# Gas Price Spikes and the Impacts on Power Prices and Dispatch

*September 17, 2014*
*Northeast Energy Summit*

*Steve Dean, ASA, P.E.*
*Managing Principal*
*sdean@daimc.com*

*DAI Management Consultants, Inc.*
*1 Veterans Way, Suite 200*
*Carnegie, PA 15106*

*(412) 220-8920*
*www.daimc.com*

DAI

# Winter 2014: What Happened?

# WINTER 2014: WHAT HAPPENED?



DAI

## Overview

• Due to an unusually cold winter, energy prices across the U.S., including in the Northeast, reached extreme levels.

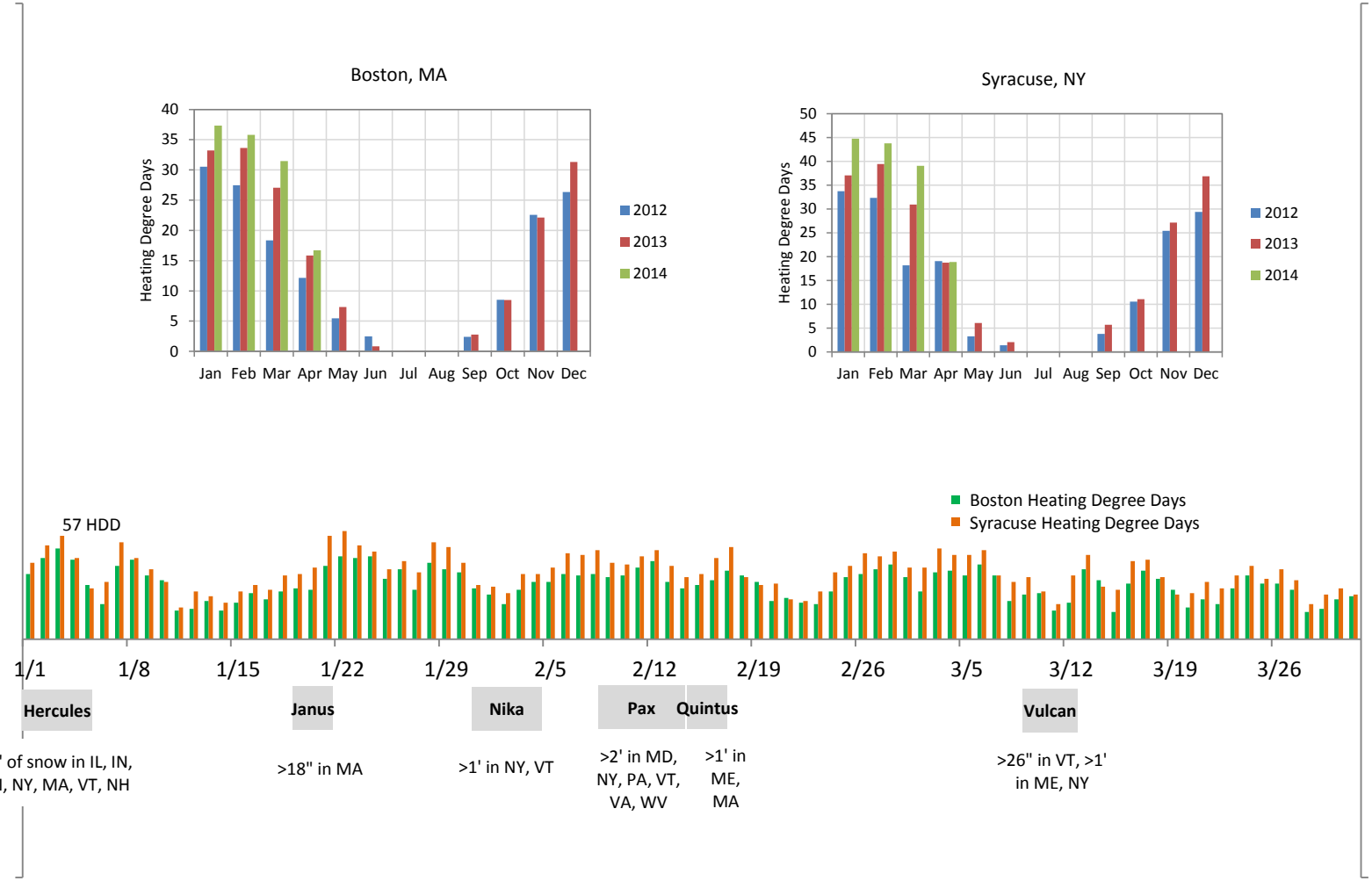
• The extreme weather conditions highlighted the economic interconnections between natural gas and power markets, and illustrated vividly the influence these forces have on a diverse array of generators and, ultimately, on ratepayers.

• In this presentation, we will examine:

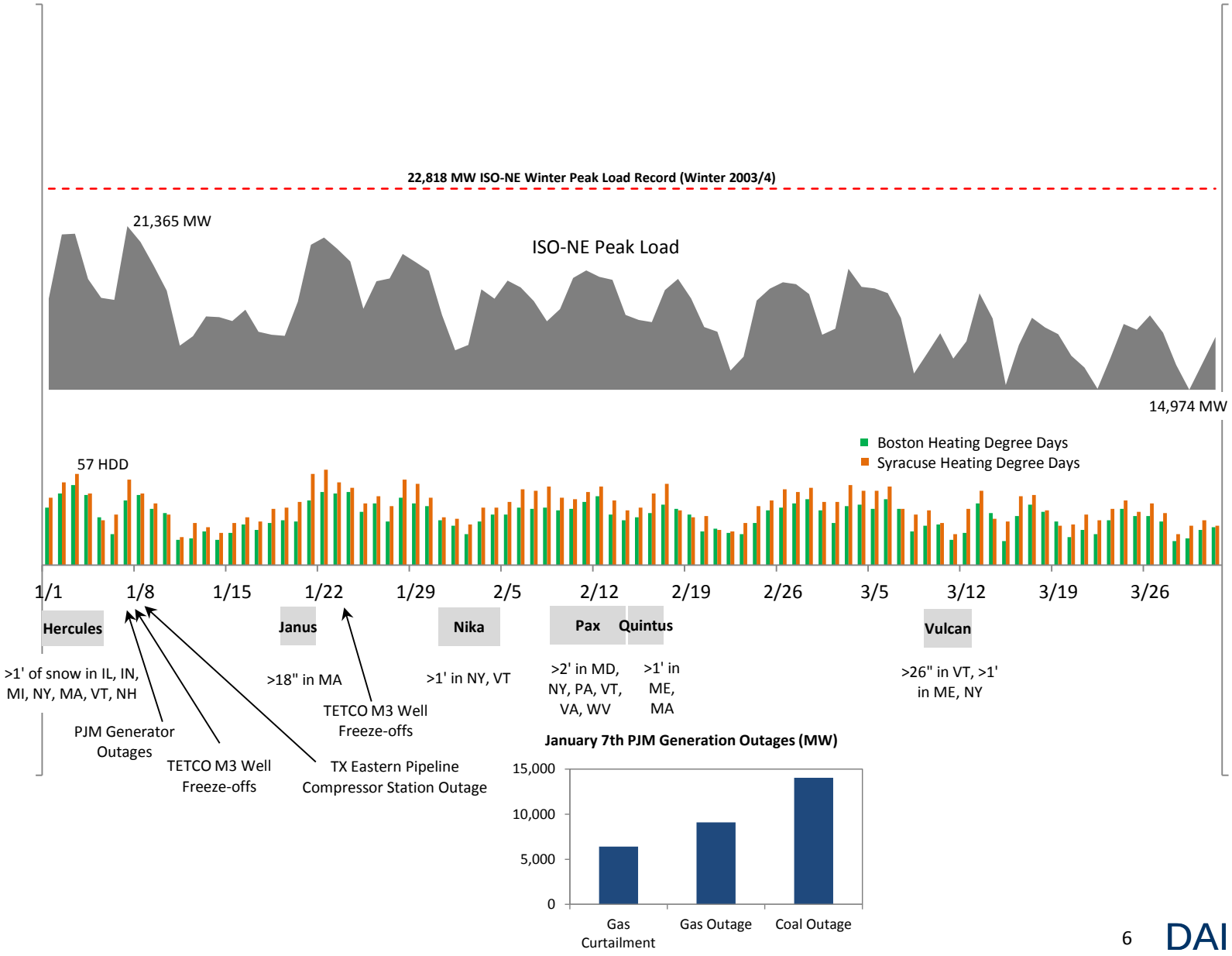
- How demand for energy was affected
- How natural gas markets responded
- How power markets responded
- How power generators responded
- How likely these dynamics are to repeat in the future

• We will focus on several representative markets in the Northeast to illustrate what happened.

## Weather Events: Extreme Cold Causes Elevated Heating Demand



## Supply & Demand: Record (NYISO/PJM) and Near-Record (ISO-NE) Peak Load Meets Supply Outages for Gas and Power



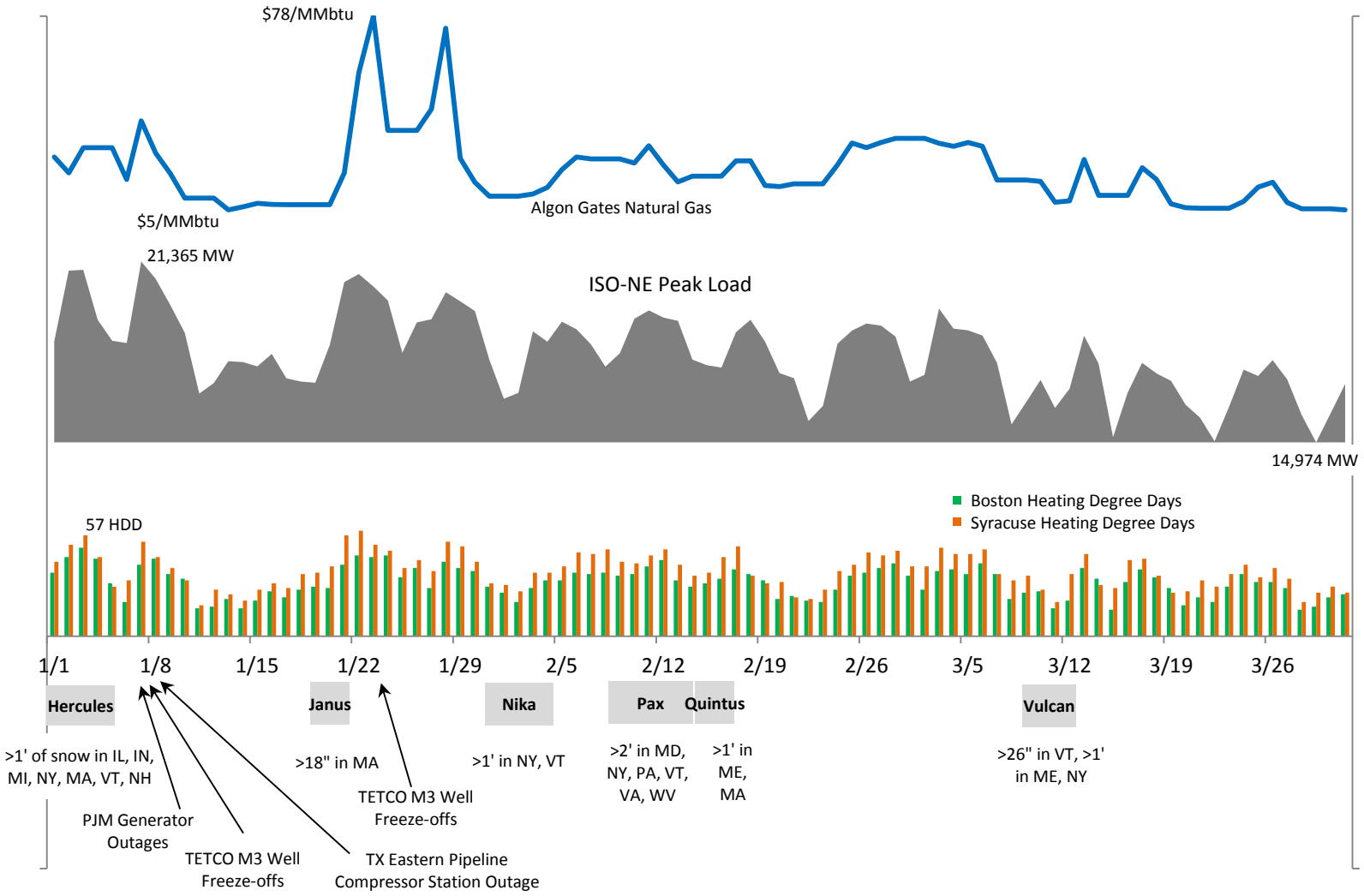






DAI

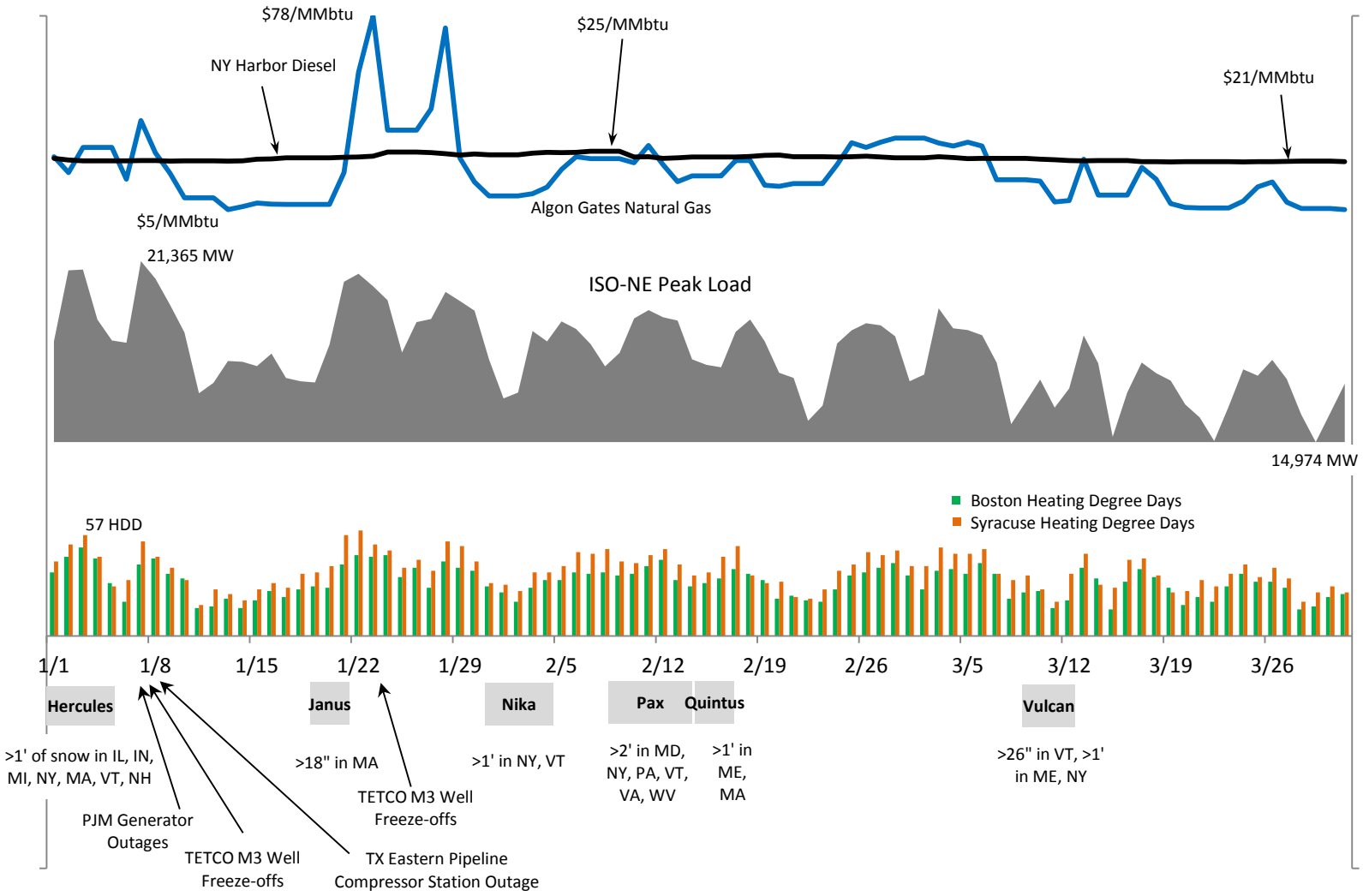
## Extreme Demand and Pipeline Constraints Cause Natural Gas to Skyrocket, with Intraday Highs Exceeding $100/MMbtu on Several Occasions






DAI

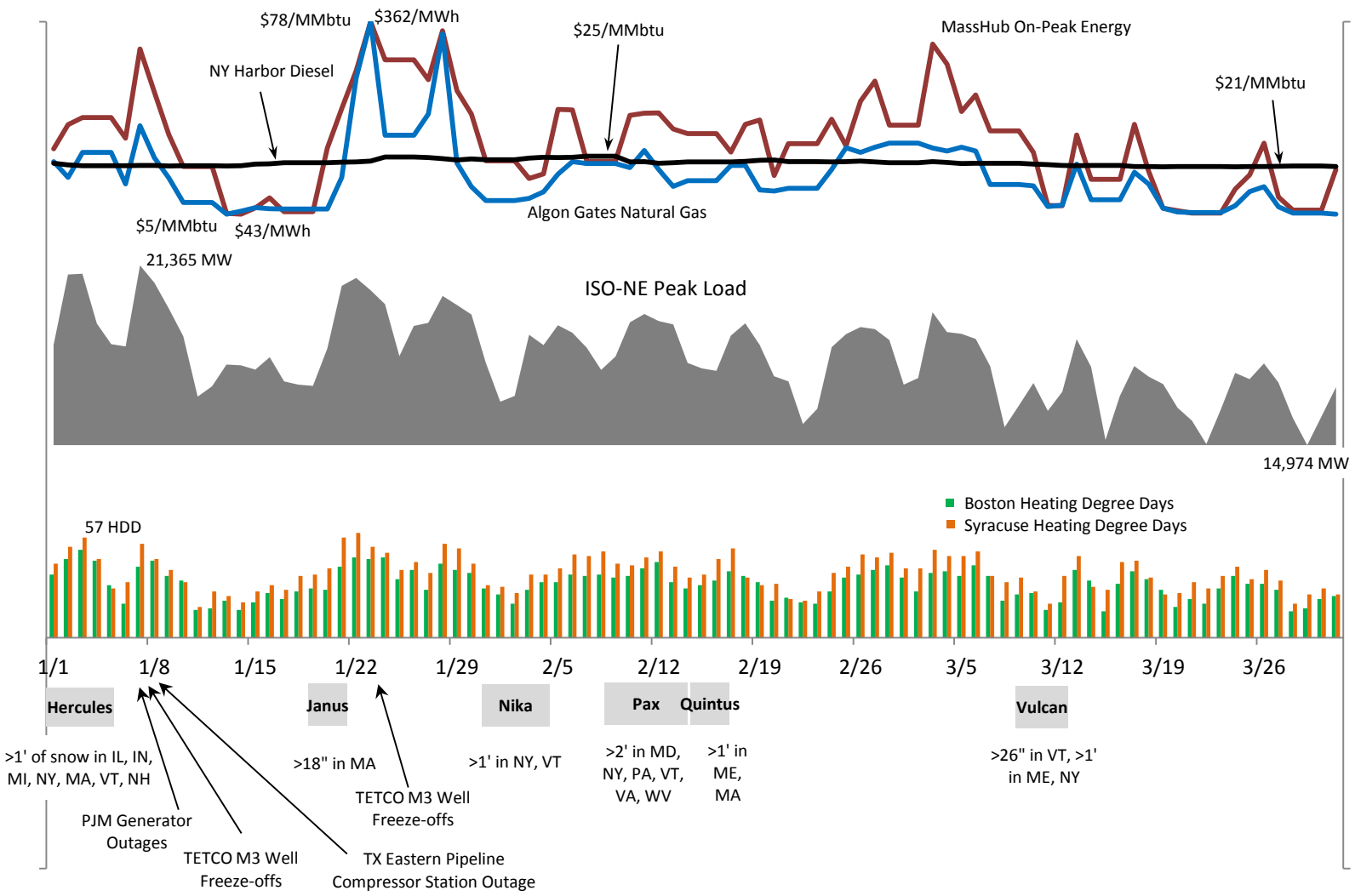
## Unlike Natural Gas Prices, DFO/RFO Prices Saw Relatively Little Change, Serving as a "Safety Value" in Northeast Markets for Many Generators






DAI

## Power Markets Largely Responded to Events in Natural Gas Markets; Oil & Coal Probably Kept the Lights On






DAI

# The Impact on Generators

## Evaluating the Impact on Generators

• With the brief overview of aggregate market conditions presented in the previous several slides, we turn now to looking at generator behavior.

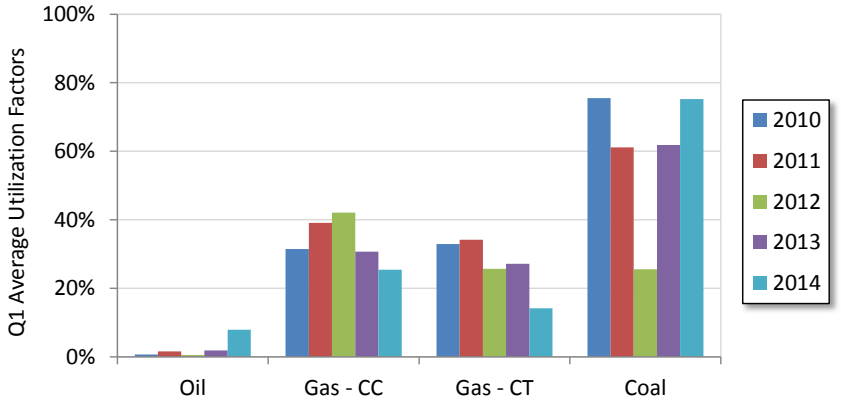
• On the whole, it appears that power generators responded capably to the challenges. Power prices increased, but only when natural gas prices increased, and in response to significantly elevated load requirements. The aggregate results, however, obscure some noteworthy details.

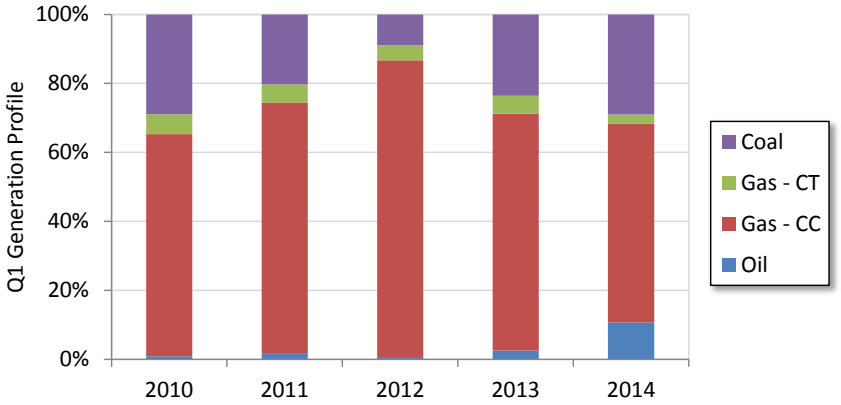
• Drilling down, we want to look at three aspects of generator-level impacts:

- Utilization: Daily utilization (actual generation / possible generation) of different types of generators. That is, as power and natural gas prices changed, how did markets make use of their generator fleets? By how much did the extreme weather increase generator dispatch?
- Profitability: Did higher prices translate into higher profits for generators? Were the appropriate incentives in place to sustain reliability?
- Efficiency: How efficiently were markets able to respond to large increases in demand? What was the aggregate cost of congestion?

## Marked Shift in Utilization in ISO-NE: When the going got tough, the tough switched to coal and oil.

- Natural gas markets became constrained as temperatures fell, wells froze, and residential heating demand soared.
- Notwithstanding soaring demand for power, utilization of gas-fired generators *fell* relative to previous years.
- Oil- and coal-fired generator utilization increased substantially.
- These shifts in utilization were caused by economic fuel dynamics (oil was cheaper than gas at times), the physical availability of gas (or lack thereof), and operational challenges faced by generators.
  - Oil facilities were dispatched as baseload units over gas as oil became cost competitive.
  - At times, less than one-third of the market's gas capacity was available.
  - The share of coal generation *would* have been even higher had it not been for Brayton Point 3 (640 MW) temporarily dropping off-line in late January.



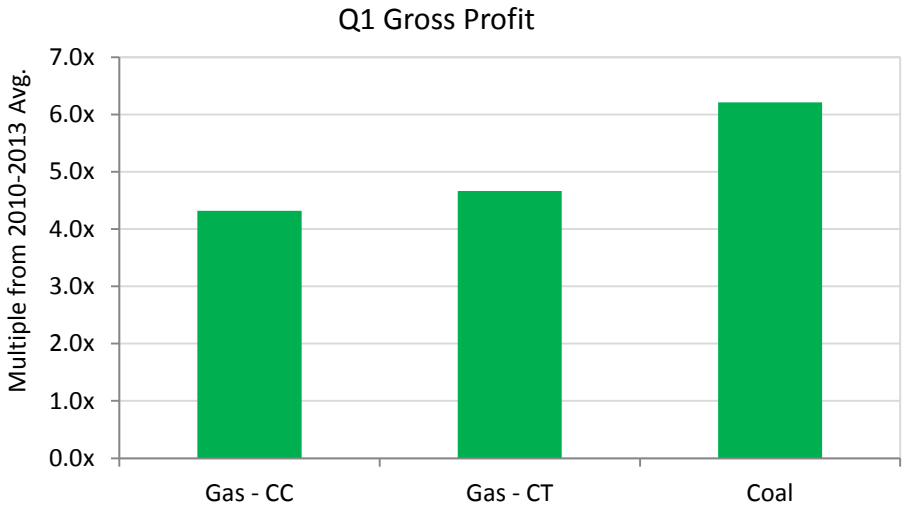

*Note: graph excludes nuclear and renewable generation*



DAI

## Did Higher Prices Translate into Generator Profit?

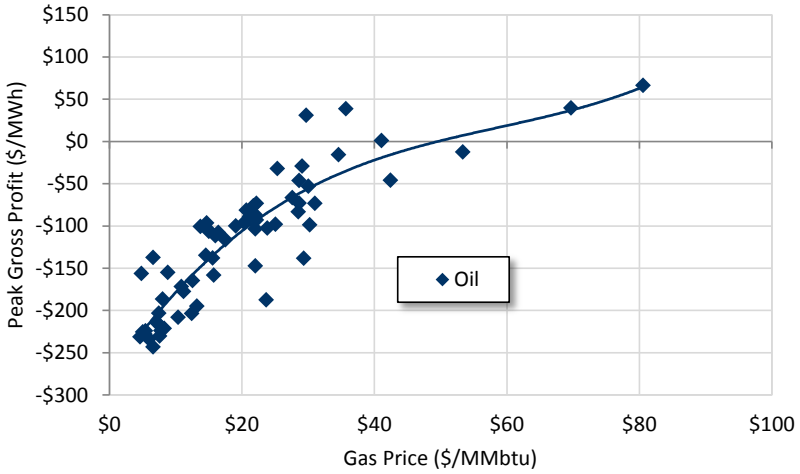
- Gross Profit = Revenue – Fuel Costs – Variable O&M Costs
- The results presented here are for the "typical" (average) generator of each type operating in ISO-NE.
- Relative to average gross profit during the first quarters of 2010-2013, gross profit in 1Q2014 increased substantially.

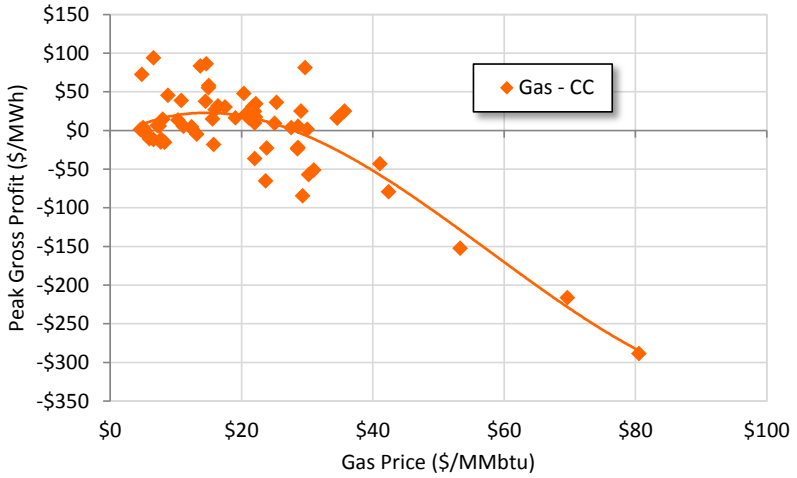



- Despite operating *less*, gas units earned greater profits on account of the energy prices received.
- Not only did coal units operate more, but their inframarginal position meant that they captured the full economic upside during the first quarter. In many respects, the outsized profits earned by coal-fired generators occurred *because* the gas-fired generators operated less.

## Oil and Gas Profit Margins

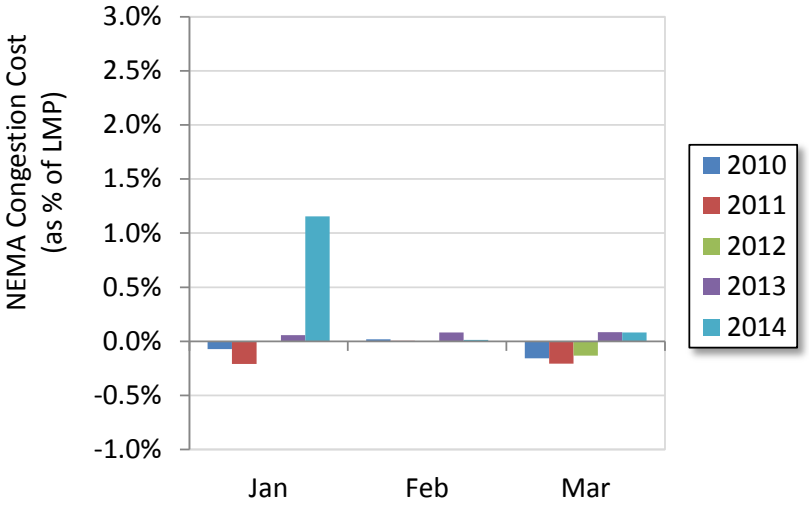
- Although each generator type was more profitable, there were differences in the incremental profitability of generators to rising prices.
- Gas-fired generator profitability *decreased* as gas prices increased, because the increases often meant gas curtailment and switching to oil-fired generators, which undercut gas-fired profitability.
- The results below illustrate the variable generator margin for our hypothetical oil- and gas-fired generators that represent the "average" generator of each type in ISO-NE for each day in 1Q2014. When gross profit is below zero, the generators would generally not be dispatched.

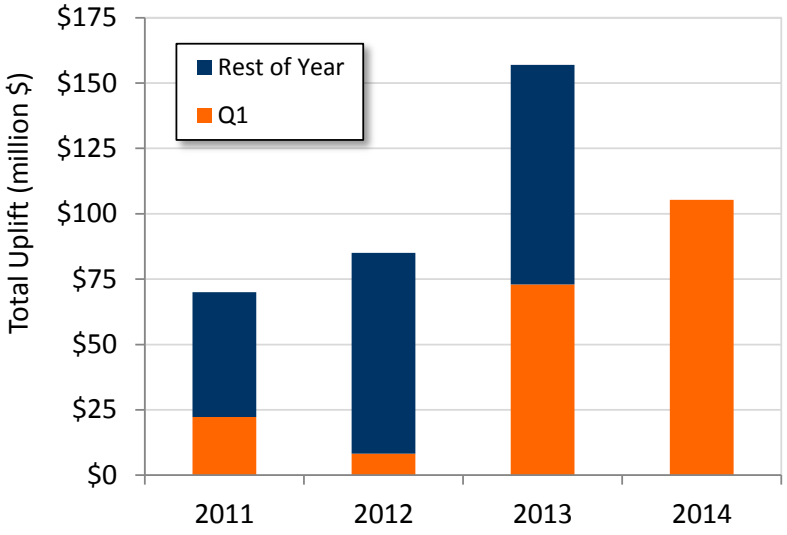


- No load was shed and system reliability was maintained.
- As outages and gas curtailments stressed the system, generation capacity reductions ranged between 2,700 MW and 5,000 MW (roughly 10-20% of total supply).
- Uplift in 1Q2014 exceeded previous annual totals for 2011 and 2012.
- Notwithstanding these increases, congestion remained limited and the $1,000/MWh price cap was never approached in ISO-NE.

- A great deal of the credit is probably due to ISO-NE's Winter Reliability Program, a one-time fuel (oil) management measure implemented before the start of the 2013-2014 winter season that helped restrain prices.
  - Started with 3 million barrels in December 2013 (out of the 3.5 million that the New England fleet had in inventory)
  - By the end of February 2014, 2.7 million barrels had been consumed

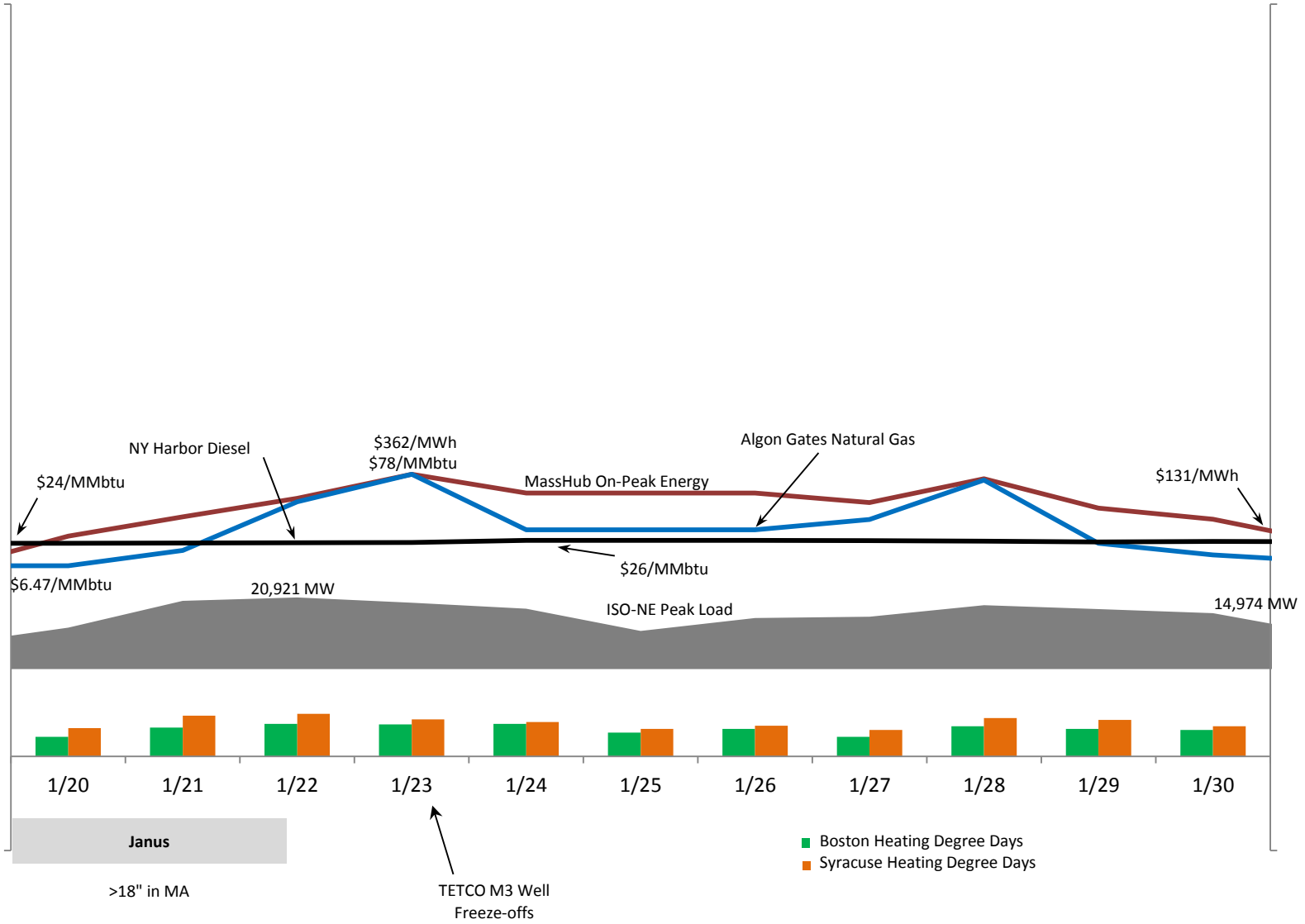


## Late January in Detail

- What is clear in the aggregate results is even more transparent in the detail.
- On the following slides, we examine one specific episode of storms in late January, illustrating prices, demand, utilization, and generator profitability together on a daily basis.

## Late January in Detail

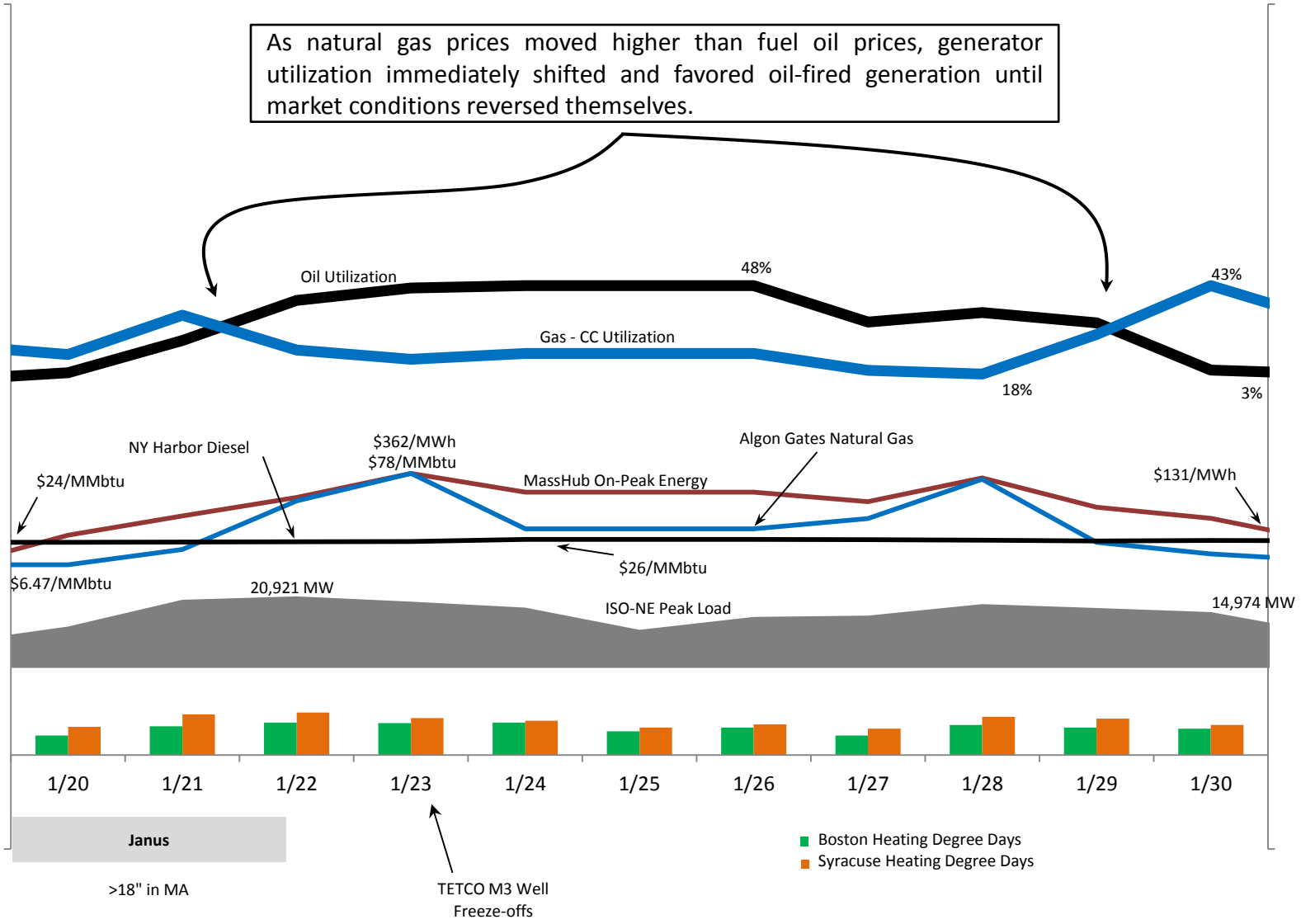



Weather, electricity demand, and market conditions during winter storm Janus and the following week.

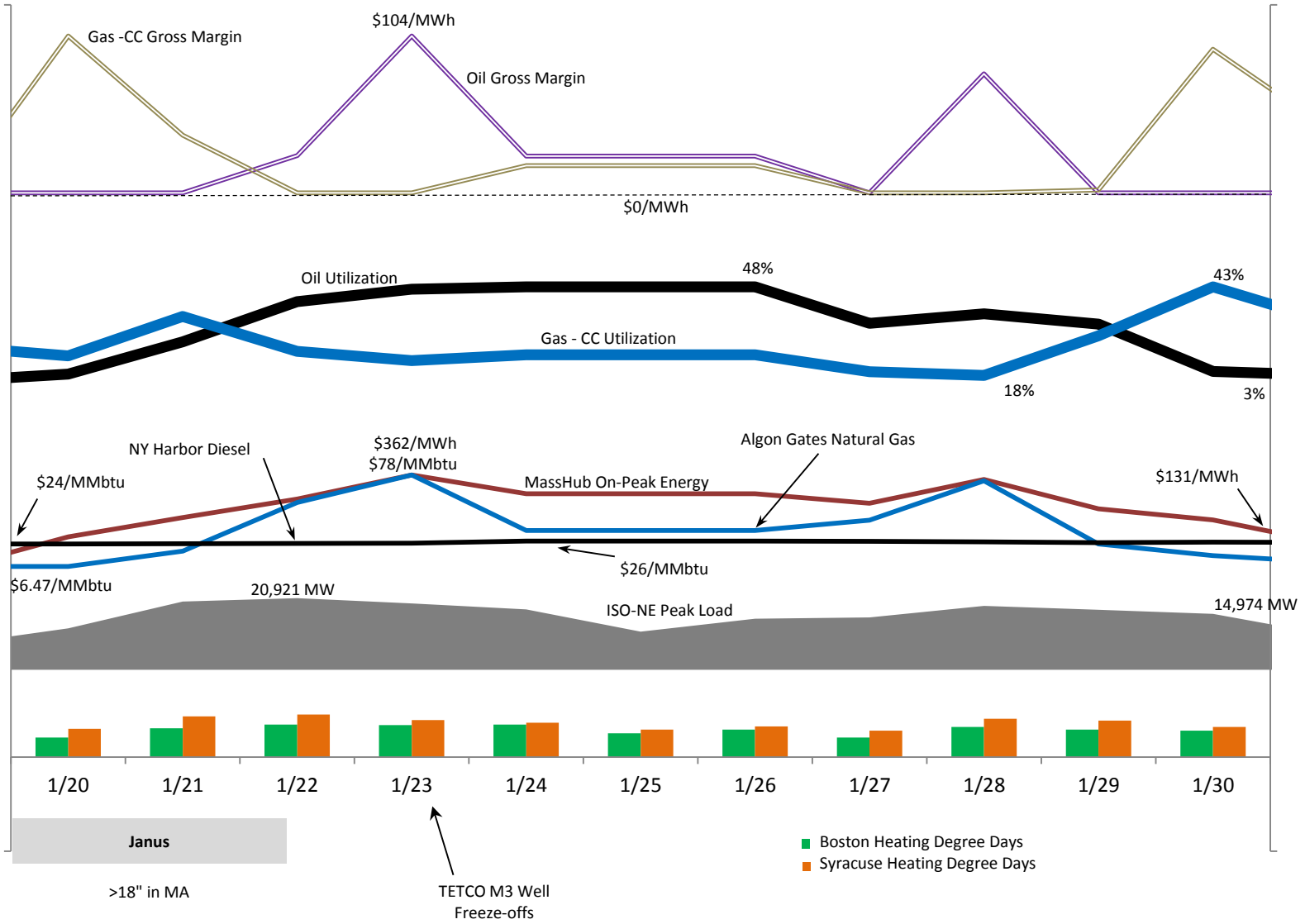


DAI

## Late January in Detail



## Late January in Detail




Consequently, energy prices didn't increase by as much as the increase in natural gas prices alone would imply. Fuel oil switching and increased coal utilization preserved reliability and limited price increases, impairing gas-fired generator margins.



DAI

# Responses and Expectations for the Future

## ISO and FERC Responses to Market Issues

• ISOs and regulators responded proactively and relatively quickly to the winter's events.

• ISO New England's Winter Reliability Program proved to be quite effective in maintaining reliability and moderating electricity price increases.

• FERC issued several orders relaxing price caps and increasing the flow of information between natural gas and power market participants:

- January 24, 2014: FERC grants PJM's request for a temporary tariff waiver to allow generators to recover costs above the $1,000/MWh price cap. Excess costs are recoverable as uplift, and therefore costs over $1,000/MWh do *not* set the market clearing price.
- January 31, 2014: FERC grants NYISO generators the ability to recover costs in excess of $1,000/MWh, but does *not* allow those generators to set market clearing prices.
- February 11, 2014: FERC allows generators to submit cost-based offers in excess of $1,000/MWh and allows such offers to set the market clearing price.

## Summary: Key Points and Challenges for the Future

1) Power markets worked as intended.
   - High electricity prices were mostly the result of high natural gas prices and equipment outages, rather than electric market failures.
2) Natural gas constraints limited gas-fired generator usefulness at times of peak demand.
   - There is an abundance of gas, with new supply capacity coming online, as well as new pipeline capacity coming online. Planned retirements in the region (older coal and oil units) are not expected to outweigh the capabilities of this new gas. *Usability* and a*ccess* to this new gas remains a seasonal concern.
3) Oil- and coal-fired generators (and nuclear!) proved essential to market functioning.
   - The Northeast's ability to switch to oil for power generation is extensive, and provides a "safety value" for extreme gas prices. ISO-NE continues to evaluate performance incentives under their capacity pricing framework and may continue to directly incentivize oil reserves to fulfill reliability gaps.
4) Natural gas-fired generators were not always able to take advantage of high prices.
5) Congestion was a relatively minor issue thanks to the ISO's advance planning.
6) Capacity is not the same as usability. Winter 2014 revealed weaknesses in relying on natural gas infrastructure to support power generation.
   - Adding gas-fired capacity without ensuring its *usability* will not improve reliability and may exacerbate price volatility.
7) Pending retirements and $CO_2$ regulations may impair future reliability without careful planning.
   - 1,200 MW of non-gas capacity is retiring this year (Vermont Yankee and Salem Harbor 3-4). The output of these units alone exceeds the generation procured through the Winter Reliability Program.

# Introduction to DAI

## Who is DAI?

- Nuclear Industry Experts
  - Advisors to institutional investors in nuclear assets
  - Advisors to firms developing new nuclear power plants
- Energy Market Experts
  - Industry-leading clients
  - University-affiliated experts at the Carnegie Mellon University Electricity Industry Center
  - Published, peer-reviewed research
- Appraisal & Valuation Specialists
  - ASA-accredited senior appraisers
- Power & Energy Market Engineers
- Electric Market Economists
- Plant Managers & Operators
  - Gas Turbine Combined Cycle (DAI Oildale)
  - Hydroelectric (DAI Great Falls)

## Recognized Expertise

- American Society of Appraisers Certified
- Licensed Professional Engineer by National Council of Examiners for Engineering
- Published, peer-reviewed research
  - *The Appraisal Journal*
  - *Journal of Structured and Project Finance*
  - *Journal of Economic Behavior and Organization*
  - *Public Utilities Fortnightly*

## Decision Analysis

- Quantitative Risk Analysis ("QRA")
- Electric and Fuel Market Studies
- Electric Market Forecasts
- Fuel Market Forecasts
- Statistical Analysis of Asset Performance
- Hedging Strategy Analysis
- Analysis of Capital Cost Uncertainty
- Default Analysis for Loan Guarantees
- Acquisition and Divestiture Advisory
- Valuation Litigation Support

## Appraisal & Valuation

- Equipment Fair Market Value Appraisal
- Residual Value Determination
- Liquidation Value Determination
- Tax Analysis/Support
  - Alternative Energy Property Allocations
  - Business Combinations (SFAS 141)
  - Goodwill and Intangible Assets (SFAS 142)
  - Gain or Loss from Acquisition (IRC 1060)

## Engineering Consulting

- Independent Engineer Analysis
- New Technology Commercialization
- Power Plant Operation and Maintenance
- Portfolio Management
- Feasibility Studies
- Expert Witness Testimony/Consulting

## Asset Management

- Acquisition and Divestiture Support
- Operations Efficiency Analysis
- Outage Management
- On-Site Operations and Maintenance
- Environmental Compliance Review
- Permitting, Licensing, and Accounting

## Industry-Leading Results for Industry-Leading Clients

ABENGOA SOLAR

**250 MW**

Appraisal to support purchase of member interests in solar thermal project

*September 2013*

citi | LIBERTY iNTERACTIVE

ARCLIGHT

**192 MW**

Appraisal to support sale of hydroelectric project

*April 2013*

PHILIP MORRIS CAPITAL CORPORATION

everpower™

**150 MW**

Appraisal to support acquisition of the Alta VI wind project

*May 2012*

Terra-Gen Power, LLC

SUNRUN

**65 MW**

Appraisal of multiple residential PV portfolios in three separate financings

*September-October 2012*

J.P.Morgan

WND WESTERN WIND ENERGY

**C$364,000,000**

Valuation of company assets for a Substantial Issuer Bid

*August 2011*

Fiberweb

**$24,180,000**

Appraisal services for a sale-and-lease back transaction

*March 2011*

Terra-Gen Power, LLC

**$1,200,000,000**

Valuation and appraisal services for lease financing of 570 MW wind project

*July 2010*

citi

ABENGOA SOLAR

**$1,450,000,000**

Valuation services in support of thermal solar project loan guarantee recipient

*December 2009*

Bank of America Merrill Lynch

**DAI Management Consultants, Inc.**
*One Veterans Way, Suite 200*
*Carnegie, PA 15106*

(412) 220-8920 voice
(412) 220-8925 fax
www.daimc.com
info@daimc.com