Mike Fontaine
3. Capacity & Energy Outlook – Mike Knowland
4. OP-21 Surveys – Jaren Lutenegger
5. ISO Communication Protocols
   - 21 Day Energy Assessment – Mallory Waldrip
   - Gas/Electric Coordination – Mike Knowland
6. Emergency Procedure Review – Steve Gould
7. Generator Preparations – Stephen George
8. 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.

Presenters

Steven Gould
Director, Operations

Thomas Knowland
Manager, Forecast & Scheduling

Mallory Waldrip
Lead Energy Security Analyst

Michael Fontaine
Lead Forecast Analyst

Jaren Lutenegger
Manager, Operations Analysis and Integration

Stephen George
Director, OPTI

Opening Remarks

Winter 2022-2023

Steven Gould

DIRECTOR, OPERATIONS

Key Takeaways

- Warmer than normal temperatures and near normal precipitation are forecasted for most of New England; extreme 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 and energy supplies are expected to be adequate under mild and moderate weather conditions this winter; in-season fuel replenishment will greatly mitigate risks of energy shortfalls under more stressful 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

Winter Weather Outlook

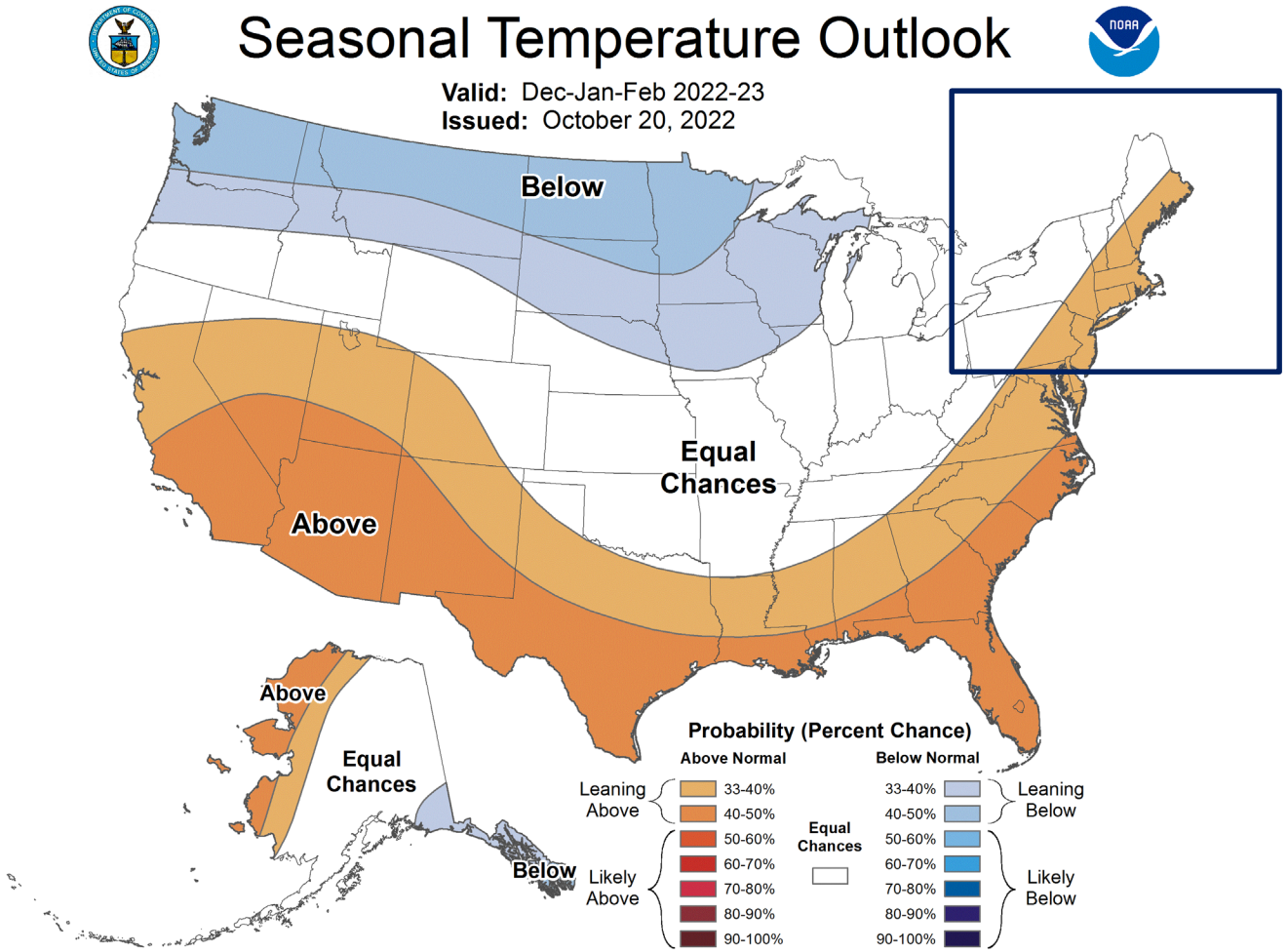
Winter 2022-23

Mike Fontaine

LEAD FORECAST ANALYST – FORECAST & SCHEDULING

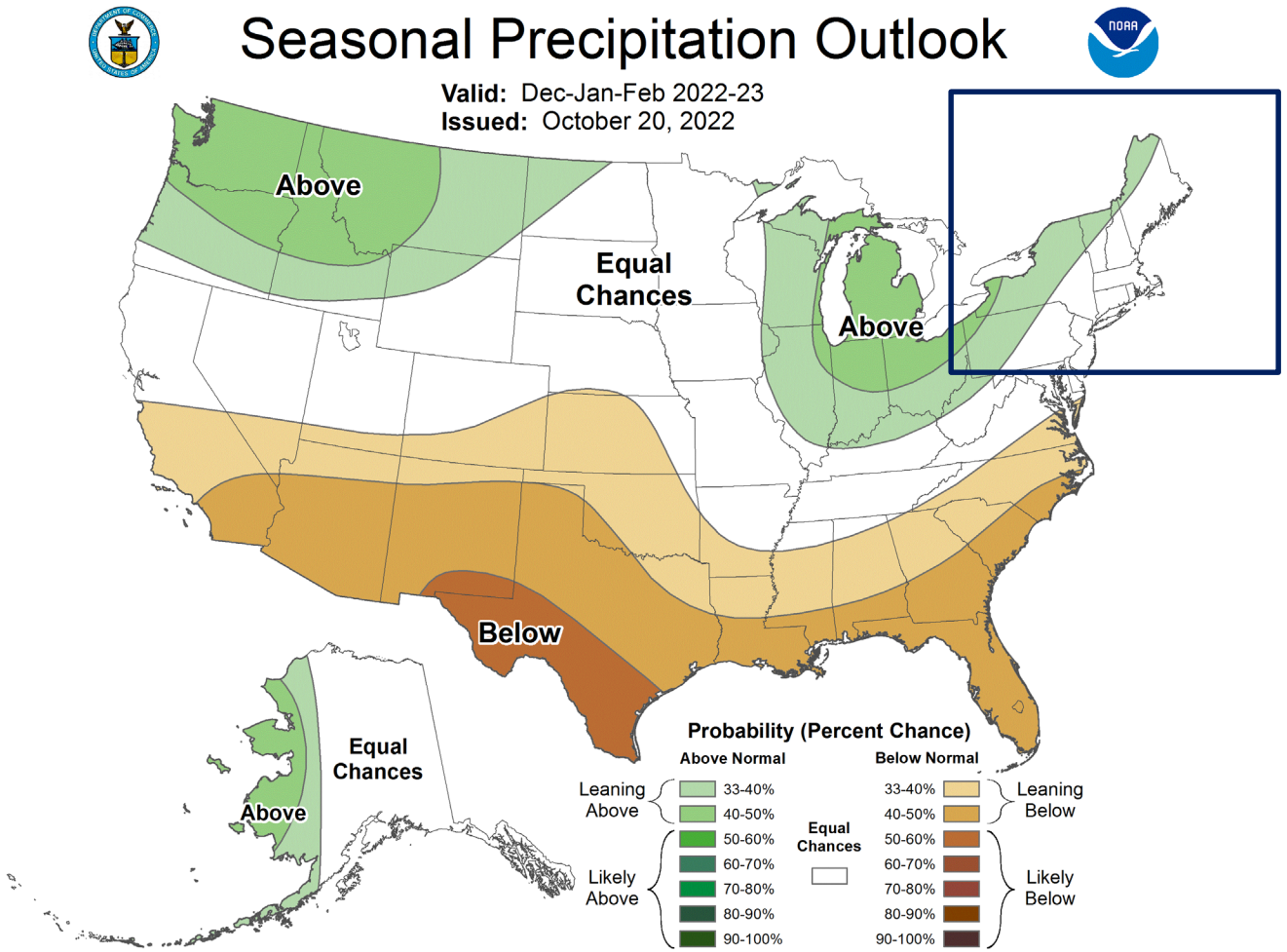
Winter Temperature Outlook

Warmer than normal temperatures are forecast for most of New England

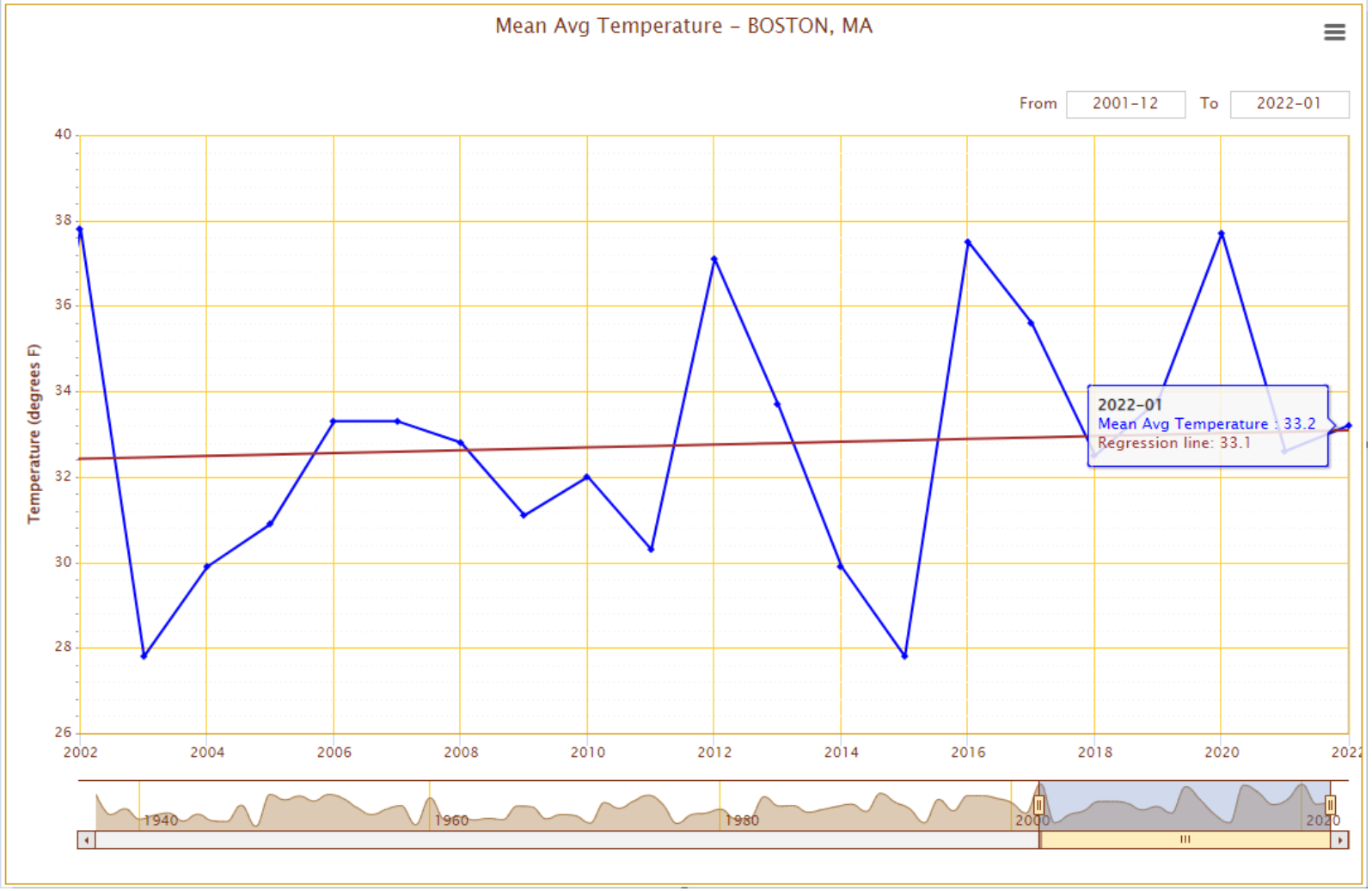


Winter Precipitation Outlook

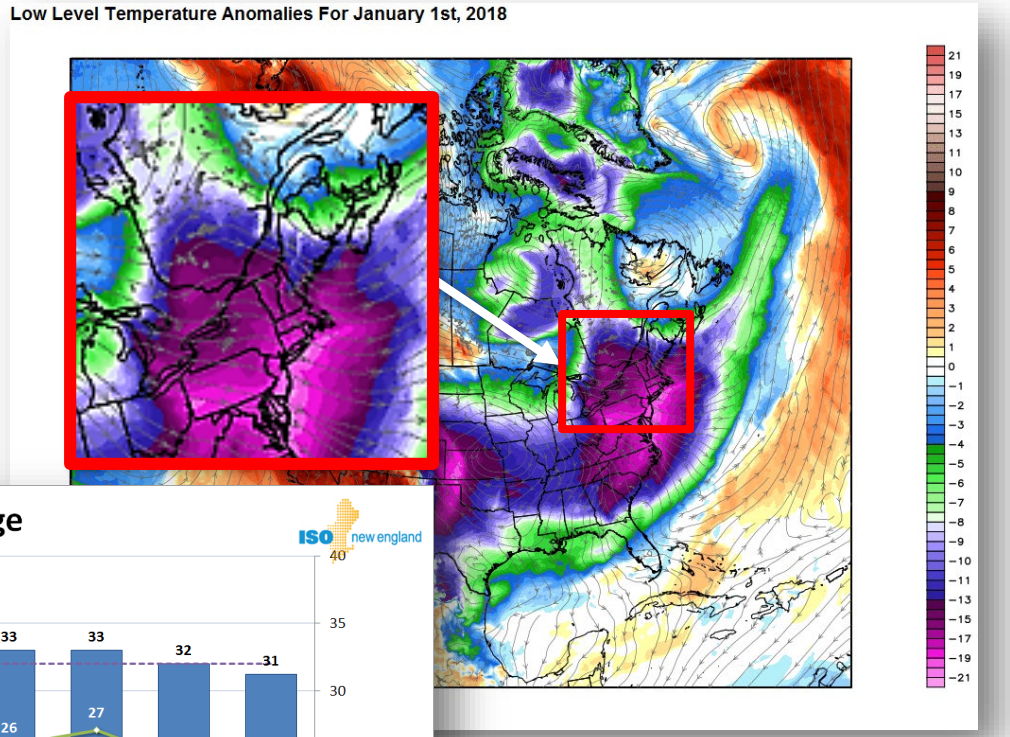
Near normal precipitation are forecast for most of New England

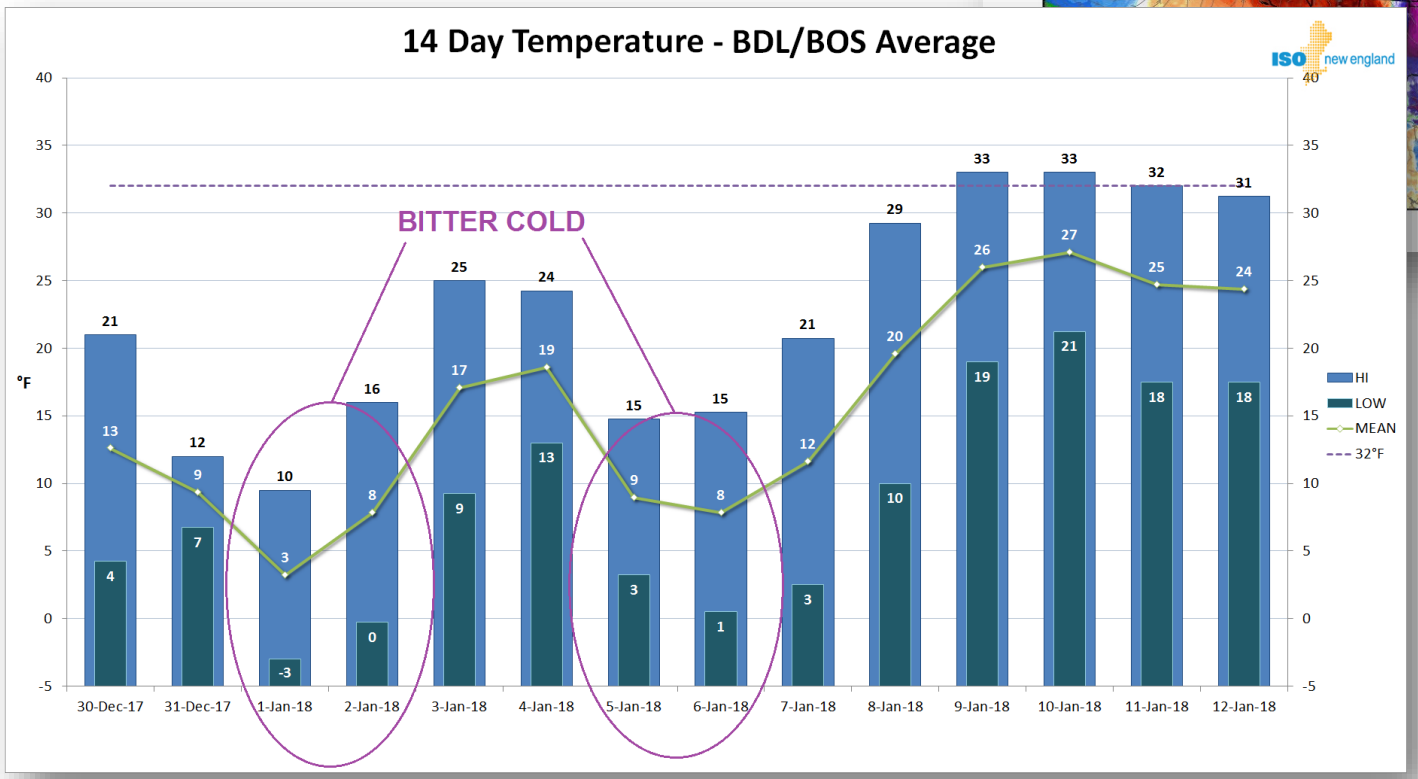


Average winter temperatures have been trending milder, however exceptional cold can occur at any time



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





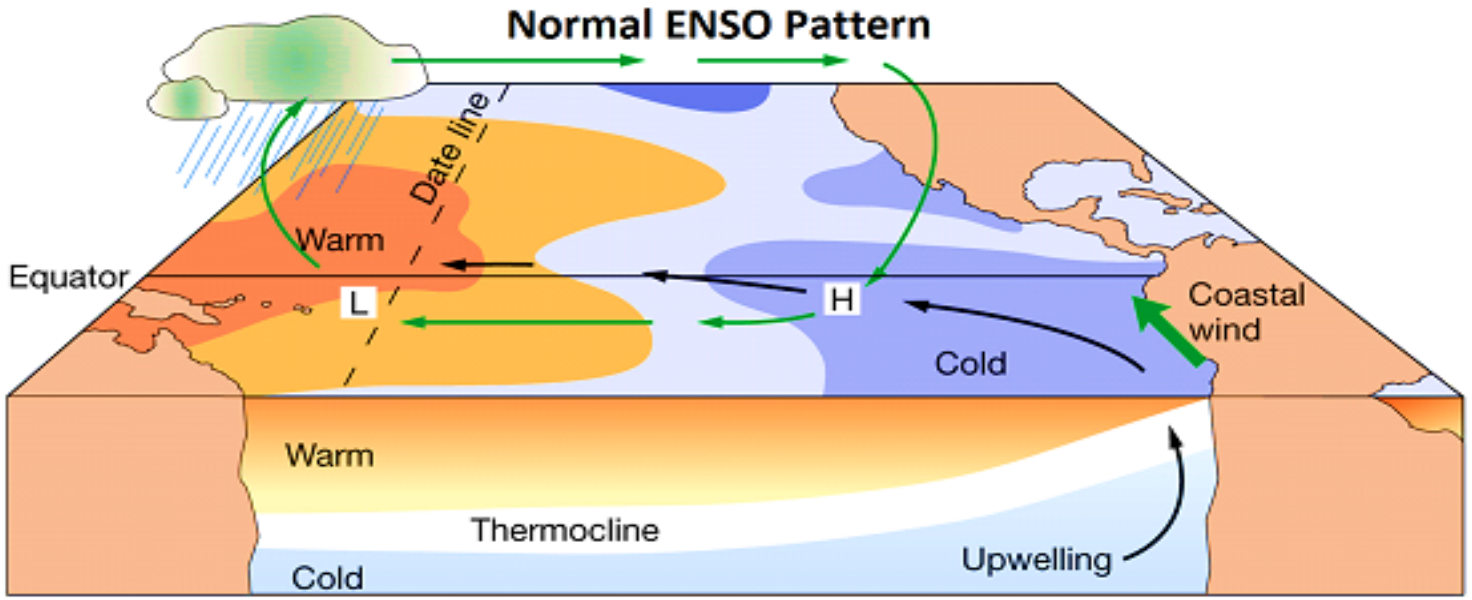
PRIMARY CLIMATE/WEATHER INDICES

Drivers For A Winter Forecast

El Niño-Southern Oscillation (ENSO)

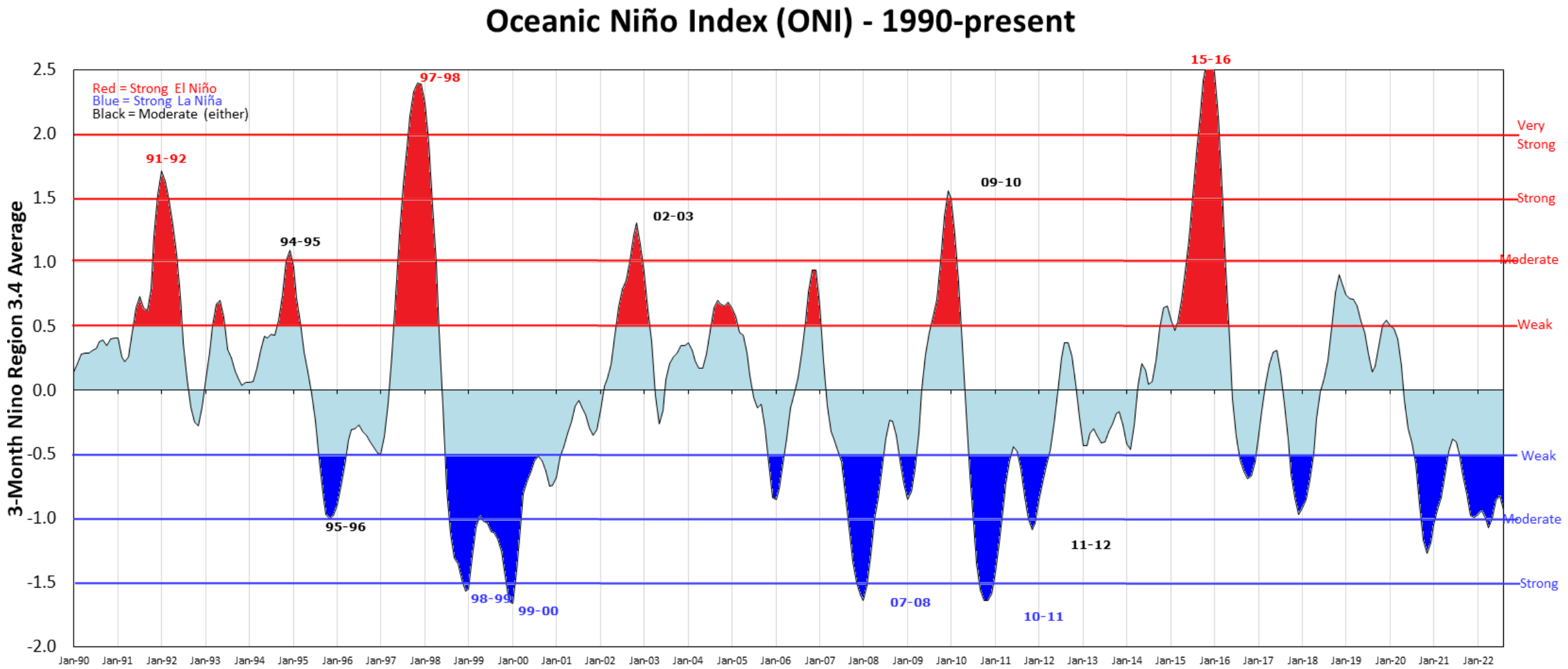
The ENSO is a multi-part circulation pattern across the tropical Pacific Ocean.

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.



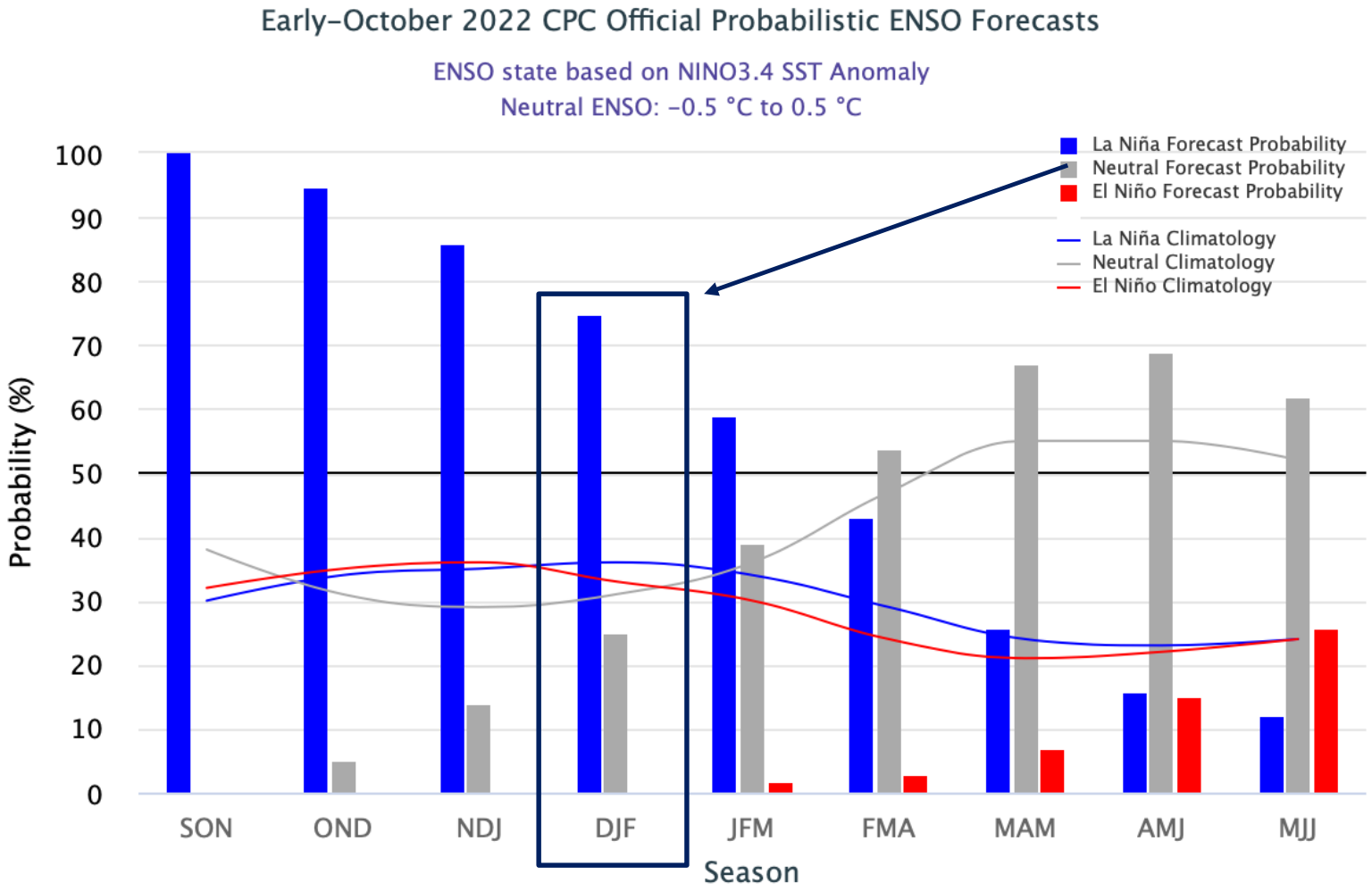
30 Year ENSO History

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



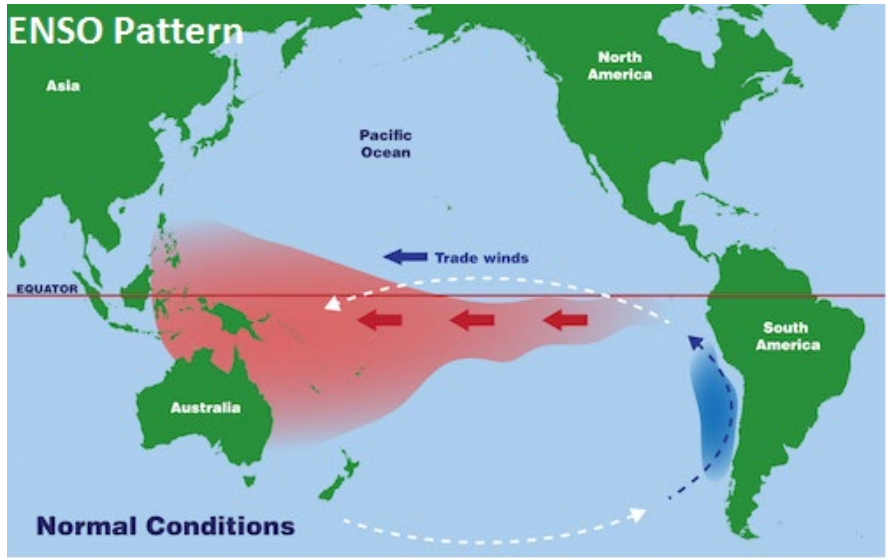
Main Driver For New England Winter Forecast

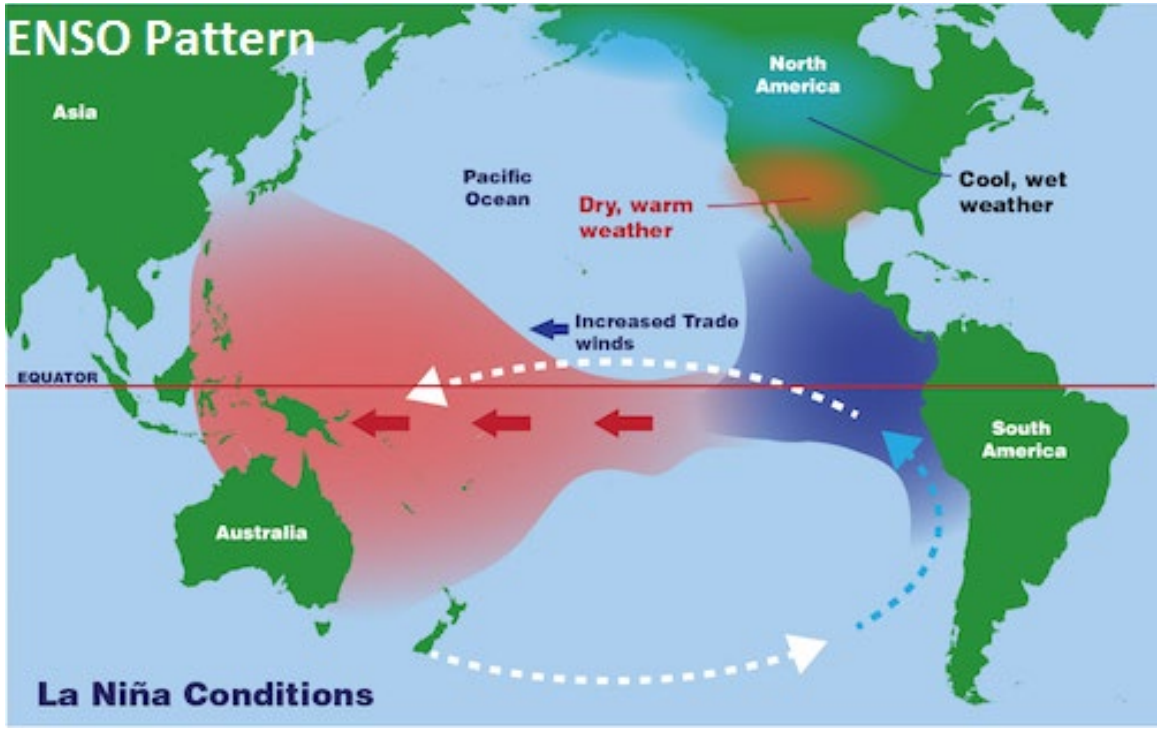
ENSO Forecast – La Niña is Predicted



La Niña Conditions Likely

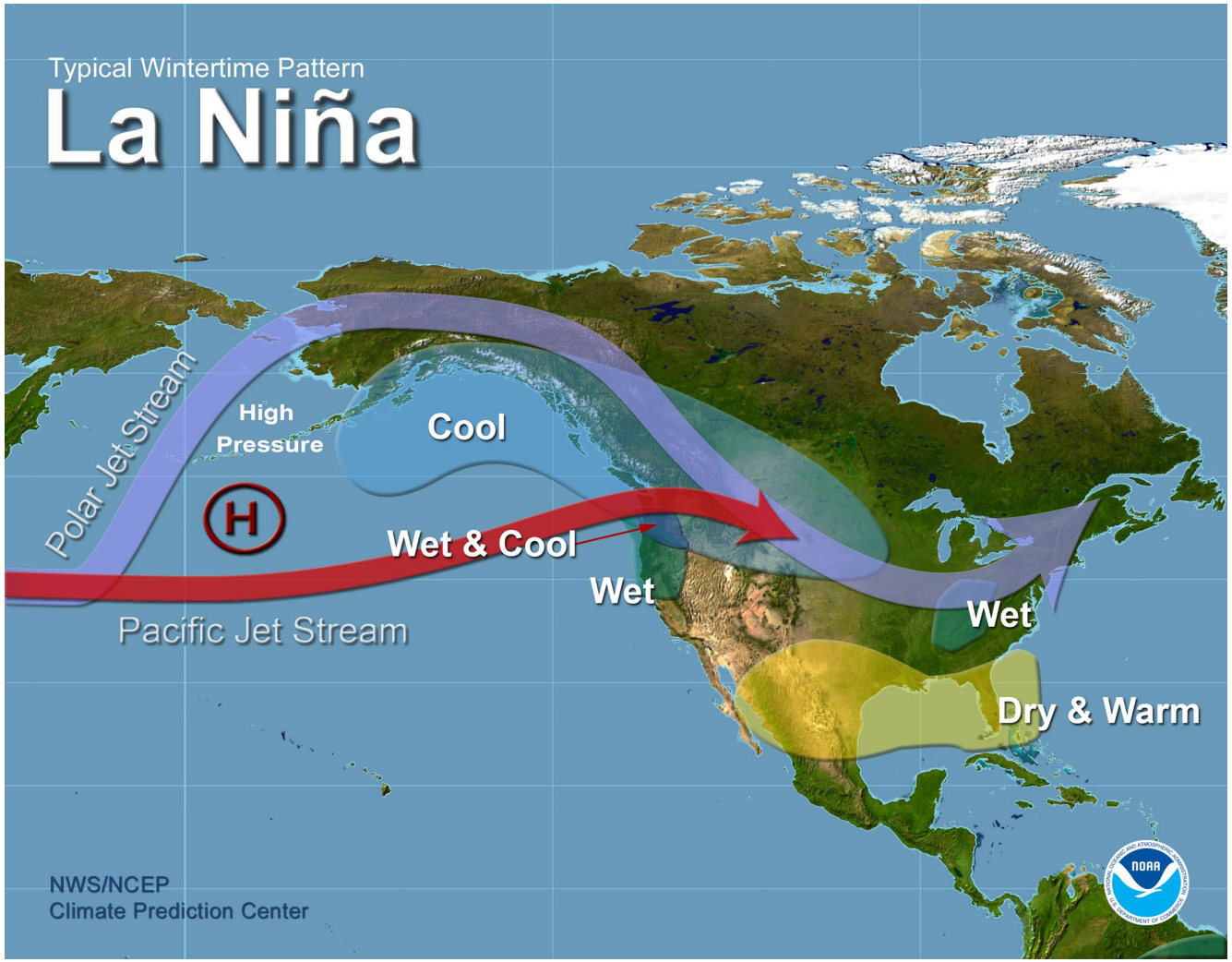
Cooler than normal waters should persist across the eastern Pacific Ocean





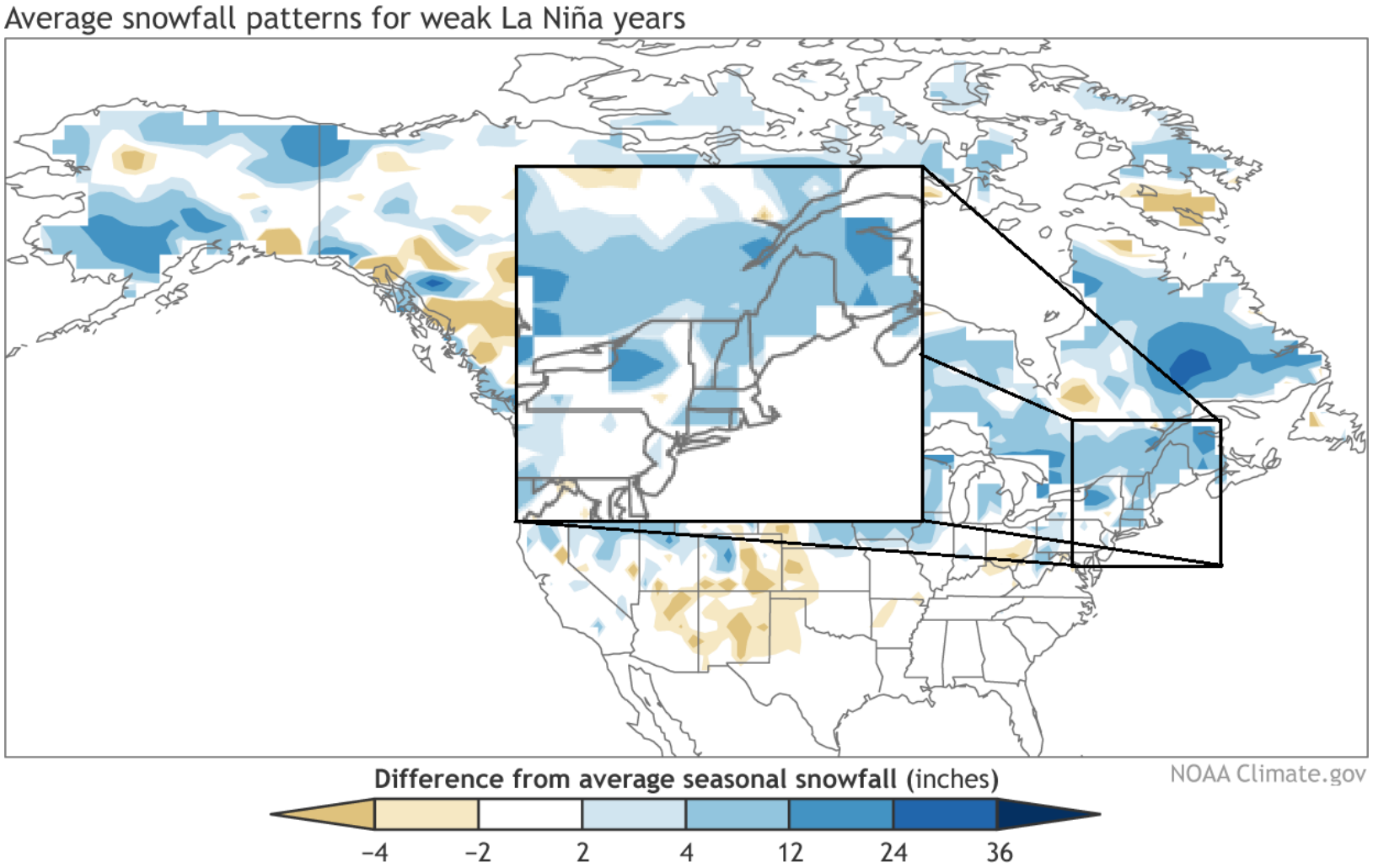
La Niña Effect

- *Most noticeable weather impacts occur in the western & southern U.S.*
- *New England generally experiences milder than normal conditions*



La Niña Effects

Although temperature may average above normal in New England, snowfall potential in the northeast U.S. shows a slight increase with a La Niña pattern



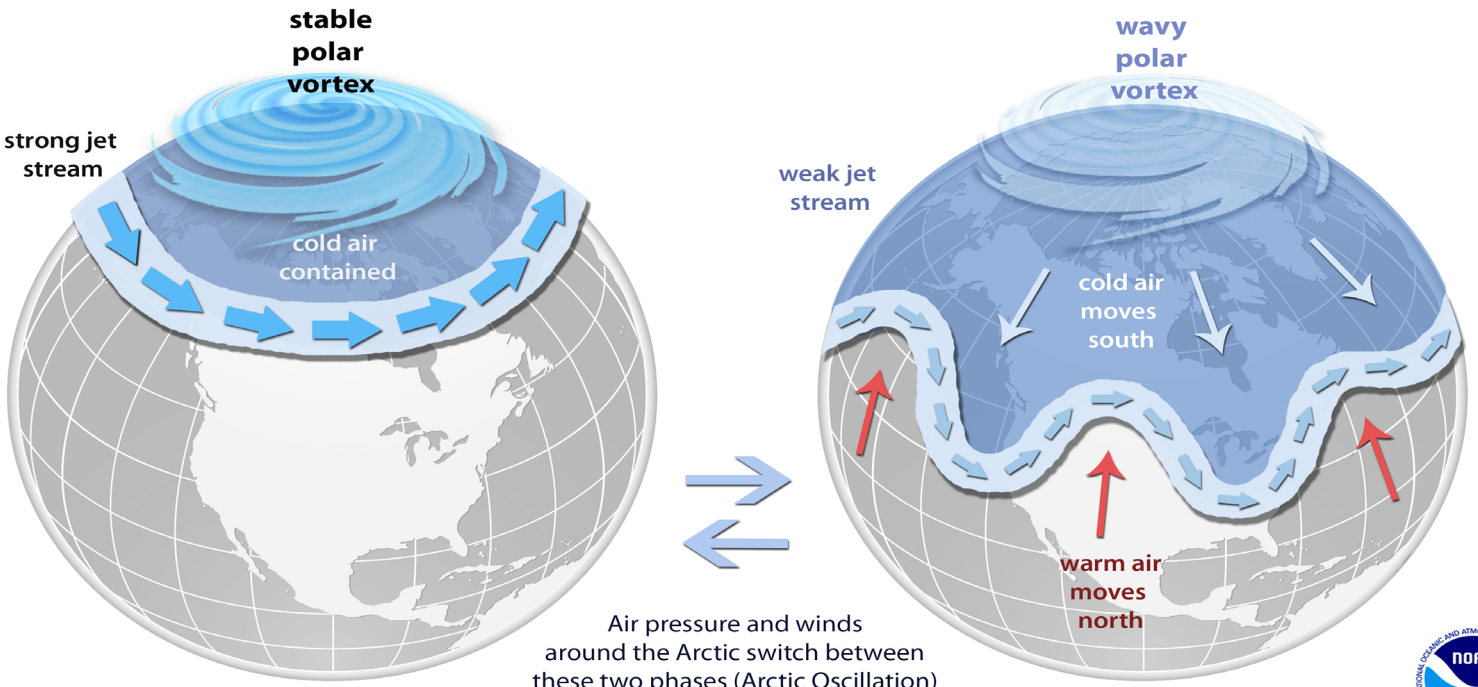
THE POLAR VORTEX

A Major Weather Factor in New England Winters

Polar Vortex: Very Important, but Low Predictability Skill

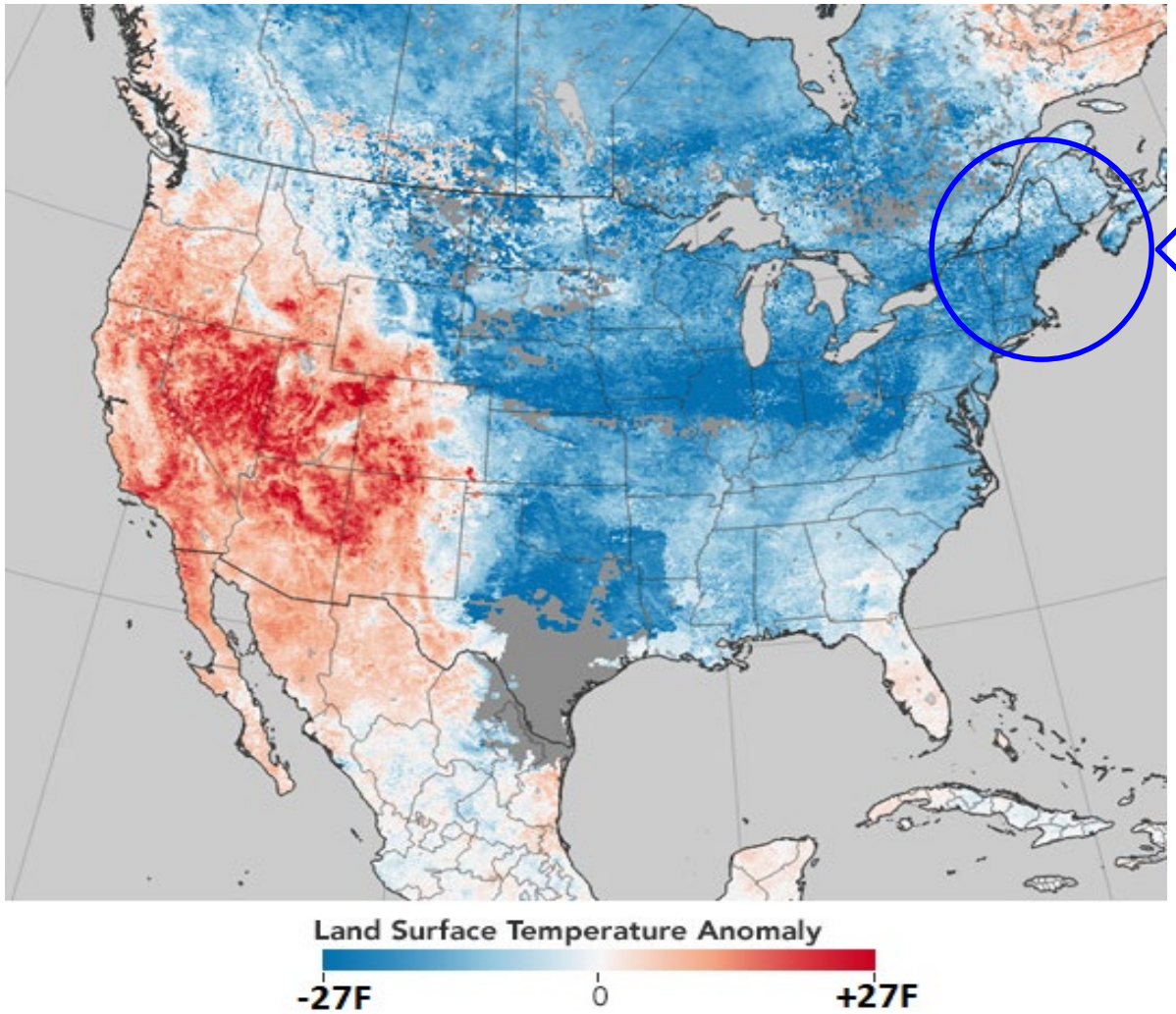
The Science Behind the Polar Vortex

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

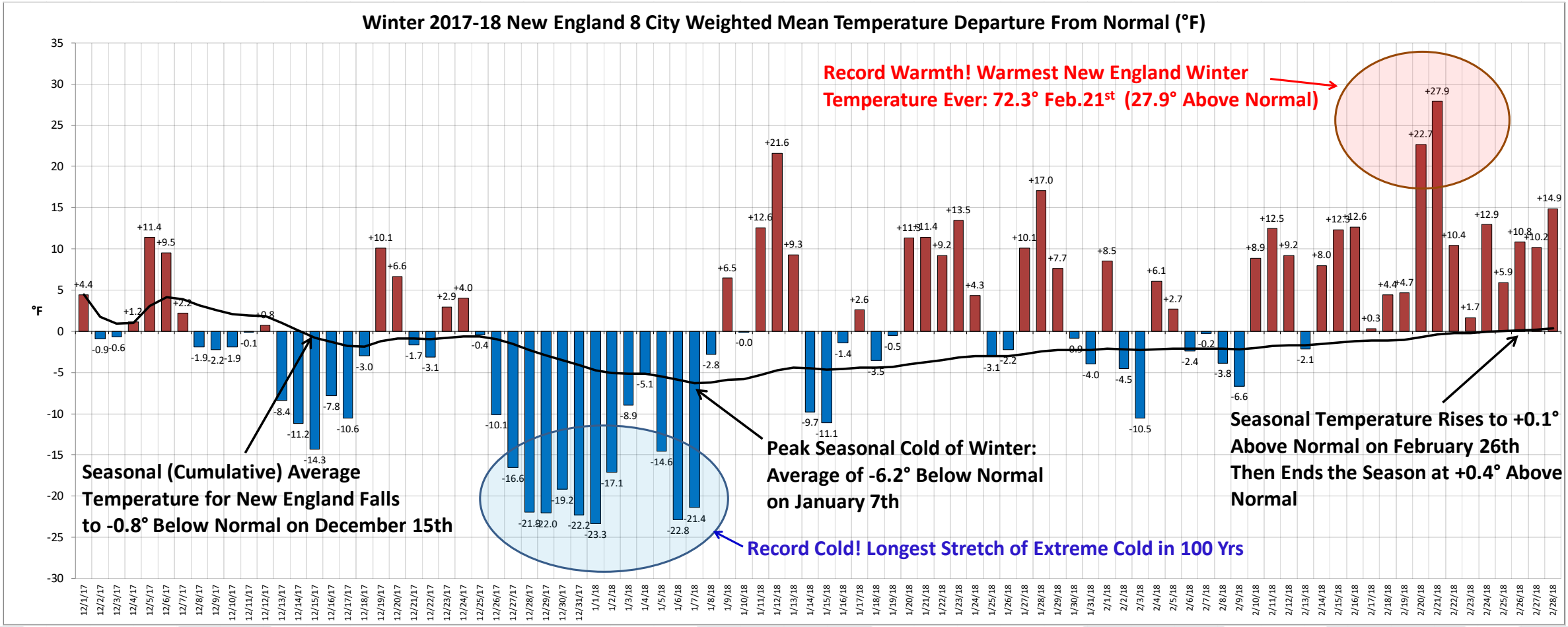


Arctic Outbreak

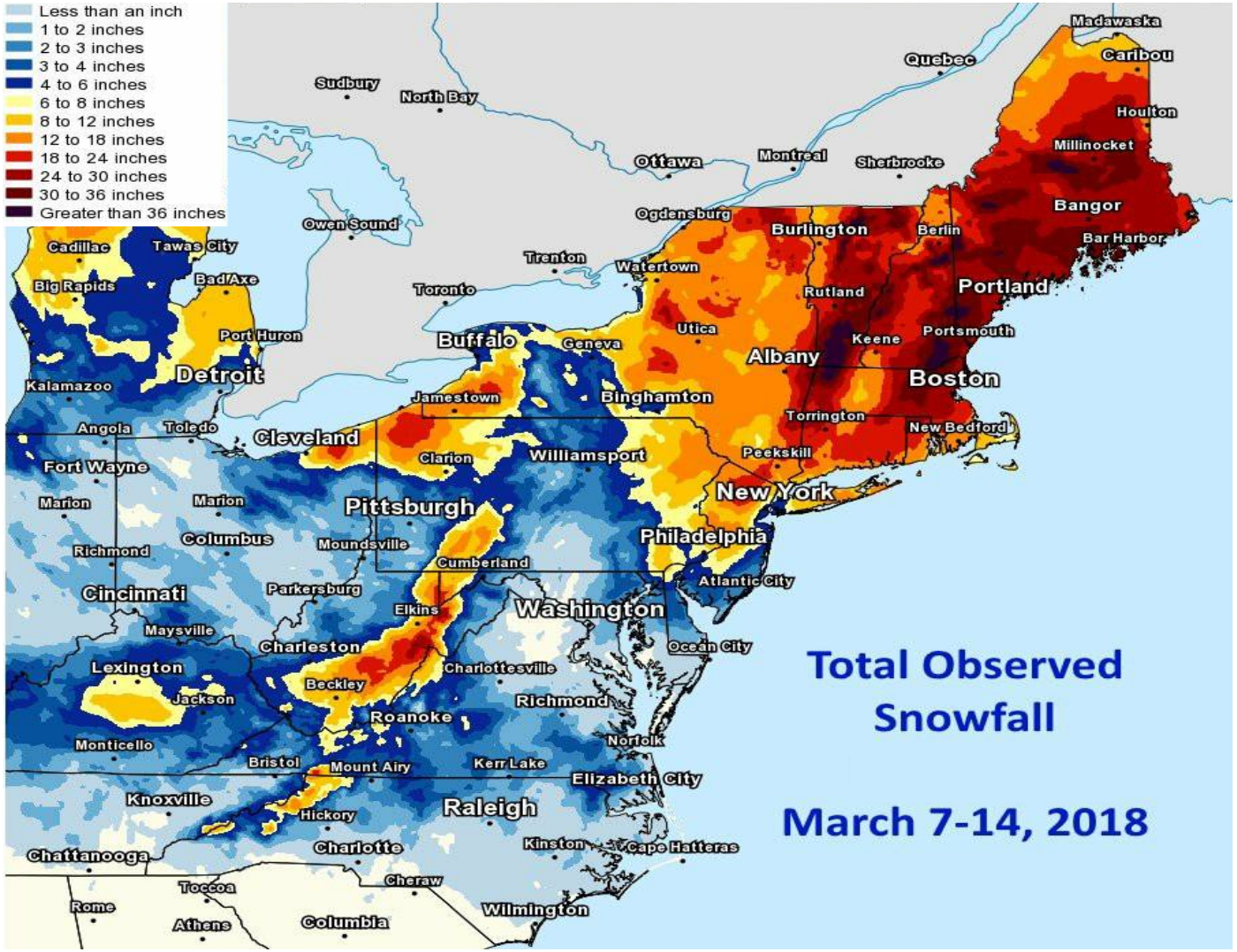
Dec. 24, 2017 - Jan. 8, 2018:
14 Consecutive Days of Below Normal Temperatures Across New England!

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

The average temperature in Winter 2017-18 was above normal; the season saw both record warmth *and* severe record cold

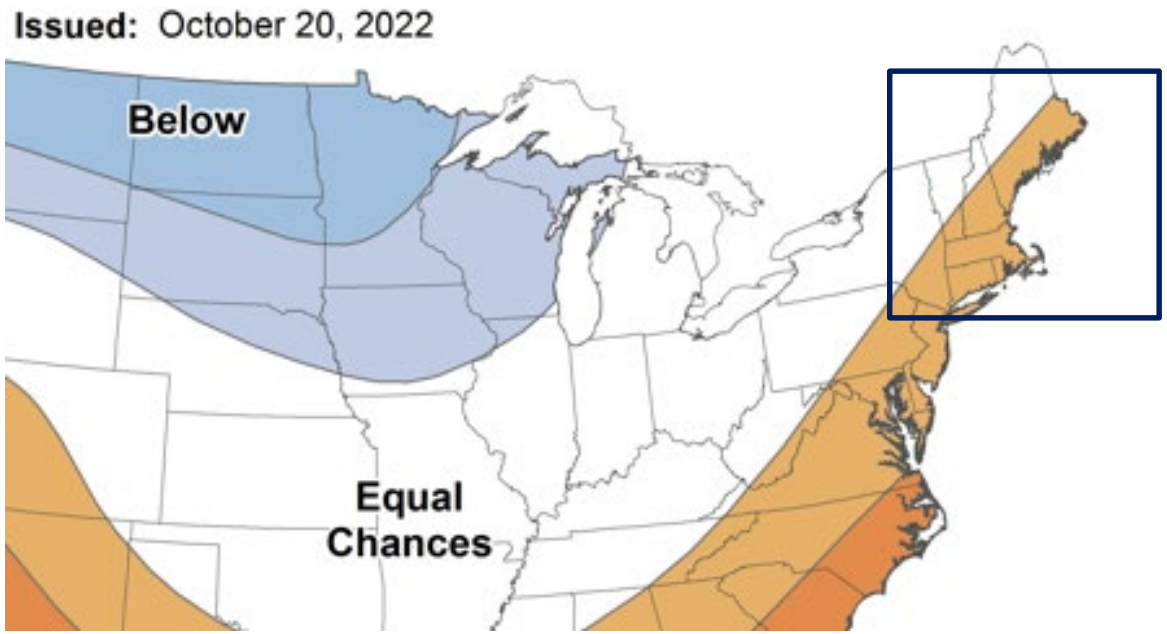


A Weak Polar Vortex Can Also Result in Blizzards & Nor'easters Across New England, Even Late In The Season



Winter 2022-23 Is *Again* Forecast To Be Warmer Than Normal In Most Of New England

Arctic Outbreaks, Cold Snaps And Even Severe Winter Storms Are All Possible



Capacity & Energy Outlook

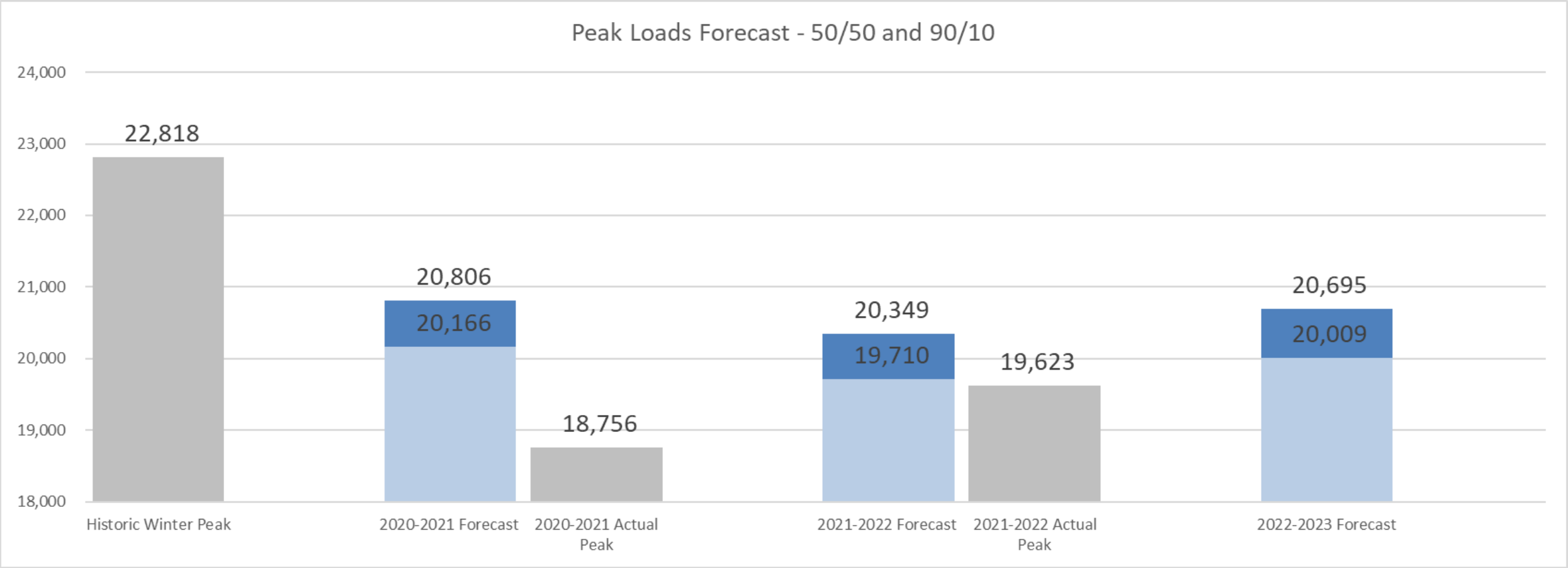
Winter 2022-23

Mike Knowland

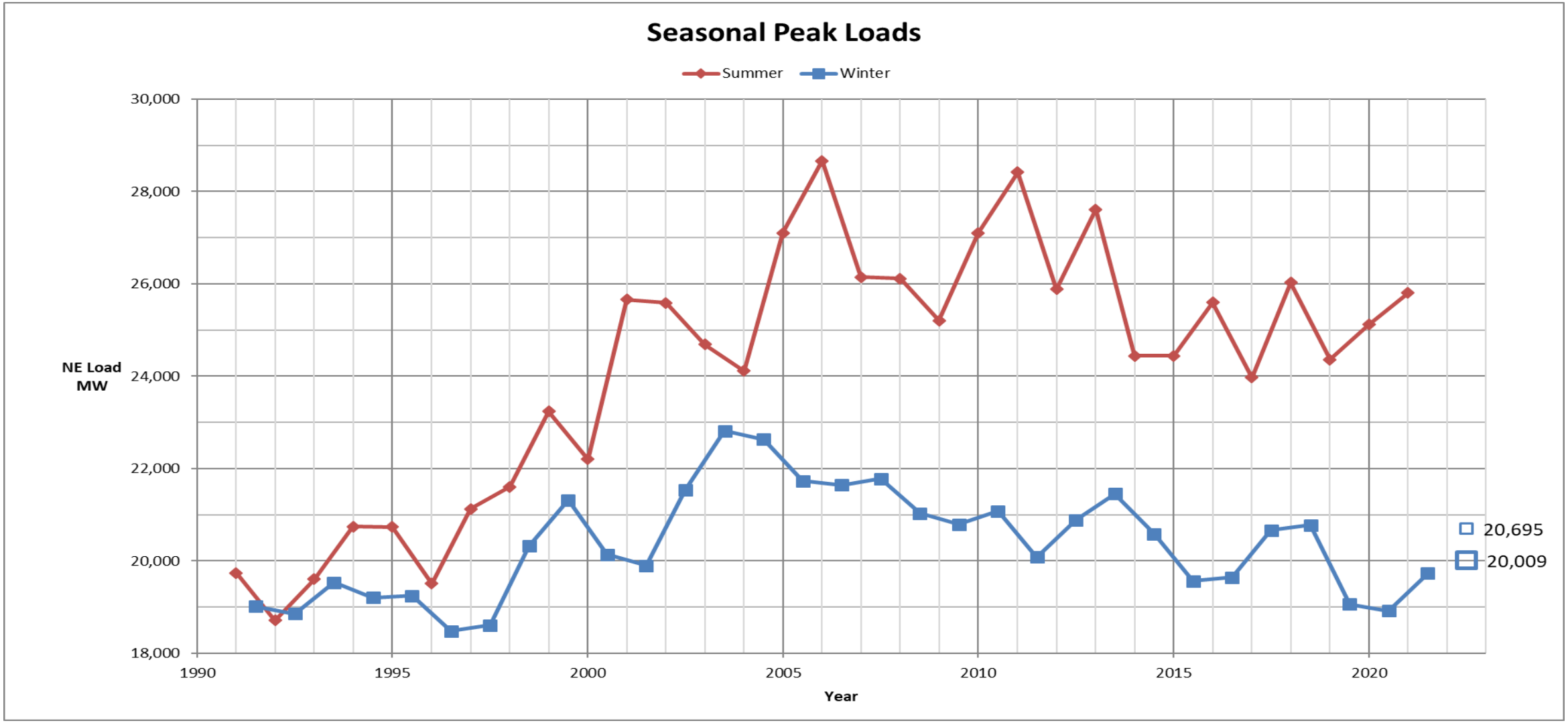
MANAGER– FORECAST & SCHEDULING

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 **1,001** MW
  - 90/10: Deficient **496** MW
- Generator Economic Maximum offers are consistently above CSO
    - Can range from 1,500 to 4,000 MW
    - Approximately **2,000** MW difference between surplus on SCC vs. CSO

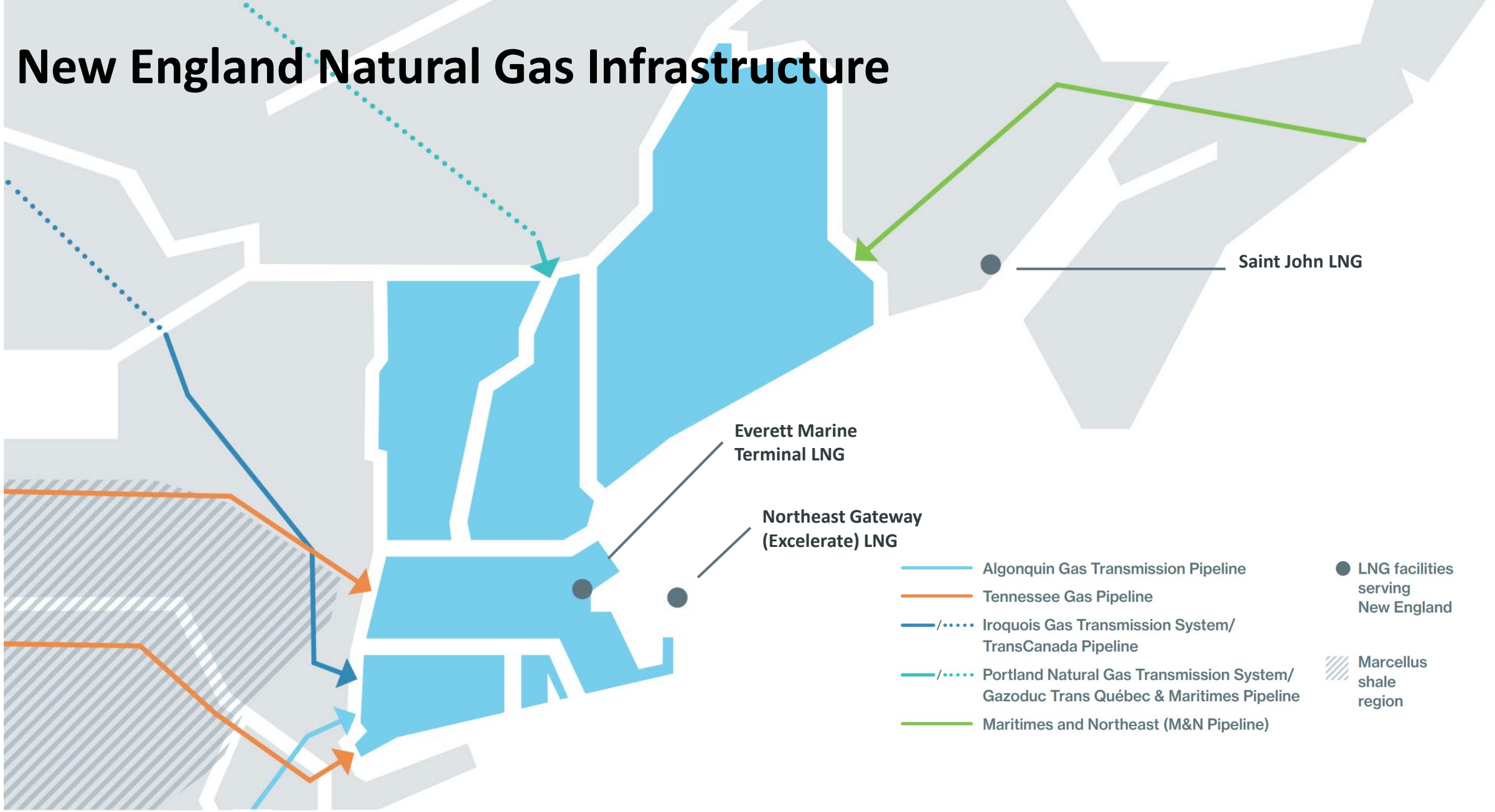
Capacity Outlooks are Useful Planning Tools; Preparation is Critical Given That Unexpected Events Can Occur

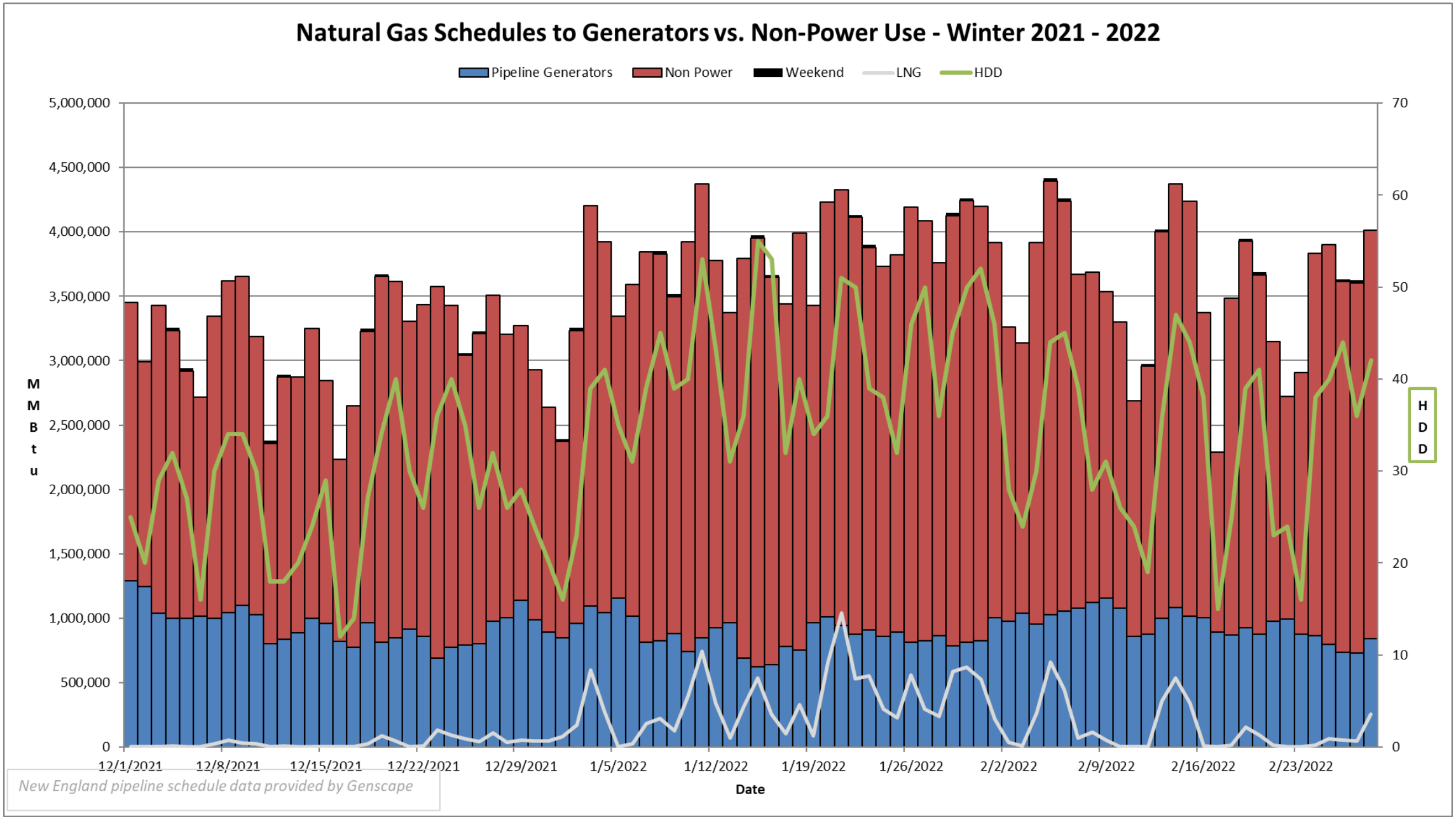
- Operable capacity analysis is a forecasted scenario before unexpected events occur
- On the date that ISO-NE last implemented actions of OP-4 (Actions in A Capacity Deficiency), the day began with over 1,900 MW of surplus

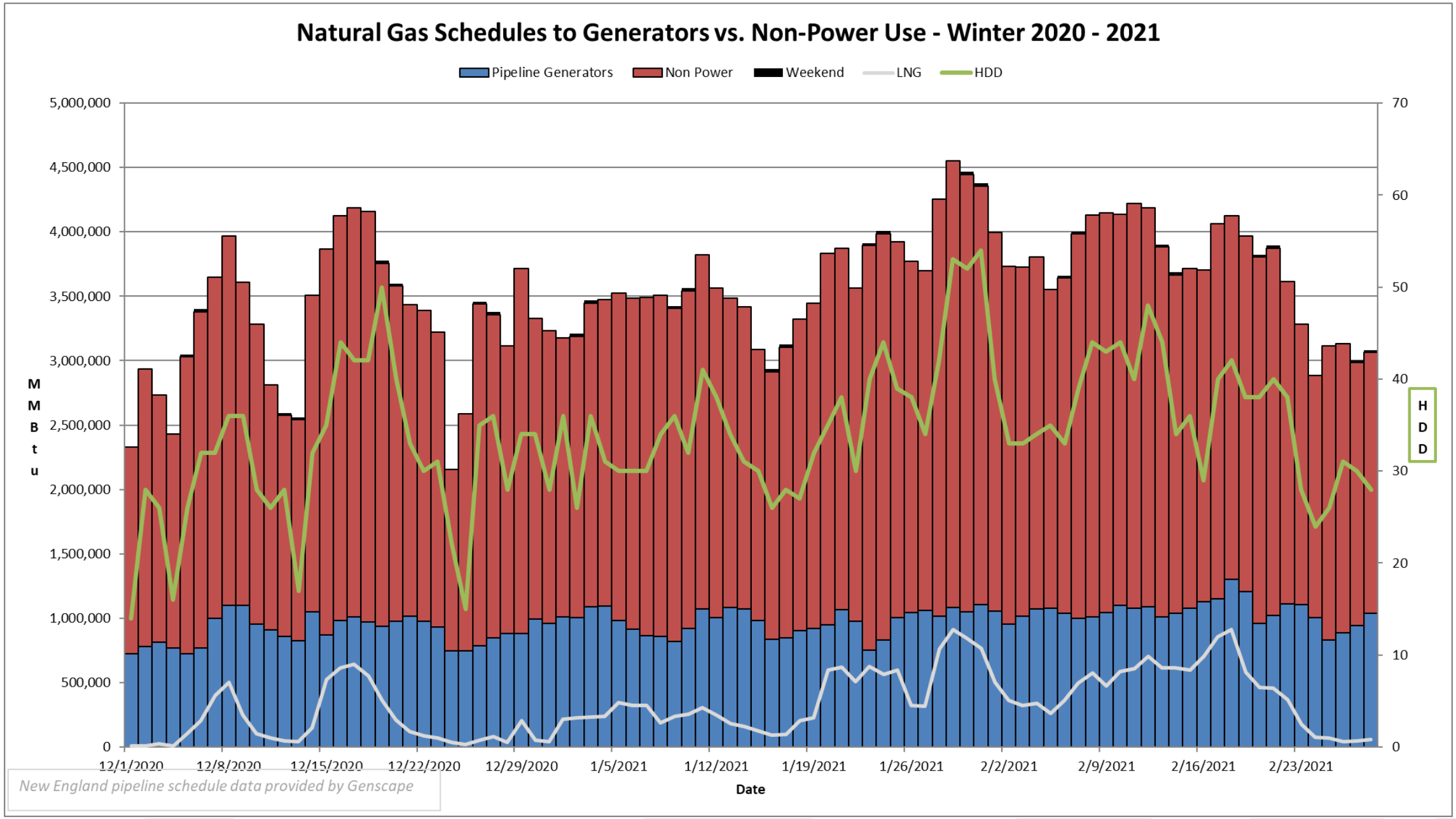
H. Total Available Capacity (A+B-C-D+E-F-G)	25,035
I. Peak Load Forecast For Hour Ending 20	20,590
J. Total Operating Reserve Requirement	2,303
K. Capacity Required = I+J	22,893
L. Surplus = (+) Deficiency = (-) (H - K)	2,142
M. Replacement Reserve Requirement	160
N. Excess Commitment Surplus = (+) Deficiency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

NATURAL GAS & PIPELINE OUTLOOK

New England Natural Gas Infrastructure




Natural Gas Schedules to Generators vs. Non-Power Use - Winter 2021 - 2022
Pipeline Generators
Non Power
Weekend
LNG
HDD
MMBtu
HDD
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
70
60
50
40
30
20
10
0
12/1/2021
12/8/2021
12/15/2021
12/22/2021
12/29/2021
1/5/2022
1/12/2022
1/19/2022
1/26/2022
2/2/2022
2/9/2022
2/16/2022
2/23/2022
Date
New England pipeline schedule data provided by Genscape


Natural Gas Schedules to Generators vs. Non-Power Use - Winter 2020 - 2021
Pipeline Generators
Non Power
Weekend
LNG
HDD
MMBtu
HDD
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
70
60
50
40
30
20
10
0
12/1/2020
12/8/2020
12/15/2020
12/22/2020
12/29/2020
1/5/2021
1/12/2021
1/19/2021
1/26/2021
2/2/2021
2/9/2021
2/16/2021
2/23/2021
Date
New England pipeline schedule data provided by Genscape

WINTER ENERGY OUTLOOK 2022-23

Winter Expectations 2022/23
LNG Replenishment

- Over the past ten winters (Dec-Feb), the region has averaged ~31.7 Bcf of LNG usage; the highest usage was ~42.9 Bcf in 2012/13, lowest usage was ~20.0 Bcf in 2021/22
- Winter 2022/23
  - Europe met its intended LNG fuel storage target ahead of winter
  - European natural gas prices continue to remain higher than in New England
  - In early October, European prices for January delivery were ~$60/MMBtu
    - Since then, the prices have trended down
  - Cost-of-Service contract with Mystic provides greater certainty of LNG availability this winter
  - ISO's current expectation is that ~31 Bcf will be available

Winter Expectations 2022/23, cont.

Fuel Oil Replenishment

- Due in large part to declining forward prices for fuel-oil, many stations (understandably) have waited until fall to procure and finalize replenishment plans
- Based on recent replenishment activities and discussions with resource owners, ISO anticipates additional replenishment prior to winter
  - Additional fuel-oil replenishment is expected to increase the region's aggregate fuel-oil inventory from ~92M gallons (~39% of max) to ~120M gallons (~50% of max) prior to winter
- Discussions with resource owners have identified some level of concern with regard to the Distillate Fuel Oil (DFO) supply chain
- No concerns have been noted with regard to the Residual Fuel Oil (RFO) supply chain and RFO stations have robust replenishment plans in place
- The potential for emissions limitations at some dual-fuel units will have to be monitored closely in the event of significant oil burn

Opportunity Cost Mechanism

- Intended to enhance the ability of economic commitment and dispatch to make the most cost-effective use of limited fuel supplies during stressed operating conditions
- Mechanism used to incorporate the future value of limited inventoried fuel into reference pricing
- Contact Market Monitor (IMM) with detailed questions
- More information
  - https://www.iso-ne.com/participate/support/participant-readiness-outlook/emoc-project

Introduction – 2022/23 Winter Scenarios

- The ISO routinely performs scenario assessments to prepare for the winter
- The following slides illustrate the qualitative and quantitative aspects of three scenarios
  - Scenario 1 assumes a mild winter as represented by the 2021/22 winter
  - Scenario 2 assumes a moderate winter, but with a 13 day cold spell, as represented by the 2017/18 winter
  - Scenario 3 assumes a 'colder than normal' winter as represented by the 2013/14 winter
- Unless otherwise noted, scenarios assume the following:
  - Expected starting fuel oil inventories; fuel oil replenishment assumptions range from minimal to moderate
  - No LNG injections assumed beyond current projections
  - No significant or long-duration generator or transmission contingencies
  - System demand reduced to account for distributed PV resources
- **The ISO's 21-day energy forecast tool will signal any potential energy emergencies, thereby alerting the market to procure necessary fuel replenishments, both to meet their obligation and to protect against scarcity**

Scenario 1 – Mild Winter, Similar to 2021/22

- Winter 2021/22 overview:
  - Milder than normal winter with very few days staying below freezing
  - Average temperature departure from normal was +1.0°F (i.e., warmer than normal)
  - Winter peak load of 19,623 MW
  - Total energy modeled is 30,591 GWh
  - During some periods, fuel oil was more economic than natural gas for power generation
  - Approximately 80M gallons of fuel oil was burned
- ISO anticipates that there would be sufficient capacity and energy available to meet the expected peak loads and energy

Scenario 2 – Moderate Winter with a Deep and Prolonged Cold Spell; Similar to 2017/18

- Winter 2017/18 characteristics:
  - Milder than normal outside of a two-week span of significantly below normal temperatures
  - Average temperature departure from normal was +0.5°F degrees
  - The region was impacted by an extended stretch of cold weather between December 25 and January 9; all major cities in the region experienced temperatures below normal for at least 13 consecutive days, of which 10 days averaged more than 10°F below normal
  - Winter peak load of 20,631 MW
  - Total energy modeled is 31,291 GWh
  - The cold snap was marked by reductions in natural gas availability and price inversion contributed to high fuel oil usage; several oil-fired resources were postured to maintain fuel reserves
- ISO anticipates that system reliability will be maintained, but may require the use of capacity deficiency actions under OP-4 on 5-7 days

Scenario 3 – Cold Winter with Several Cold Stretches; Similar to 2013/14

- Winter 2013/14 characteristics:
  - Colder than normal overall highlighted by a polar vortex event which resulted in significant stretches of cold weather in New England and surrounding areas
  - Average temperature departure from normal was -2.3°F degrees
  - The region experienced six cold weather stretches of four or more consecutive days, including a stretch of ten consecutive days at or below freezing
  - Winter peak load of 21,514 MW
  - Total energy modeled is 33,881 GWh
  - Significant energy usage caused high demand on both the electric and natural gas systems
- Significant usage of all available capacity deficiency actions under OP-4 (including public appeal actions) may be necessary across several weeks, including the use of OP-7 across several days
  - In-season fuel replenishment will greatly mitigate this risk

Review of OP-21 Surveys

Winter 2022-2023

Jaren Lutenegger

MANAGER, OPERATIONS ANALYSIS & INTEGRATION

OP-21 GENERATOR SURVEY PROCESSES

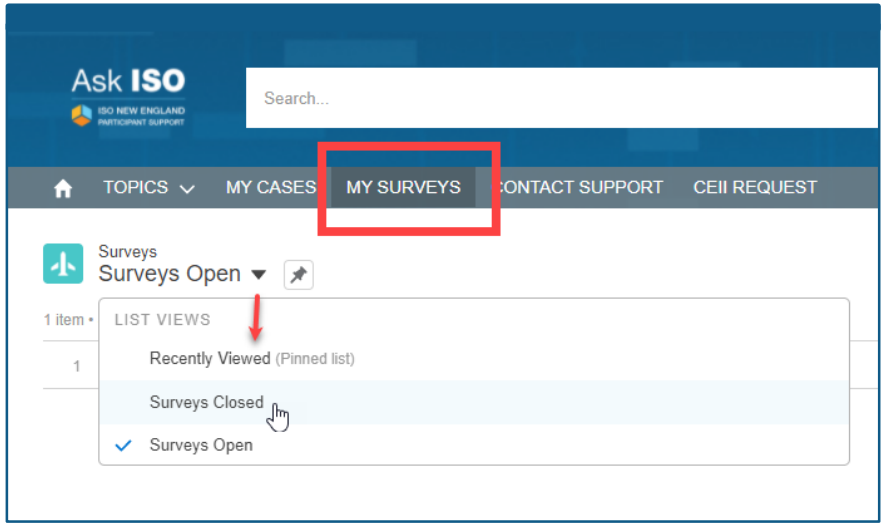
OP-21 Survey Summary

Survey Process	Audience	Periodicity	Purpose
Generator Fuel and Emissions Survey	Oil, Coal, and Natural Gas Generators	Winter: Weekly Non-Winter: Bi-Weekly	Monitor fuel inventory levels, fuel replenishment plans, and actual or anticipated environmental limitations on generators within New England
Generator Winter Readiness Survey	All Generators	Annually	Facilitate situational awareness of generator readiness during winter months
Natural Gas Critical Infrastructure Survey	Interstate Natural Gas Pipeline Companies and Saint John and Everett LNG Facilities	Annually	Ensure that the critical infrastructure of the interstate natural gas system are not served by transmission or distribution circuits subject to automatic or manual load shedding schemes

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

OP-21 Generator Surveys in AskISO

- Beginning in 2021, ISO-NE began using AskISO for OP-21 generator surveys
  - Training materials, user guides, and other project materials are available here: https://www.iso-ne.com/participate/support/participant-readiness-outlook/generator-survey-system-project-gss
- When new surveys are requested, all registered submitters will receive an email request with the survey type, due date, and link to the survey in AskISO
- Current and past surveys in AskISO can be seen in the "My Surveys" section of AskISO

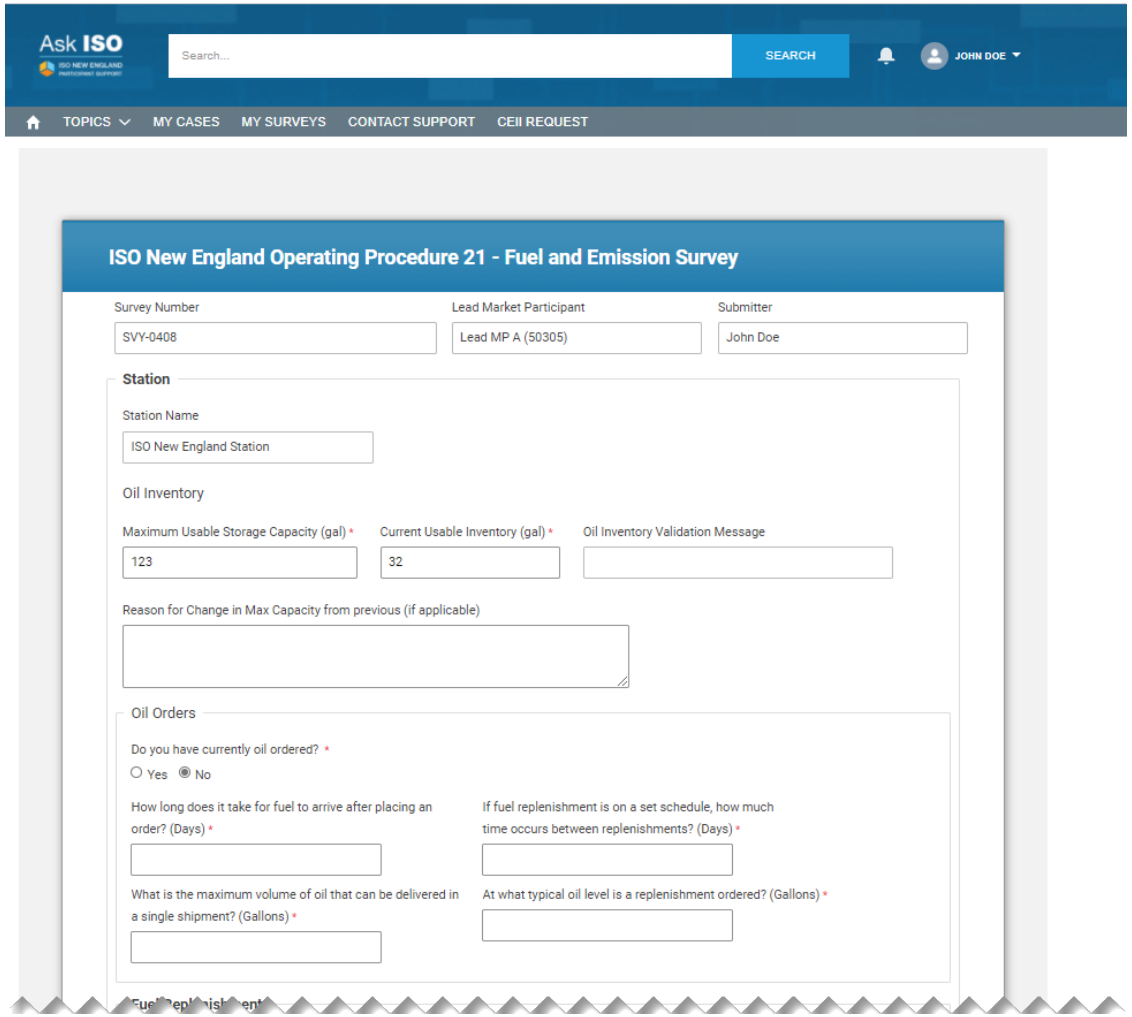


Generator Fuel and Emissions Survey

- Collect information to:
  - Perform a regional energy assessment
  - Identify potential reliability issues
- All oil, coal, and natural gas generators are surveyed to gather:
  - Available and maximum volumes of fuel
  - Fuel supplier and procurement information
  - Environmental and emissions limitations
- Survey frequency:
  - Weekly*, in the months of December - March (i.e. winter)
  - Bi-Weekly*, in the months of April - November (i.e. non-winter)

  *Note - Frequency of surveys may be increased as needed, up to and including daily, based on indications of potential energy deficiencies in the region
- Surveys are conducted via the AskISO platform

Generator Fuel and Emissions Survey

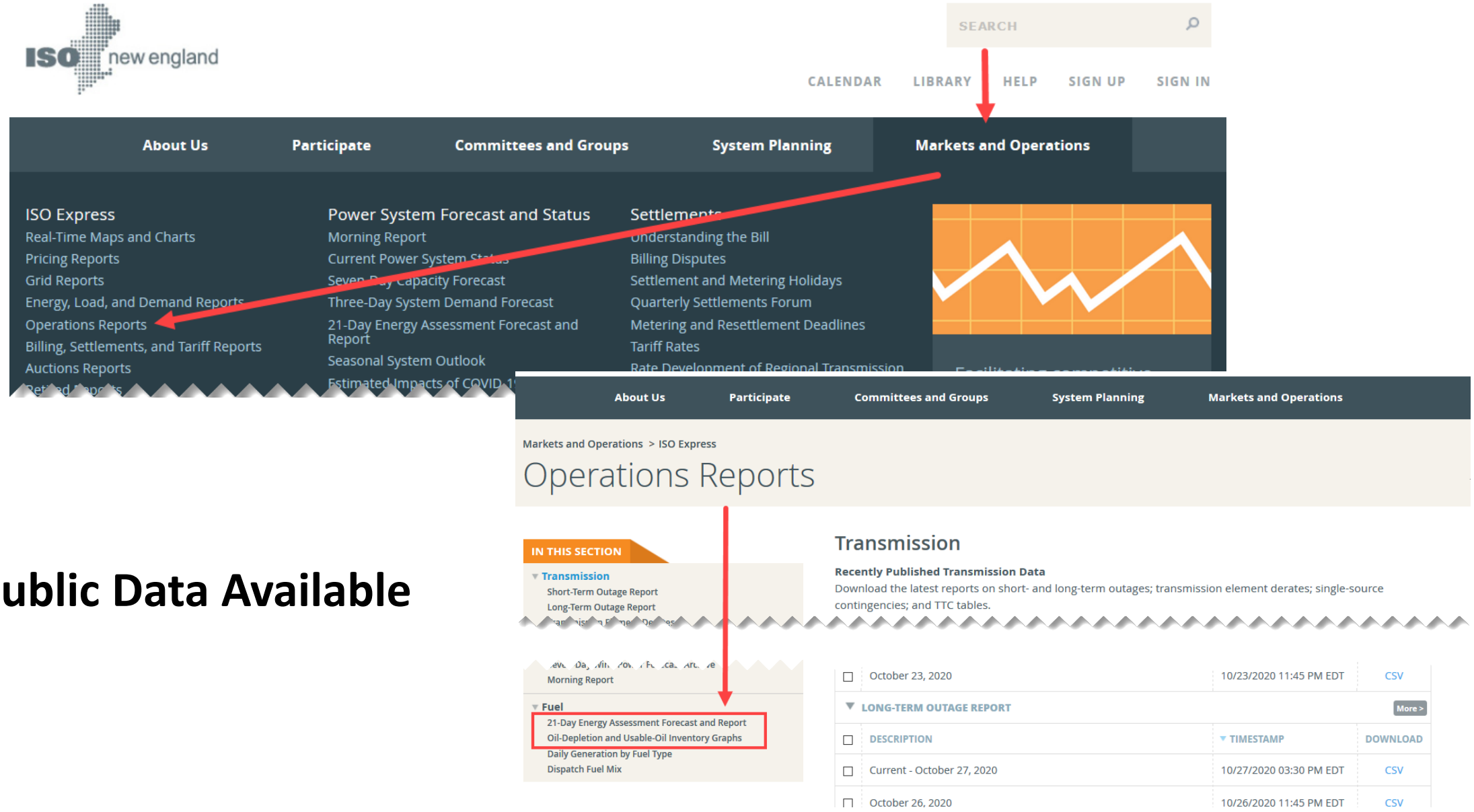


Generator Winter Readiness Survey

- Collect information to facilitate ISO-NE situational awareness
- All generators surveyed to gather:
  - Winter preparation activities
  - Ambient temperature limitations on real-time or future capabilities
  - Specific protocols followed in extreme cold weather events
  - Specific training completed prior to cold weather events
- 2022 Survey was distributed to lead market participants on October 31st via AskISO platform
- Lead market participants shall submit responses to the survey in AskISO no later than December 1st

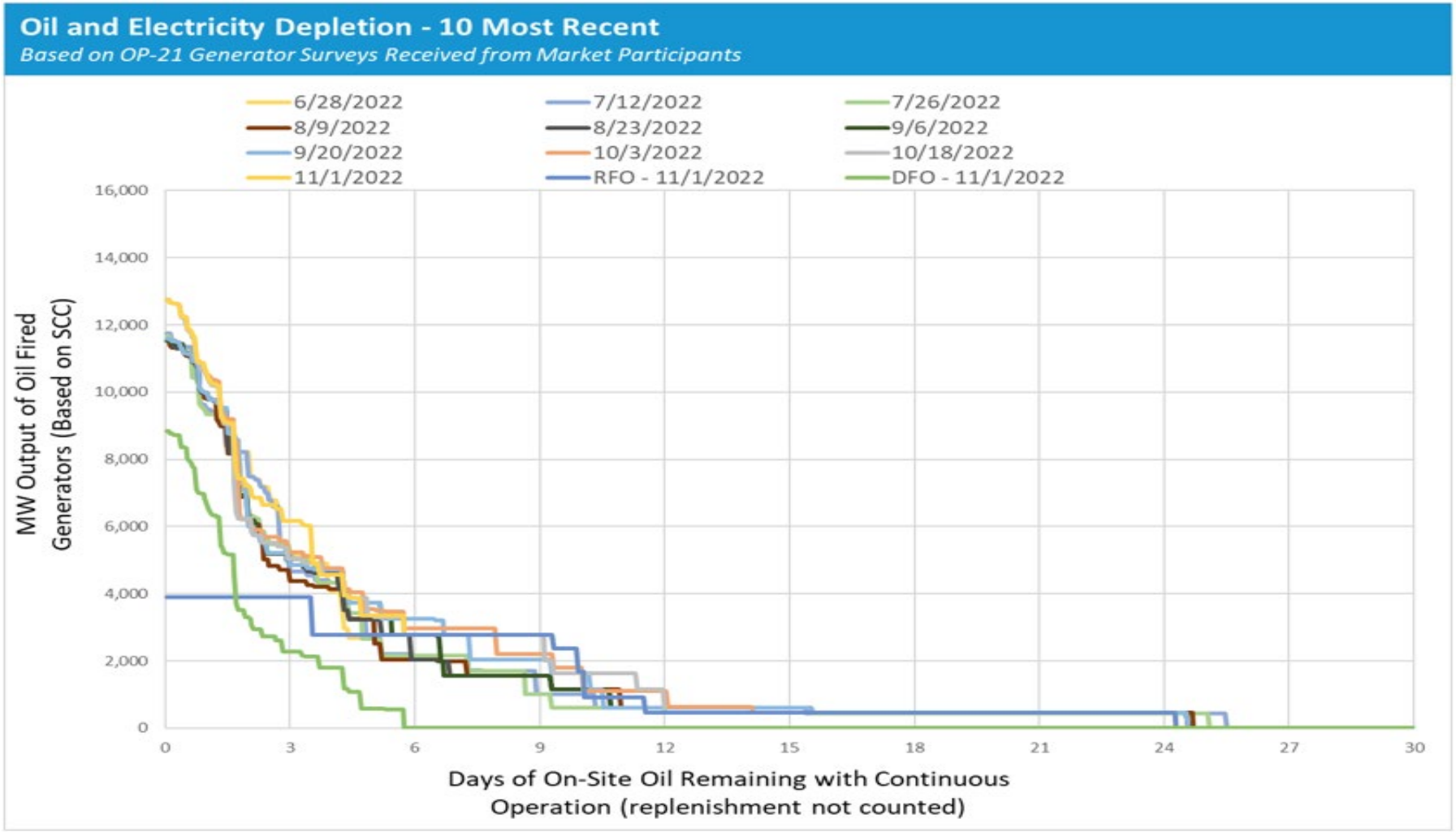
OP-21 SURVEY REPORTING

Public Data Available



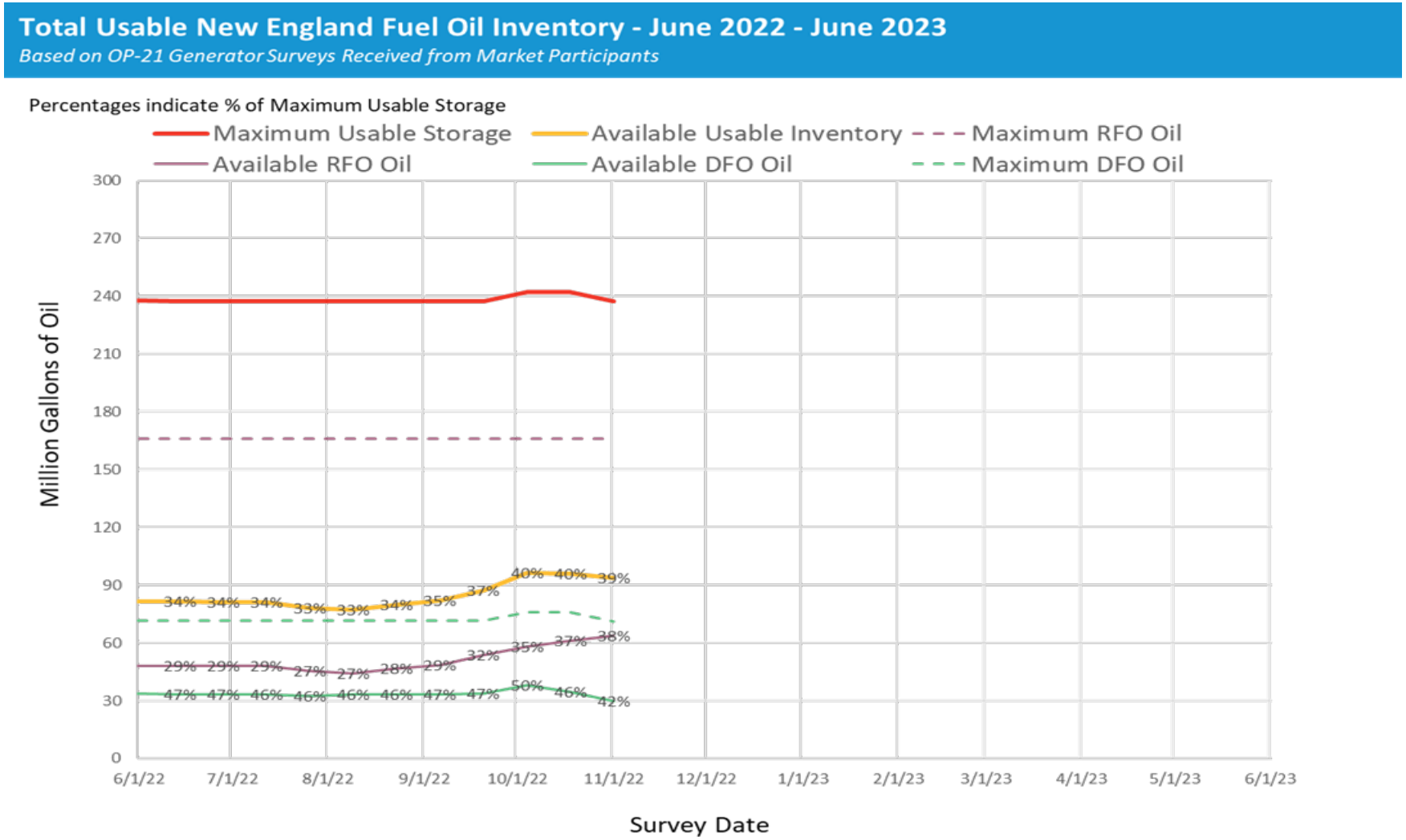
Oil Depletion Graphs

https://www.iso-ne.com/isoexpress/web/reports/operations/-/tree/oil-depletion-graphs



Oil Inventory Graphs

https://www.iso-ne.com/isoexpress/web/reports/operations/-/tree/oil-depletion-graphs



21-Day Energy Assessment

Winter 2022-23

Mallory Waldrip

LEAD ENERGY SECURITY ANALYST

21-Day Energy Assessment - Introduction

21 Day Energy Assessment

December 27th 2022 – January 16th, 2023

System Conditions: **Energy Alert**

Alert Threshold	Start	Through
Forecasted EEA 2	1/14/2023	1/15/2023

Emergency Threshold	Start	Through
Forecasted EEA 2	12/31/2022	1/8/2023
Forecasted EEA 3	1/2/2023	1/8/2023

Oil Consumption Summary – December 20th – December 26th	
Fuel Type	**Gallons Consumed**
Residual Fuel Oil	-
Distillate Fuel Oil	877,269
Total Consumption	**877,269**

EXAMPLE

21-Day Energy Assessment Identifies Projected System Conditions

21 Day Energy Assessment
December 27th 2022 – January 16th, 2023

System Conditions: **Energy Alert**

Alert Threshold	Start	Through
Forecasted EEA 2	1/14/2023	1/15/2023

Emergency Threshold	Start	Through
Forecasted EEA 2	12/31/2022	1/8/2023
Forecasted EEA 3	1/2/2023	1/8/2023

Oil Consumption Summary – Decem	
Fuel Type	
Residual Fuel Oil	
Distillate Fuel Oil	
Total Consumption	

SYSTEM CONDITION: NORMAL

SYSTEM CONDITION: ENERGY ALERT

SYSTEM CONDITION: ENERGY EMERGENCY

Normal Conditions – No emergency actions forecasted in the upcoming 21 days.
Energy Alert – Forecasted EEA 2 and/or Forecasted EEA 3 are anticipated in the upcoming 21 days. These are capacity deficiencies where emergency actions are expected to be required to support grid reliability.
Energy Emergency - Forecasted EEA 2 and/or Forecasted EEA 3 are projected for 2 or more consecutive days in the upcoming 5 days or load shed is imminent in the 21-day study period.

EXAMPLE

21-Day Energy Assessment Indicates Forecasted Alerts or Emergencies

21 Day Energy Assessment
December 27th 2022 – January 16th, 2023

ISO new england

System Conditions: Energy Alert

Alert Threshold	Start	Through
Forecasted EEA 2	1/14/2023	1/15/2023

Emergency Threshold	Start	Through
Forecasted EEA 2	12/31/2022	1/8/2023
Forecasted EEA 3	1/2/2023	1/8/2023

Oil Consumption Summary – Decembe	
Fuel Type	
Residual Fuel Oil	
Distillate Fuel Oil	
Total Consumption	

Alert Threshold	Start	Through
Forecasted EEA 2	1/14/2023	1/15/2023

Emergency Threshold	Start	Through
Forecasted EEA 2	12/31/2022	1/8/2023
Forecasted EEA 3	1/2/2023	1/8/2023

Forecasted EEA 1 (FEEA1) – Indicates that available resources are forecasted to be less than those required to meet operating reserves without the use of use emergency actions; OP-4 actions 1-5 are forecasted.

Forecasted EEA 2 (FEEA2) – Indicates that available resources are forecasted to be less than those required to meet operating reserves without the use of use emergency actions; OP-4 actions 6-11 are forecasted.

Forecasted EEA 3 (FEEA3) – Indicates that available resources are forecasted to be insufficient to serve firm load requirements and the implementation of firm load shed under OP-7 is forecasted.

EXAMPLE

21-Day Energy Assessment Indicates Prior Oil Consumption

21 Day Energy Assessment
December 27th 2022 – January 16th, 2023

ISO new england

System Conditions: **Energy Alert**

Alert Threshold	Start	Through
Forecasted EEA 2	1/14/2023	1/15/2023

Emergency Threshold	Start	Through
Forecasted EEA 2	12/31/2022	1/8/2023
Forecasted EEA 3	1/2/2023	1/8/2023

Oil Consumption Summary – December 20th – December 26th

Fuel Type	Gallons Consumed
Residual Fuel Oil	-
Distillate Fuel Oil	877,269
Total Consumption	**877,269**

Oil Consumption Summary – December 20th – December 26th

Fuel Type	Gallons Consumed
Residual Fuel Oil	-
Distillate Fuel Oil	877,269
Total Consumption	**877,269**

The oil consumption summary indicates the number of gallons of oil burned in the previous week as reported by participants via generator surveys

EXAMPLE

21-Day Energy Assessment Provides Narrative of System Conditions

21 Day Energy Assessment
December 27th 2022 – January 16th, 2023

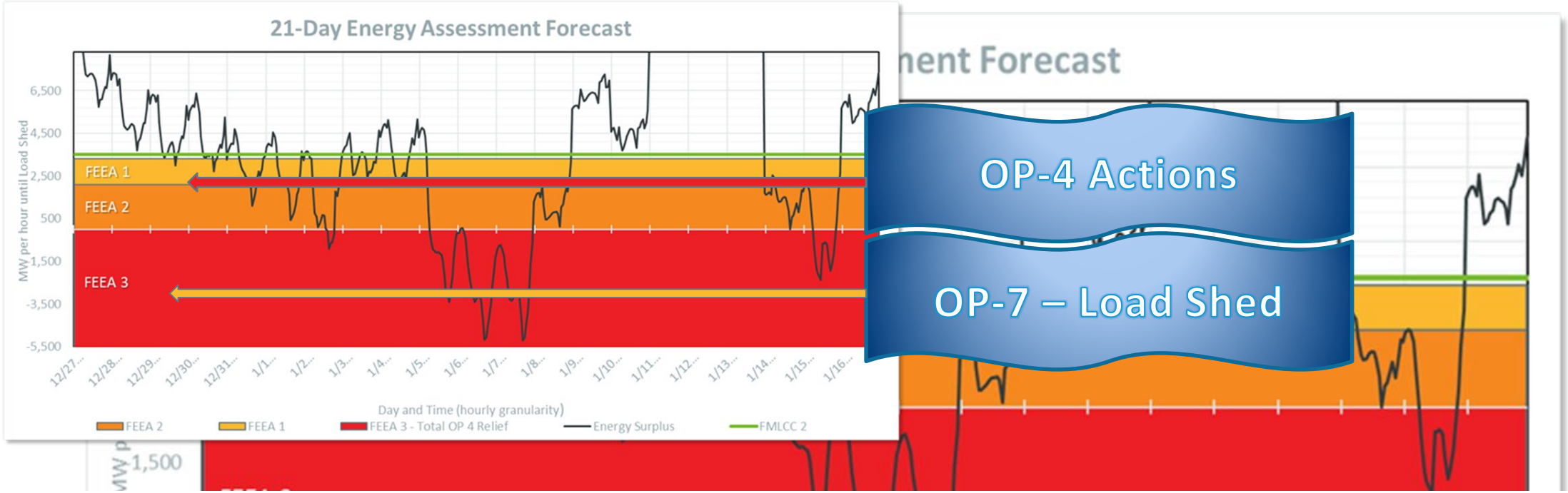
ISO new england

Status Summary
Energy Alert is declared – Load Shed is expected – Fuel replenishment is critical
ISO New England is anticipating inadequate energy supplies in the upcoming weeks where periods of capacity deficiencies are forecast daily starting on 12/29, with significant load shed expected to follow.
Due to projected sustained cold weather, consumption of stored fuels is expected. Inventories are currently at extremely low levels and fuel replenishment is critical.
Energy conservation today will help limit the need for controlled outages later, helping to keep power to more customers. ISO New England is recommending voluntary commercial and residential energy conservation.
Examples include but are not limited to: • Turn down your thermostat • Limit usage of electronics and appliances (TVs/Microwaves/Ovens/Washers & Dryers) • Turn off lights in unoccupied rooms
For more information, see https://isonewswire.com

- The status summary provides a brief narrative summarizing system conditions that are explained in further detail throughout the report
- Status summary is also an opportunity for the ISO to communicate with market participants and the public about weather, fuel scarcity, energy conservation, or other significant details worth noting

EXAMPLE

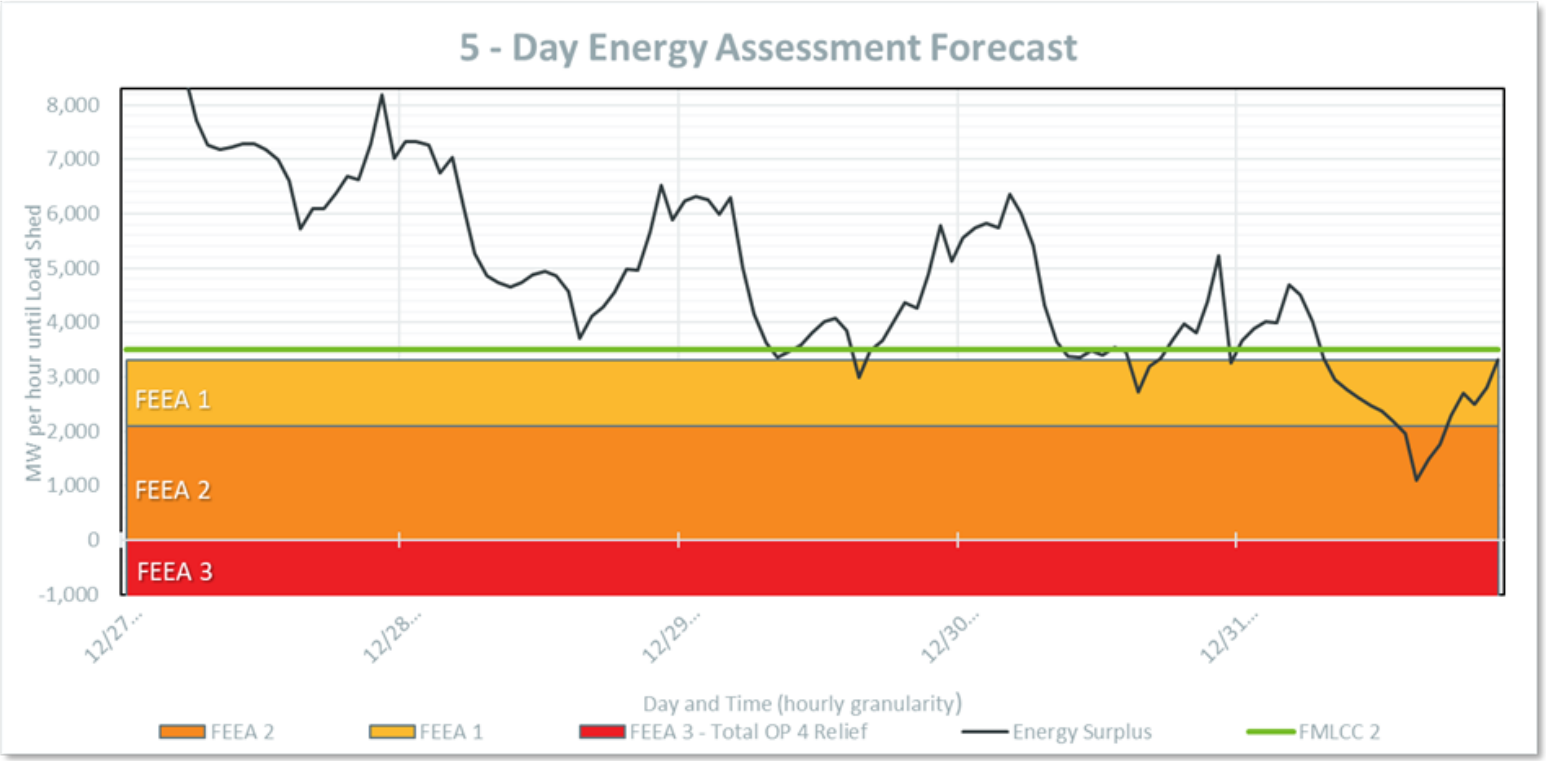
21-Day Energy Assessment Summarizes Overall System Reliability



- The black line, Energy Surplus, is the capacity surplus in each hour of the next 21 days; if and when the black line enters any of the shaded regions, emergency actions are expected to support grid reliability
- The yellow and orange shaded regions are capacity deficiency actions associated with OP-4 and Forecasted EEA 1 and Forecasted EEA2. These FEEAs indicate that ISO expects that 30 minute operating reserves (yellow) or 10 minute operating reserves (orange) cannot be maintained without use of emergency actions
- The red shaded region is associated with Forecasted EEA3 and indicates that reserves have been depleted and load shed is anticipated.

EXAMPLE

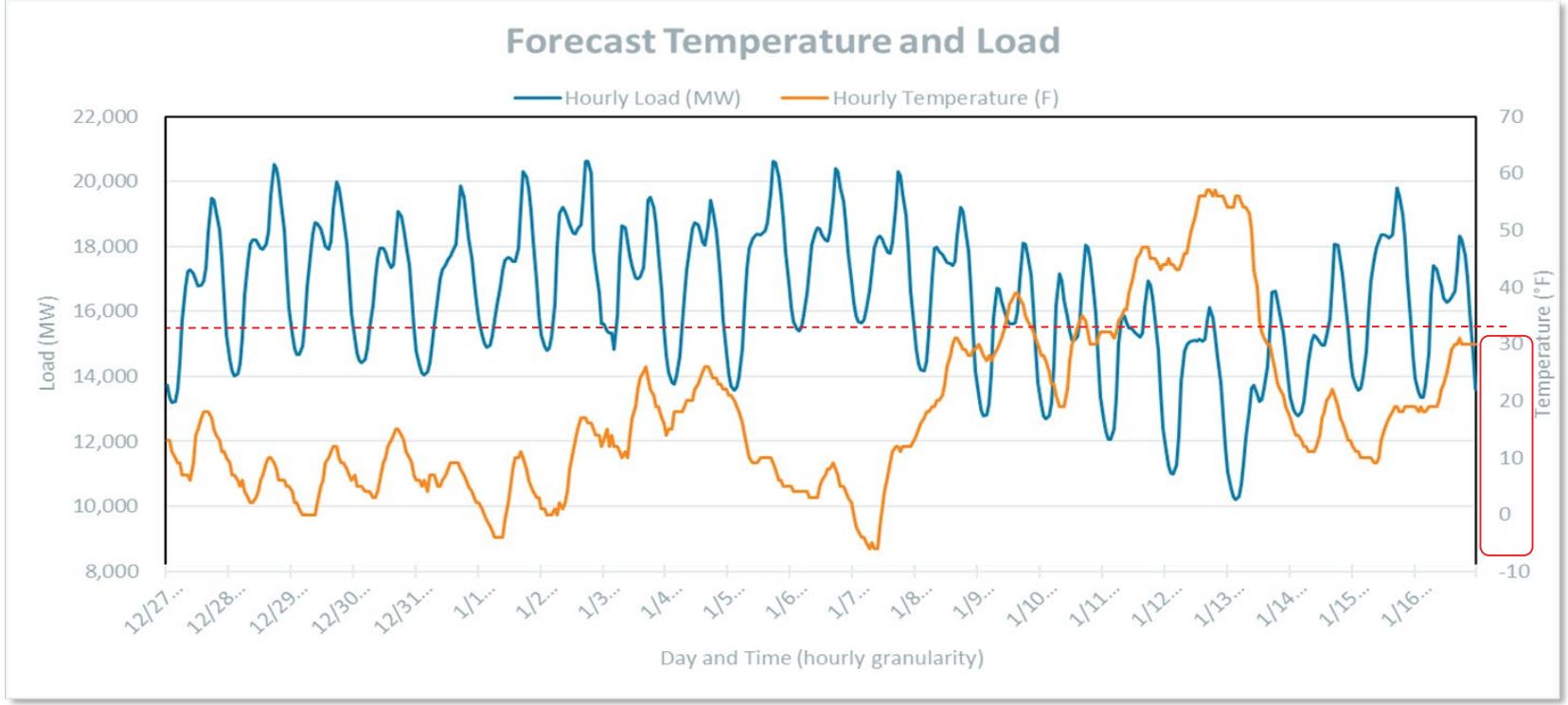
21-Day Energy Assessment Provides Near-Term Energy Forecast



- This chart is a short-term look at the energy surplus in New England. The chart defines the difference between an *Energy Emergency* and an *Energy Alert*. If a Forecasted EEA were identified in the first 5 days of the report, for 2 or more consecutive days, the system condition would be an *Energy Emergency*.
- If the a Forecasted EEA only appears for one day, then the system condition would be an *Energy Alert*.

EXAMPLE

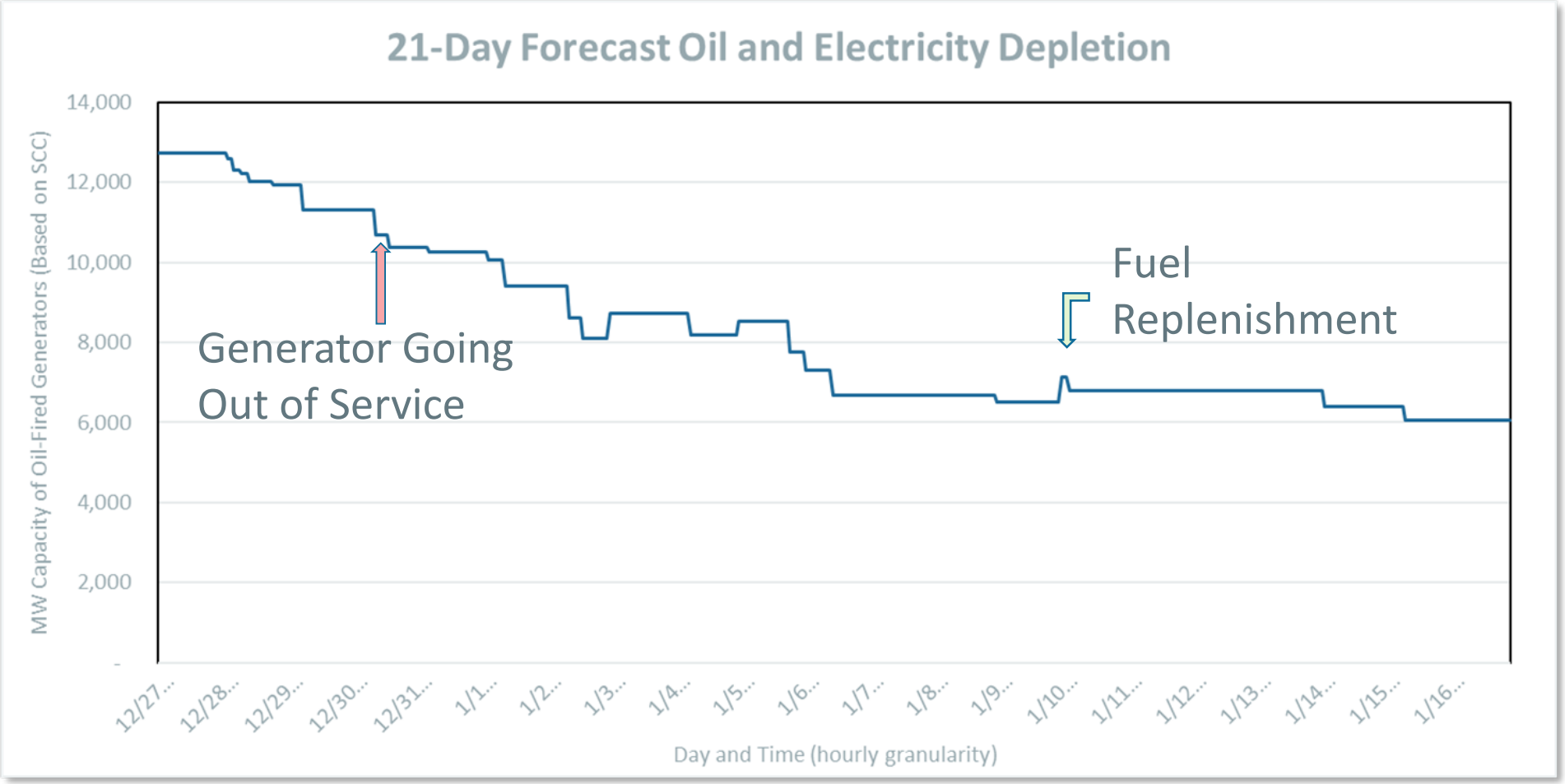
21-Day Energy Assessment Displays Forecasted Temperatures and Load



- The blue line represents load and is on the primary axis and the orange represents temperature on the secondary axis
- Extended cold temperatures make securing natural gas for generators a challenge; this increases the use of stored fuels to meet energy demand

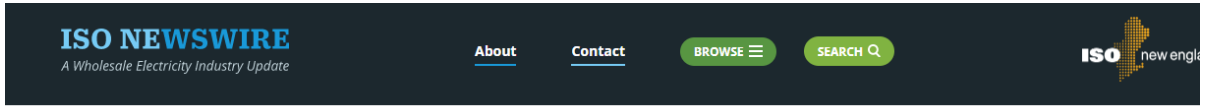
EXAMPLE

21-Day Energy Assessment Includes a Forecast of Oil and Electricity Depletion



EXAMPLE

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



[ISO Newswire - 21 Day Energy Assessment]

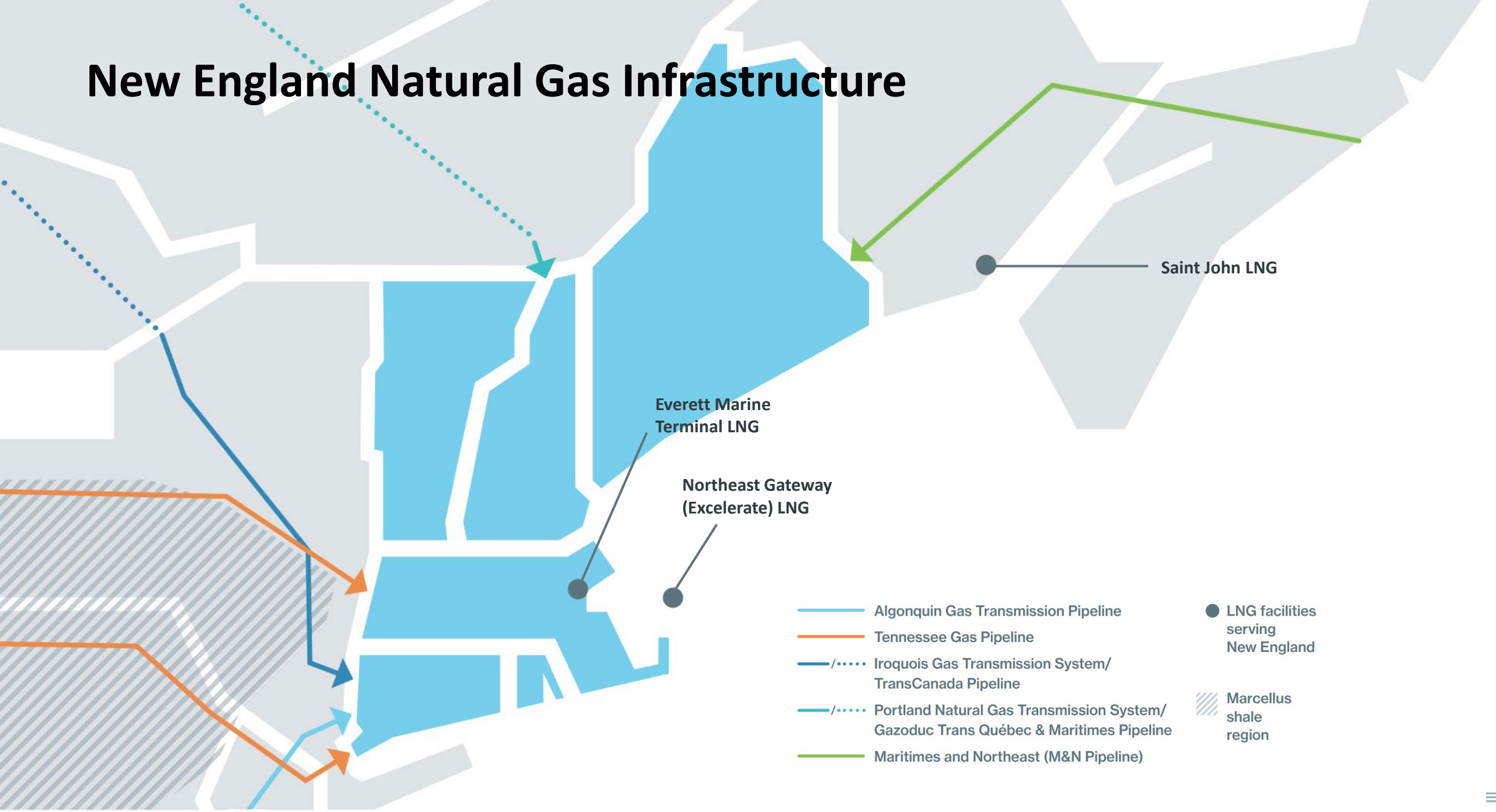
Gas – Electric Coordination

Winter 2022-23

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-NE 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/

ISO Emergency Procedure Review

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

Winter 2022-2023

Steven Gould

DIRECTOR, OPERATIONS

Overview of ISO-NE 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 Monday, September 3, 2018 was caused by significant generation outages and reductions totaling ~1,650MW, and higher than forecasted temperatures and dew points, with largest departures in the afternoon, resulted in significant load forecast deviations
- System conditions required implementation of Master/Local Control Center Procedure No. 2 (M/LCC2) and OP-4
  - M/LCC2: 15:15 – 21:00
  - OP-4, Actions 1, 2: 15:30 – 20:00
  - OP-4, Actions 3-5: 16:00 – 19:00
- 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-NE 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-NE to the LCCs verbally as a % of area load to be shed

Generator Preparations

Stephen George

DIRECTOR, OPERATIONAL PERFORMANCE, TRAINING & INTEGRATION

NERC Cold Weather Reliability Standards

- On August 24th, 2021 FERC approved NERC's Cold Weather Standards
  - Impacted standards are EOP-011-1, IRO-010-4, and TOP-003-5
- 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, which was published in 2019
  - February 2021 cold weather events in the Midwest and South Central states contributed to the accelerated pace of cold weather standard development and approval
- The effective date of these Cold Weather Standards is April 1, 2023

NERC Cold Weather Reliability Standards, cont.

- These standards will require generators to implement plans to prepare for cold weather and will also require the exchange of certain generator cold weather operating parameters that will help enhance situational awareness
  - EOP-011-1 includes two new requirements related to generator cold weather preparation, including freeze protection and training of maintenance or operations personnel responsible for cold weather preparedness plans
  - IRO-010-4 and TOP-003-5 are revised to include provisions of generator cold weather data to RCs, BAs, and TOs
    - Examples include fuel supply and inventory concerns, fuel switching capabilities, historical minimum operating temperatures
- ISO is evaluating its current data collection processes (e.g. OP-21) to determine if additional cold weather-related data needs to be collected in order to inform processes and development of operating plans

Recent Cold Weather Events and Reports

- The FERC - NERC - Regional Entity Staff Report: *The February 2021 Cold Weather Outages in Texas and the South Central United States*, was published on November 17, 2021
  - Key findings include generation freezing issues, natural gas fuel supply issues, natural gas and electric reliability interdependency, firm load shed impacts on natural gas facilities, and coordination of manual and automatic load shedding
  - Recommendations include additional enhancement of NERC Reliability Standards, generator and natural gas infrastructure winterization, and development of natural gas - electric reliability forums
- ISO is monitoring efforts related to further NERC Reliability Standard enhancement under the "Extreme Cold Weather Grid Operations, Preparedness, and Coordination" project
- Preparation for cold temperatures is a priority for the region; lessons learned from recent events are relevant to our seasonal preparation efforts

NERC Reliability Guideline

- NERC Generating Unit Winter Weather Readiness Reliability Guideline
  - In general, the objective of NERC reliability guidelines is to distribute key practices and information on specific issues critical to promote and maintain a highly reliable and secure bulk power system
  - The Generating Unit Winter Weather Readiness Reliability Guideline consists of industry best practices related to enhancing resource reliability while minimizing the likelihood that the impacts of severe cold weather will negatively impact overall system reliability
  - Review of these best practices is highly encouraged

NERC Reliability Guideline, cont.

- The NERC Generating Unit Winter Weather Readiness Reliability Guideline, Version 3 was published in December 2020
- More recent updates included:
  - Guidance for scheduling of any needed cold weather related inspections, repairs, winterization, etc. prior to the NOAA First Frost Date
  - Identification of potential critical component problem areas
  - Best practices & recommendations for communication of low temperature cut-outs to the Balancing Authority (BA)
- This Reliability Guideline and the Natural Gas and Electrical Operational Coordination Considerations Reliability Guideline provide guidance to aid in preparation for winter weather conditions

Effective Winter Weather Readiness Programs

- The NERC Generating Unit Winter Weather Readiness Reliability Guideline describes that an effective winter weather readiness program consists of the following components:
  - Safety
  - Management roles & expectations
  - Processes and procedures
  - Evaluation of potential problem areas with critical components
  - Testing
  - Training
  - Communications

NERC Cold Weather Training Materials

- NERC has developed many additional resources applicable to cold weather preparation and operations
- The NERC website also has a page which provides a single location listing all applicable resources related to cold weather preparation

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC Information Resources on Cold Weather Preparation and BPS Impacts

(as of 2/11/2021)

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

Version 3 of the Generating Unit Winter Weather Readiness Reliability Guideline was approved by the RSTC at the end of 2020. The changes between versions 2 and 3 were discussed in the 2020 Winter Weather Webinar.

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.)

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 – 2020 can be found on this site.

Annual Winter Reliability Assessments 2003/2004 thru 2019/2020 can be found on this site.

RELIABILITY | RESILIENCE | SECURITY

Key Takeaways

Winter 2022-23

Steve Gould

DIRECTOR, OPERATIONS

Key Takeaways – A Reminder!

- Warmer than normal temperatures and near normal precipitation are forecasted for most of New England; extreme 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 and energy supplies are expected to be adequate under mild and moderate weather conditions this winter; in-season fuel replenishment will greatly mitigate risks of energy shortfalls under more stressful 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

AGENDA

1. Opening Remarks – Steve Gould
2. Winter Weather Outlook – Mike Fontaine
3. Capacity & Energy Outlook – Mike Knowland
4. OP-21 Surveys – Jaren Lutenegger
5. ISO Communication Protocols
   - 21 Day Energy Assessment – Mallory Waldrip
   - Gas/Electric Coordination – Mike Knowland
6. Emergency Procedure Review – Steve Gould
7. Generator Preparations – Stephen George
8. Conclusion and Key Takeaways - Steve Gould

Additional Questions for presenters?

Select the presenter to email.

Steven Gould
Director, Operations

413-540-4641

Stephen George
Director, OPTI

860-683-3299

Thomas Knowland
Manager, Forecast & Scheduling

413-540-4525

Jaren Lutenegger
Manager, Operations Analysis and Integration

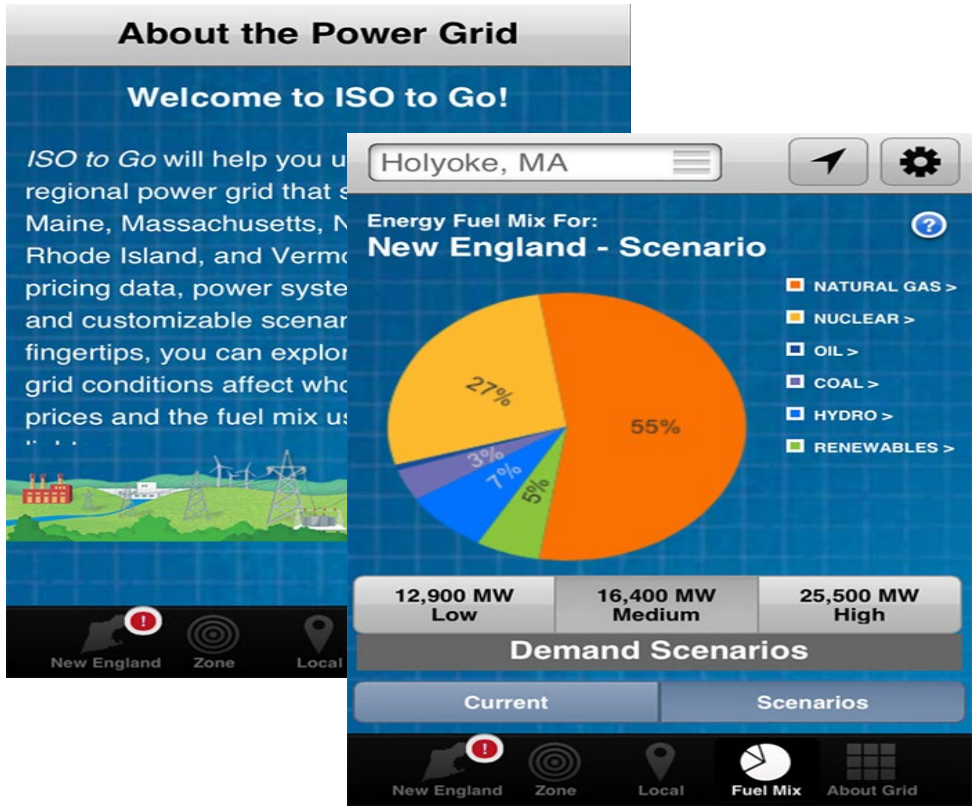
(860) 683-3302

Michael Fontaine
Lead Forecast Analyst

Mallory Waldrip
Lead Energy Security Analyst

Conclusion

- Thank you for attending
- Presentation PDFs will be posted soon
  - We will email you
- Survey
  - Let us know what we did well and what we can improve
  - Survey will open once you exit the session
- Still have questions?
  - Email your questions to: OperationsTraining@iso-ne.com

For More Information…

- Subscribe to the ***ISO Newswire***
  - *ISO Newswire* is your source for regular news about ISO New England and the wholesale electricity industry within the six-state region
- Log on to **ISO Express**
  - *ISO Express* provides real-time data on New England's wholesale electricity markets and power system operations
- Follow the ISO on **Twitter**
  - *@isonewengland*
- Download the **ISO to Go App**
  - *ISO to Go* is a free mobile application that puts real-time wholesale electricity pricing and power grid information in the palm of your hand