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Cold Weather Operations

Federal Energy Regulatory Commission

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Overview and Contents

- Given concerns about generator performance and fuel availability, ISO-NE made preparations for Winter 2013-14 (slides 4-10)
 - Implemented a Winter Reliability Program to secure the additional MWh that would be needed in a cold winter
 - Made market rule changes
 - Enhanced communications and coordination
- Cold weather and outages made operations difficult (slides 11-19)
 - Price inversion led to extensive use of oil units, which were in merit
 - Oil replenishment was difficult
- Electricity prices were high, as were uplift payments (slides 20-23)



Overview and Contents, cont.

- ISO-NE is focused on “lessons learned” (slides 24-29)
 - Lesson 1: Oil inventory was vitally important to reliability this winter
 - Lesson 2: Gas pipelines were constrained even without significant use by gas-fired generators
 - Lesson 3: Unless the weather is mild, next winter will be more challenging given retirements
- Operating conditions next winter will depend on the interaction of the following factors:
 - The severity of the winter
 - Implementation of offer flexibility market rule changes
 - The Commission’s determination that generators have the obligation to procure fuel
 - Additional actions to be taken by ISO-NE to mitigate fuel supply risks (still under consideration)



PREPARATION FOR WINTER 2013-14

Concerns About Winter 2013-14

- Winter 2012-2013 was comparatively mild, with peak load under the 50/50 forecast
- Despite the mild weather, there were gas constraints
 - More than 50% of New England's installed capacity is gas-fired
 - Includes dual fuel units
- In addition to gas constraints, oil was limited
 - Fuel surveys during Winter 2012-13 indicated that oil-fired generators maintained inventory averaging 24% of capacity
- ISO-NE and generators were litigating the generators' complaint contesting their obligation to have sufficient fuel to operate



Concerns About Winter 2013-14, cont.

- In sum, ISO-NE and stakeholders were concerned about the ability to maintain reliability during a colder winter
 - Weather cannot be accurately predicted months in advance
 - Cold weather correlates to higher system demand – and less gas available for electric generators
 - Lead time to replenish oil inventory varies
- The region agreed that these concerns warranted action and proposed a “Winter Reliability Program” that was approved by the Commission
 - The program was intended to be a one-time out-of-market action
 - Some stakeholders objected because of lack of fuel neutrality
 - Others – particularly suppliers – were concerned about inability to anticipate costs



Developing the Winter Reliability Program

- ISO-NE analyzed the incremental need (i.e., the additional MWh that would have been required in Winter 2012-13 if the weather had been colder)
 - The case used temperatures from the 2003-04 winter, which was the coldest in the past decade
- The analysis concluded that New England would have a reliability gap of approximately 1.1 - 1.5 million MWh, or, in fuel terms, about 1.9 - 2.6 million barrels of oil
- When combined with actual oil inventory in Winter 2012-13, the entire requirement was 2.4 million MWh, or 4.2 million barrels of oil



Overview of the Winter Reliability Program

- To meet the 2.4 million MWh requirement, ISO-NE solicited offers from oil-fired generators that would commit to maintain oil inventory and from new demand resources
- In total, ISO-NE accepted bids for oil inventory and demand resources equivalent to 1,950,600 MWh, or 3,057,554 barrels of oil
- Total program costs were estimated to be about \$75 million, but will be about \$9 million less given unit unavailability and failure to procure oil
- In addition, the program allowed dual-fuel units to recover the costs of a successful test demonstrating the ability to switch fuels
- Finally, the program changed market monitoring rules to give generators more flexibility



Other Preparations for Winter – Rule Changes

In preparation for winter, ISO-NE:

- Accelerated Day-Ahead Market timing to better coordinate with gas day timing
- Increased reserve requirements
- Tightened the FCM Shortage Event trigger to create better incentives for performance



Other Preparations for Winter – Coordination and Communication

ISO-NE stepped up communications through:

- Regular conference calls with NPCC Reliability Coordinators
 - Beginning on December 31st and continuing through the cold weather
 - Per standard operating procedures, ISO-NE confirmed expected interchange schedules to ensure enough resources were available to meet the load and reserve requirements in a coordinated fashion
- Pre-winter conference call with the Northeast Gas Association
 - Emphasized importance of maintaining close coordination regarding outages
- Regular communications with gas pipelines
 - Information Policy changes were made to improve gas-electric coordination per FERC Order 787
- Winter preparedness seminars
 - ISO-NE offered both online and live training
- Fuel surveys
 - Initially monthly; became twice-weekly and daily at different points in the winter



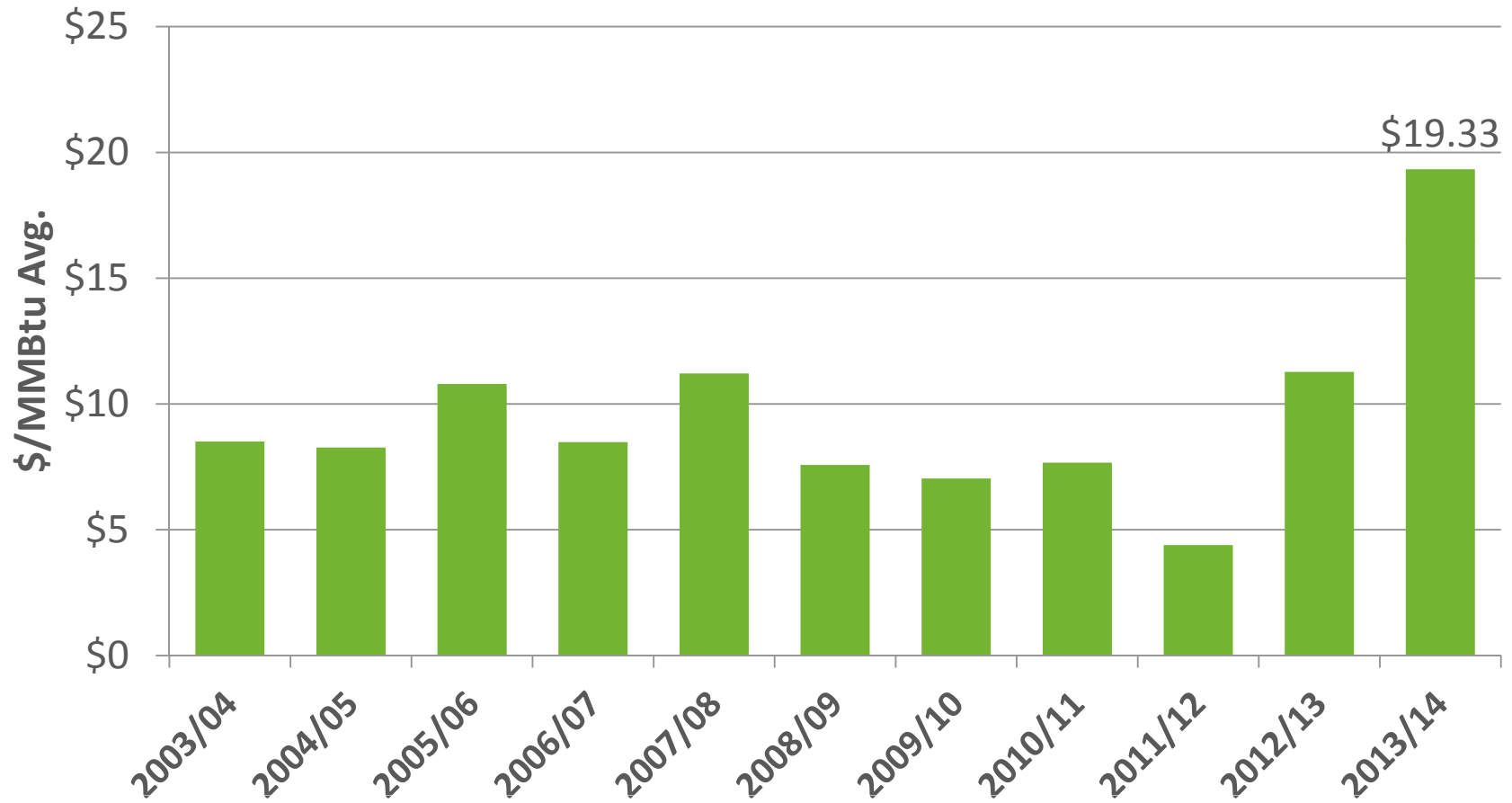
WINTER 2013-14 OPERATIONS

Winter Weather Was Colder

- Winter temperatures in the Northeast were 13% colder than the prior year (per U.S. Energy Information Administration)
- January ranks among the coldest months in recent history
 - 9 days in January were in the coldest 5% of days over the past 20 years
- On a number of occasions, daily average temperatures were well below the 20-year historical average
 - December 10-17
 - January 1-10
 - January 21-30
 - February 6-12
 - February 16-19
 - February 25-28
- Nonetheless, there was no extreme cold snap as in 2004



Winter Gas Prices Nearly Doubled in a Year

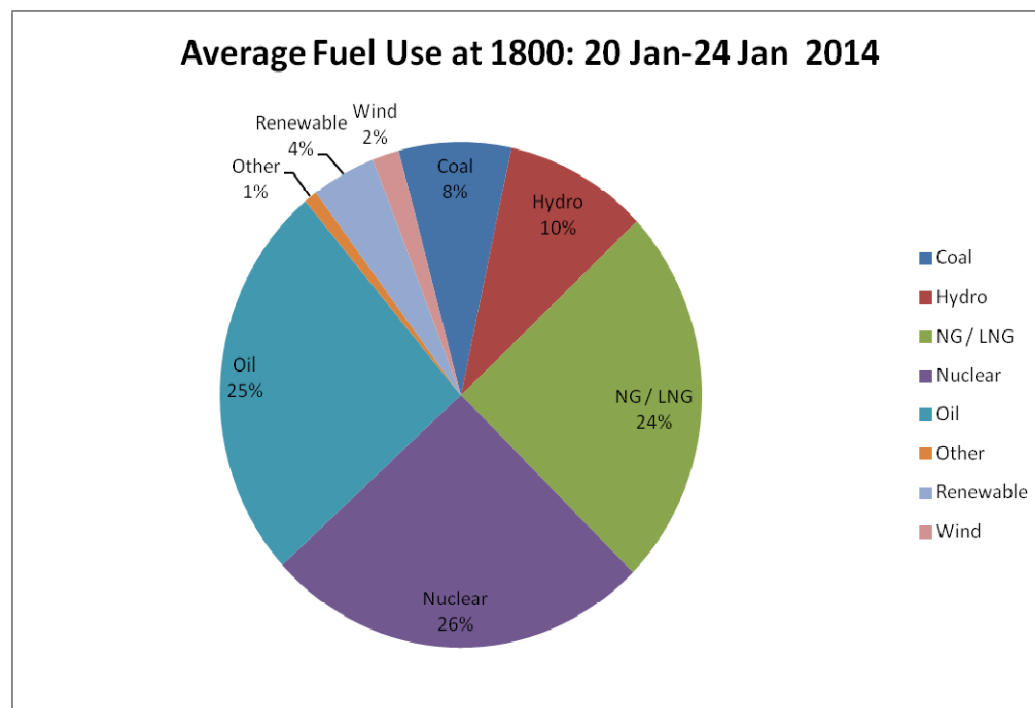


* Algonquin Citygate price, December – February average



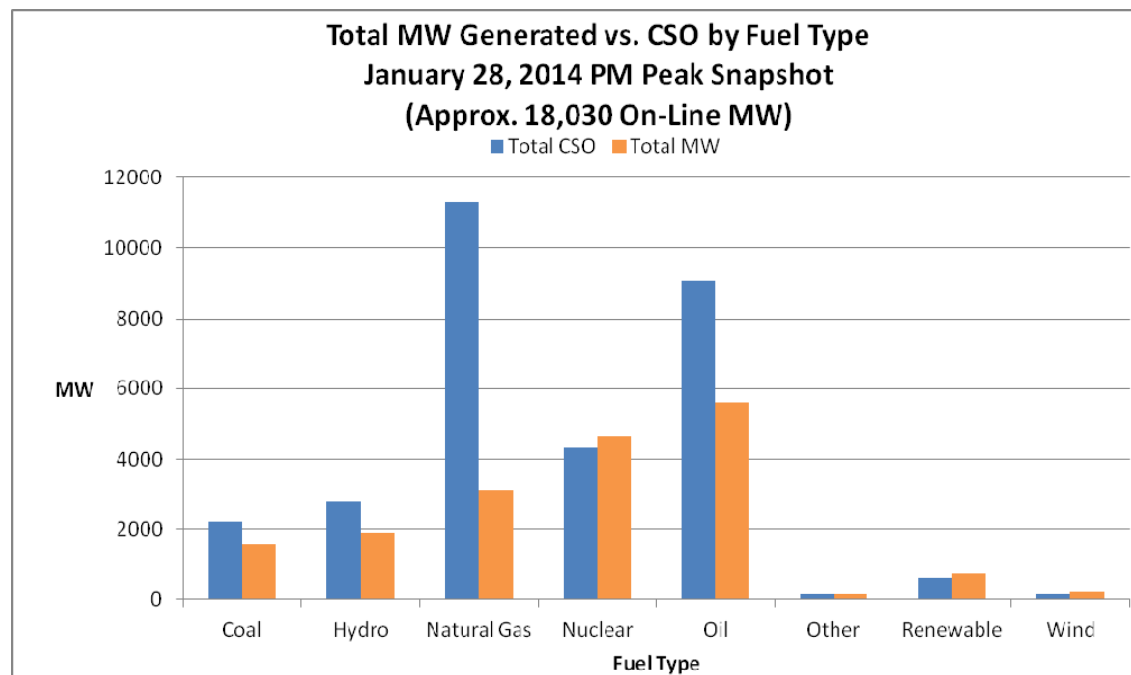
Oil Units Were in Merit

- Gas prices exceeded oil prices on 57% of winter days (as compared to 18% in preceding winter) and on all but three of the cold days listed on slide 12
- As a result of “price inversion,” oil units were in economic merit and base-loaded on several days
- The following figure shows generation by fuel type during the peak hours of a cold period in January



Gas Units Produced Significantly Less Than Capacity

- While oil provided more energy than in recent years, and other non-gas generators neared their capacity limits, gas produced far less than capacity
- As shown below, on one cold day, the system had total gas-fired capability (“Capacity Supply Obligation” or “CSO”) of more than 11,000 MW – but gas generators produced only about 3,000 MW during the peak hour



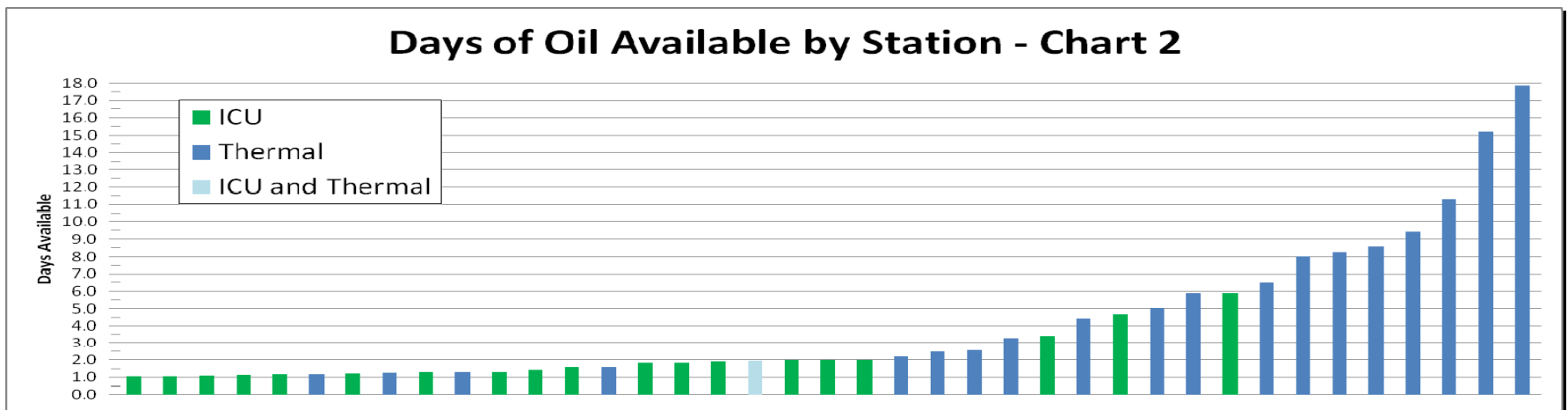
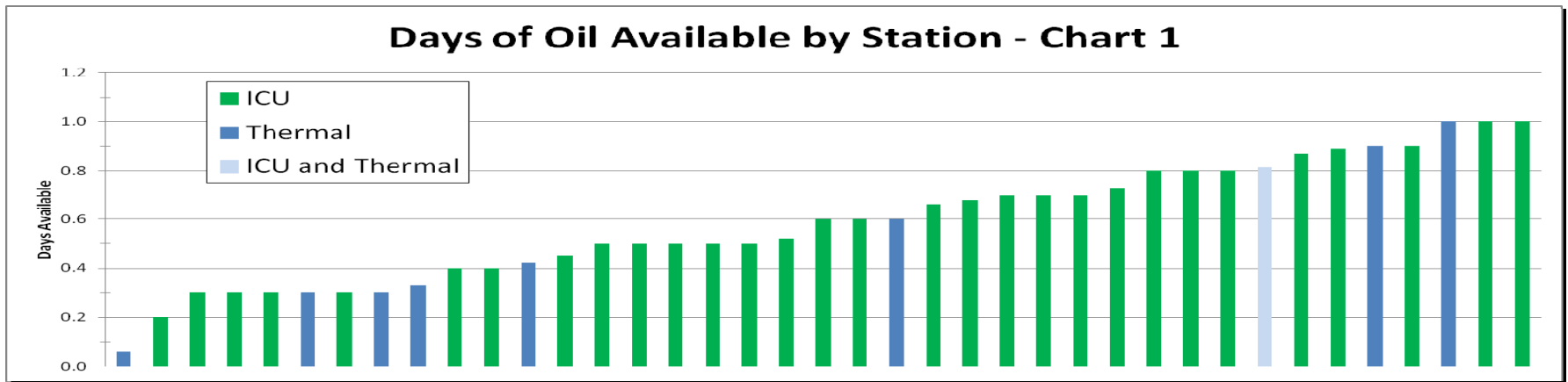
Having Oil Inventory Was Critical

- Fuel surveys of the New England fleet showed oil inventory at the beginning of winter (December 1) of 3,544,945 barrels
 - Nearly all (3,057,554 barrels) was Winter Reliability Program oil
- Including replenishment barrels, New England burned 2,700,468 barrels of program oil during the winter
- As of February 3, 1,874,983 barrels remained in inventory, but much of this inventory was concentrated in a small number of units, some of which had been out of service for much of January
 - In other words, the remaining oil was characterized by limited diversity and questions about the reliability of some of the units holding it



By February, Oil Was Limited

By February, most stations had less than two days of oil on site



Oil Supply Replenishment Was Difficult

- Oil-fired generators reported difficulty in replenishing fuel inventory
- Issues included:
 - Unavailability of oil
 - Increased demand from both heating and power sectors
 - No. 6 is not readily available on short notice
 - Supply chain contraction
 - Following diminishment of oil generation in recent years
 - Transportation
 - Great difficulty securing barge transportation throughout the Northeast, due to weather and inability to transport through shallow areas
 - Trucks were limited, as were hours for truck drivers
 - Massachusetts Governor extended trucking hours at ISO-NE's request



Outages Were an Additional Operating Challenge

- A number of large units were out of service during cold spells:
 - A 600 MW dual fuel unit was out from mid December to early February
 - A large coal unit missed most of the January 21-28 cold weather
 - Two oil units (400+ MW each) missed parts of both January cold spells
 - A coal unit has been out of service since early January
- There were a number of cold days with significant unplanned outages:

Date	Reduction from Capacity Supply Obligation before Day-Ahead	Reduction From Day-Ahead to Real Time	Total Generation Reduction	Reductions After Day-Ahead Offer (Fuel Related)
January 21	2,890	2,060	4,950	100
January 22	3,370	1,300	4,670	140
January 23	3,120	1,500	4,620	385
January 26	2,540	1,700	4,240	445
January 27	2,650	2,100	4,750	265
January 28	3,075	1,045	4,120	330*
February 5	1,720	1,000	2,720	0

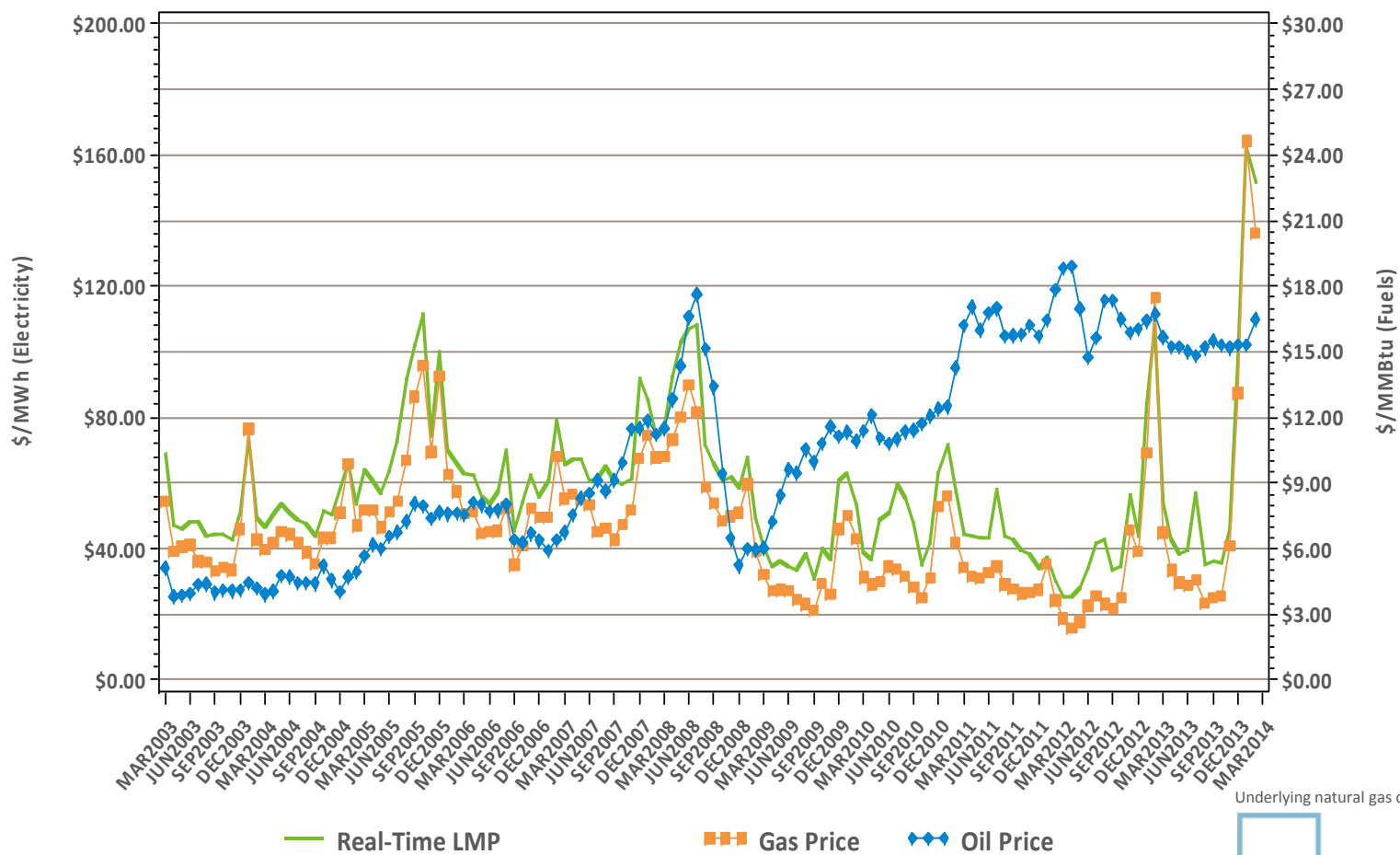
* MW of reduction due to posturing actions taken to conserve oil

- Outages and Uncertainty
 - Additional commitments may be required due to uncertainty of return to service and can create a larger surplus than necessary



PRICE IMPACTS

Electricity Prices Followed Gas Prices

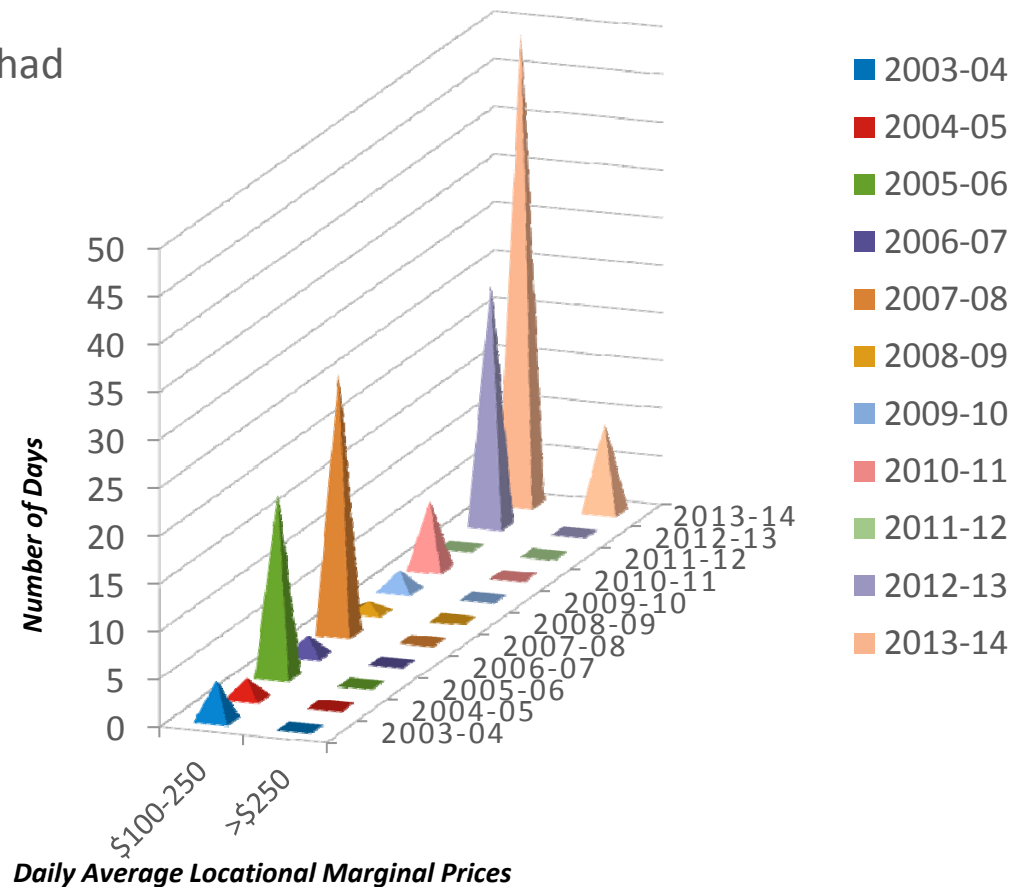


Underlying natural gas data furnished by:



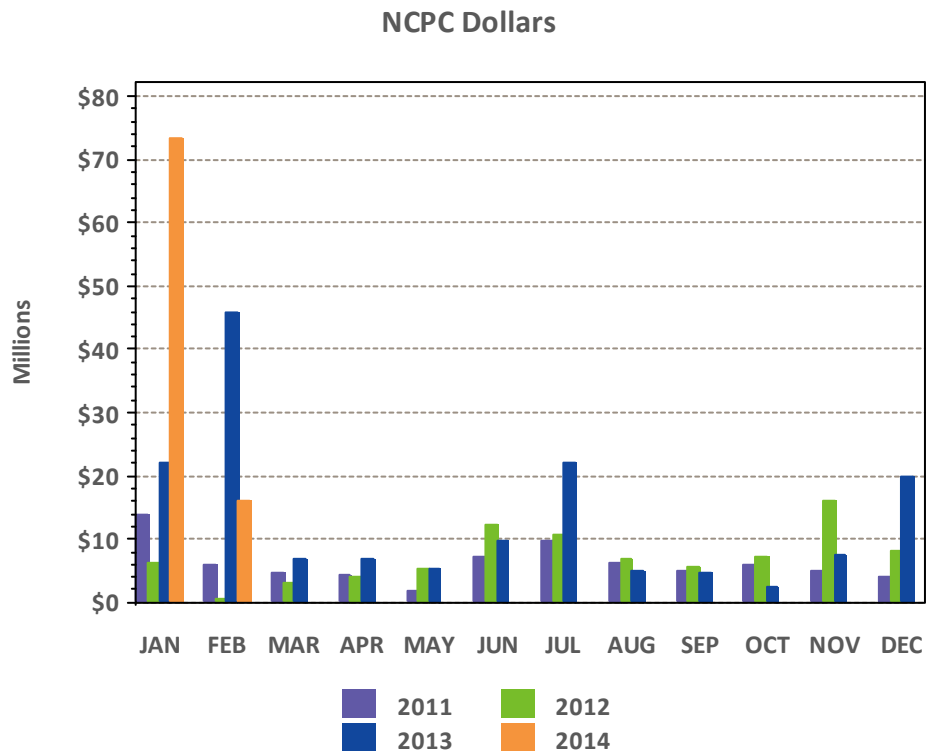
Accordingly, Electricity Prices Spiked

- Wholesale electric prices were high and stayed high, although the Winter Reliability Program had some price-suppressing effect
- 64% of average daily real-time prices were above \$100, in contrast with past years (e.g., 28% in 2012-13 winter)
- For the first time in more than 10 years, average daily real-time prices exceeded \$250 (9 times)
- Energy market costs were \$5.05B this winter, in contrast to \$5.2B for all of 2012



Uplift Payments to Participants Also Spiked

- Operational challenges (see slide 19) led to significant uplift payments
- As gas units were out of merit, they received these payments to compensate them for their high start up and no load costs
- Uplift increased from \$20.4 million in December 2013 to \$73.3 million in January 2014



IMPLICATIONS FOR FUTURE WINTERS

Lessons Learned

No. 1: Oil inventory was vitally important to reliability this winter

- The Winter Reliability Program was instrumental in maintaining reliable system operations
- Through Feb 28, New England generators burned 2,700,000 barrels of oil
- In contrast, generators averaged only 1,594,000 million barrels of oil in inventory during Winter 2012-13
- Given difficulties securing mid-winter replenishment, it was critical that units had significant inventory at the beginning of the winter



Lessons Learned, cont.

No. 2: Gas pipelines were constrained even without significant use by gas-fired generators

Despite the limited gas generation, the pipelines from the North were heavily utilized

- See the examples from January 22 and 23 below

This raises questions about the viability of gas-fired operating reserves

Pipeline	Location	Operating Capacity	Scheduled 1/22/2014	Scheduled 1/23/2014
Algonquin	Stony Point	1,450,000	1,200,801	1,275,776
Tennessee	Station 245	1,062,800	1,045,901	1,048,312
Iroquois	Waddington	1,150,000	1,041,387	1,065,246
M&N	Baileyville	850,000	833,000	779,000
PNGTS	E. Hereford	168,000	216,759	217,398
Totals		4,680,800	4,337,848	4,385,732

Note: data doesn't show counterflows.



Lessons Learned, cont.

No. 3: Unless the weather is mild, next winter will be more challenging given retirements

- Non-gas generators capable of producing up to 2.6 million MWh are scheduled to retire in time for next winter
 - Salem 3 (coal)
 - Salem 4 (oil)
 - Vermont Yankee (nuclear)
- To put the retirements in perspective, the Winter Reliability Program procured *less* than these units' capability
- The retiring generators actually produced approximately 1.6 million MWh this winter



Improvements for Winter 2014-15

- The most significant market improvement in time for next winter is implementation of the “Offer Flexibility” project
 - Allows participants to update their offers in real-time to reflect changing fuel costs
 - Allows participants to submit certain supply offer parameters with hourly granularity to better reflect operational limits and costs that vary intra-day
 - Improves market pricing and incentives to perform
- ISO-NE is also working with stakeholders to change allocation of Net Commitment Period Compensation (a/k/a uplift)
 - Expected to further improve accuracy of day-ahead commitments by increasing incentives for load to bid into the Day-Ahead Market
- Significantly, the Commission has clarified generator obligations
 - For oil units, this includes the obligation to have inventory to meet obligations:
 - Under Good Utility Practice, cost-of-service oil units keep sufficient inventory to meet load
 - The order confirms that capacity resources have a higher (“strict”) performance obligation
 - As oil cannot be procured “just in time,” oil-fired generators must make arrangements in advance to ensure that they will have oil inventory sufficient to produce energy when dispatched this winter



Further Considerations for Winter 2014-15

- ISO-NE believes that it must prepare for cold winters
- The “lessons learned” create concerns for Winter 2014-15
- In particular, can the region:
 - meet the energy needs of a severe winter (like 2013-14 or 2003-04), and
 - fill the deficit resulting from the shutdown of Vermont Yankee and Salem Harbor?
- Will generators translate the generator obligations order into adequate fuel inventory at the start of winter and sufficient forward resupply arrangements, or is it necessary to propose another winter reliability program?
- A future program could include:
 - Dual fuel incentives
 - Other performance incentives

