Platts Northeast Energy Markets Conference

Gas-Electric Coordination: Pipeline Infrastructure

New England States Committee on Electricity

April 23, 2013

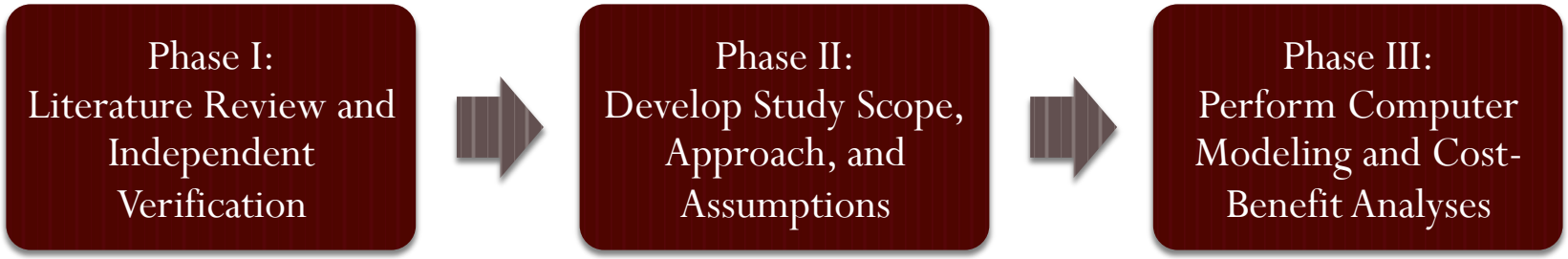
NESCOE

- New England's Regional State Committee
- Governed by a Board of Managers appointed by each of the New England Governors
- Focus: Resource Adequacy, System Planning & Expansion
- More information at www.NESCOE.com

Overview

- Three-Phase Study of Gas-Electric Interaction
  - Recap Phase I Results
  - Phase II Results and Methodology
    - Congestion Analysis
    - Assumptions and Methodology
  - Approach to Phase III
    - Scenarios and Sensitivities
    - Assumptions and Methodology
- Study Limitations
- Next Steps, Timing & Questions

Gas-Electric Market Interaction Study



- Phase I: Black & Veatch concluded that the New England natural gas infrastructure will be increasingly under pressure from demand growth from the power sector
- In Phase II, Black & Veatch has:
  - Analyzed historical gas demand in New England by sector
  - Projected growth requirements by sector for the next 15 years
  - Summarized announced pipeline expansion projects and generic infrastructure options and provided high level cost estimates for infrastructure options
  - Identified demand and power side response
  - Identified scenarios and sensitivities for further analysis
- In Phase III, Black & Veatch will:
  - Refine cost estimates associated with potential solutions
  - Perform computer simulations to estimate benefits of potential solutions

Recap Phase I Results

Literature Review

	ISO-NE Gas Study	Spectra Study	ISO-NE White Papers (2)
Scope	Assess the adequacy of natural gas pipeline capacity to serve core and electric sector demand in New England. "Deficiency" defined as a lack of adequate interruptible natural gas transportation capacity available to New England power generators.	Estimates benefit of incremental natural gas pipeline capacity from the Mid-Atlantic to New England	Discusses reliability issues that could arise from growing demand from natural gas-fired generation capacity and proposes several solutions.
Conclusions	1,500 to 2,300 MW equivalent capacity deficiency of interruptible natural gas transportation capacity available to New England Power Generators through 2020	Estimated benefit to New England of $420 to $630 million as a result of 300 MMcf/d of incremental natural gas delivery capacity	Propose several electric market incentives to mitigate reliability risk: • Allow hourly and intra-day offers to reflect the real-time cost of power generation • Better align natural gas and electric nominating schedules • Re-design the Forward Capacity Market
Analysis Gaps	• Does not consider impact of greater North American market on New England • Does not consider intricacies of New England natural gas and power infrastructure • Does not explore potential duration and probability of supply deficiency	• Incremental infrastructure may not restore historical price relationships as assumed in study • Deterministic analysis does not consider uncertainties related to evolving market conditions • Does not explore potential duration and probability of supply deficiency	• Do not explore costs, benefits, or market responses of proposed solutions

Source: Black & Veatch Analysis

Observations and Conclusions

- Studies have different scopes – lack of comparability
- Partial Analysis of Infrastructure Adequacy – need to examine congestion extent and duration
- Missing comprehensive cost and benefit analysis

- ***Black & Veatch believes that the natural gas infrastructure serving New England will become increasingly stressed as regional demand for natural gas grows***
  - Natural gas expected to be relied upon as a major electric generation fuel source for New England going forward
  - Increased usage potentially raises reliability risks
  - Electricity Market does not provide the right incentives for infrastructure development

Source: Black & Veatch Analysis

Phase II: Forecast Demand

Approach for Demand Forecasts

- Black & Veatch analyzed historical natural gas demand by sector in New England by State
- Residential, commercial and industrial gas demand are projected as determined by
  - Weather
  - Economic Growth
  - Population Growth
  - Efficiency Gains/Usage per Customer
  - Policy Initiatives
- Demand growth from the power generation sector is projected using a combination of production simulation model ProMod IV and fundamental natural gas model GPCM
  - Consistent fuel price from GPCM inputs into ProMod
  - Customized assumptions on technology costs, environmental policies, renewable resources, transmission, which were supported by industrial knowledge and project experience
- **Black & Veatch disaggregated gas demand into local demand centers to account for different infrastructure access**
- **Monthly and daily variation of gas demand is constructed to provide a comprehensive profile of demand requirements**

Residential Commercial & Industrial

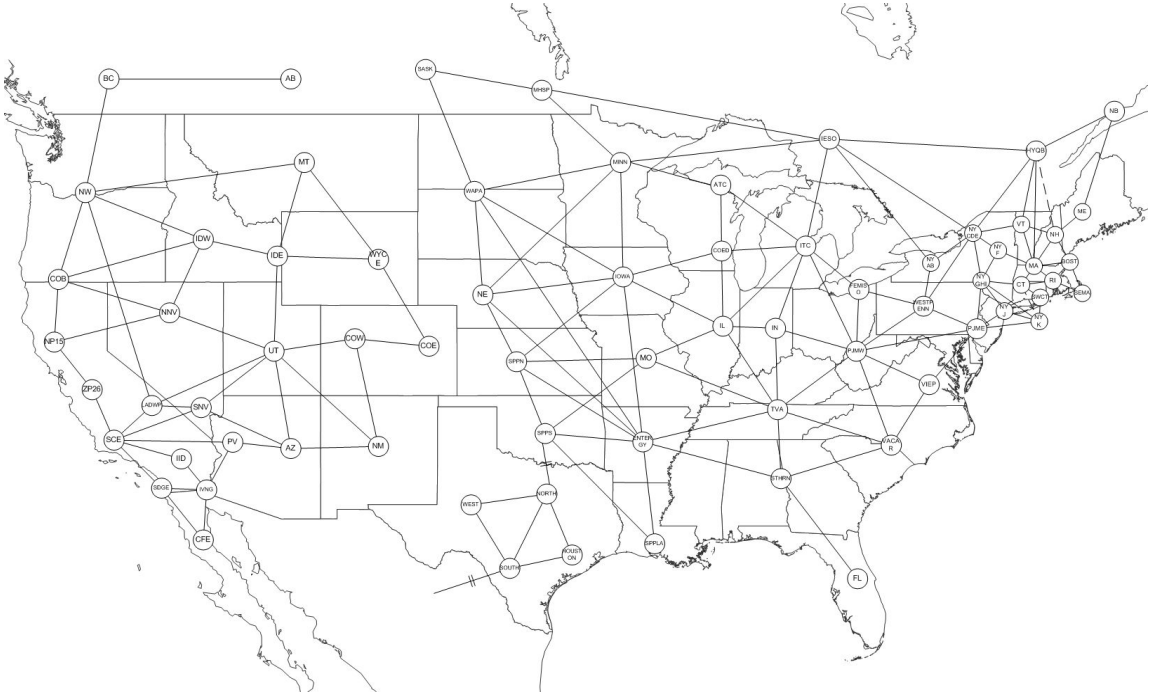
Compound Annual Growth Rate 2013-2028	Connecticut			Massachusetts			New Hampshire		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial
Average Customer Usage	-0.76%	-1.02%	2.80%	0.10%	-0.15%	-3.22%	0.32%	4.56%	13.28%
No. of Customers	2.99%	3.16%	-3.10%	0.47%	2.35%	4.00%	1.51%	0.66%	-12.59%
Projected Demand Growth	2.21%	2.11%	-0.30%	0.57%	2.20%	0.78%	1.82%	5.22%	0.69%
2011 Consumption (MMcf/d)	127	126	71	356	211	119	20	25	17
2011 Consumption as % of New England demand for sector	22.48%	30.06%	22.91%	63.06%	50.33%	38.52%	3.57%	6.05%	5.60%

Compound Annual Growth Rate 2013-2028	Rhode Island			Maine			Vermont		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial
Average Customer Usage	-2.30%	-2.94%	6.45%	1.66%	2.42%	22.40%	-0.07%	-0.76%	1.31%
No. of Customers	3.42%	2.96%	-4.15%	2.52%	1.42%	-13.00%	2.84%	1.81%	-0.55%
Projected Demand Growth	1.12%	0.02%	2.30%	4.18%	3.83%	9.40%	2.78%	1.05%	0.76%
2011 Consumption (MMcf/d)	49	31	21	4	19	73	9	7	8
2011 Consumption as % of New England demand for sector	8.59%	7.41%	6.84%	0.71%	4.48%	23.64%	1.60%	1.67%	2.50%

Source: Black & Veatch Analysis

Electric Sector

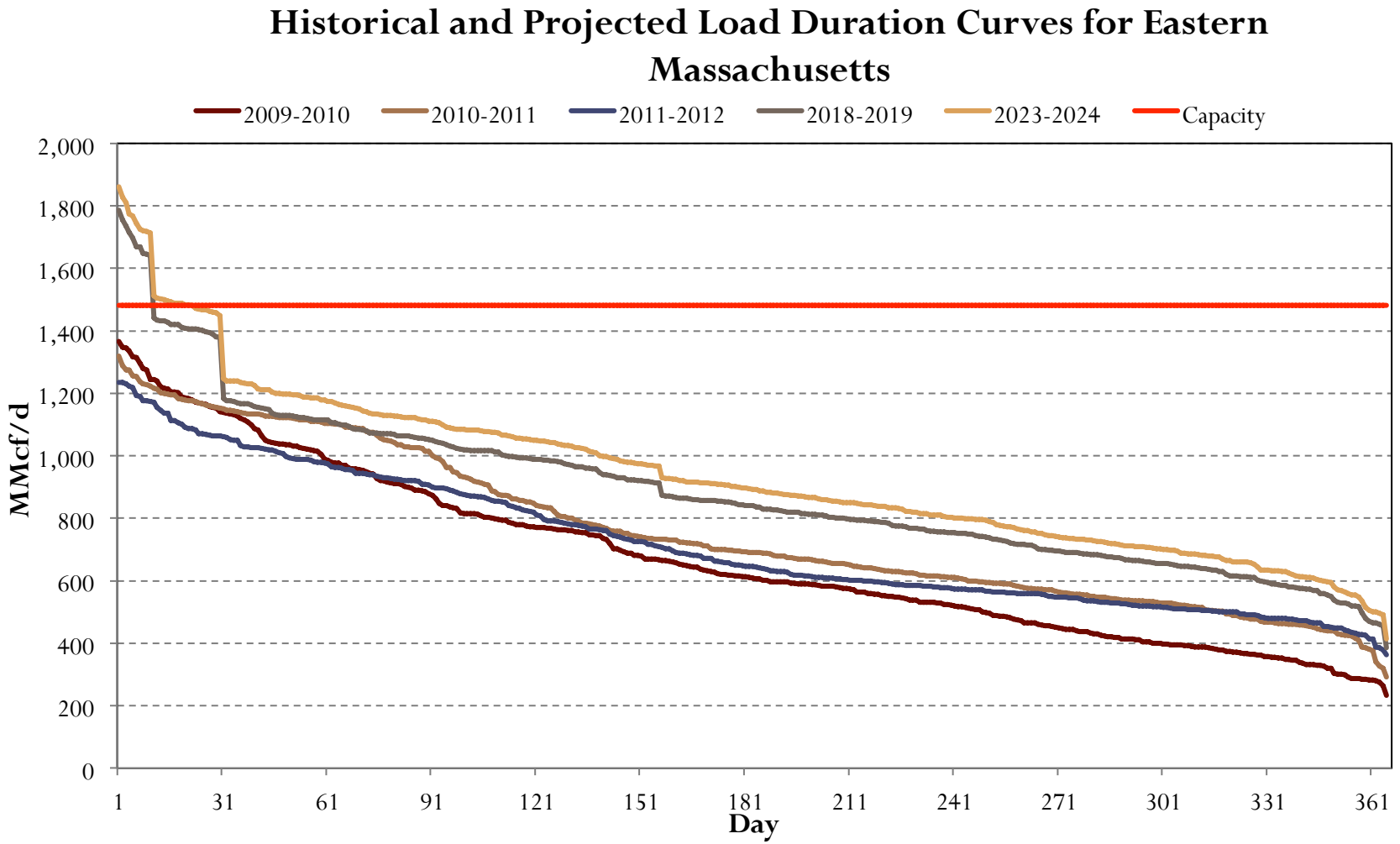
- Load Forecast
- Fuel Prices
- Environmental Compliance
- Greenhouse Gas Programs
- Renewable Portfolio Standards
- Retirements & Additions
- Incremental Transmission



Source: Black & Veatch Analysis

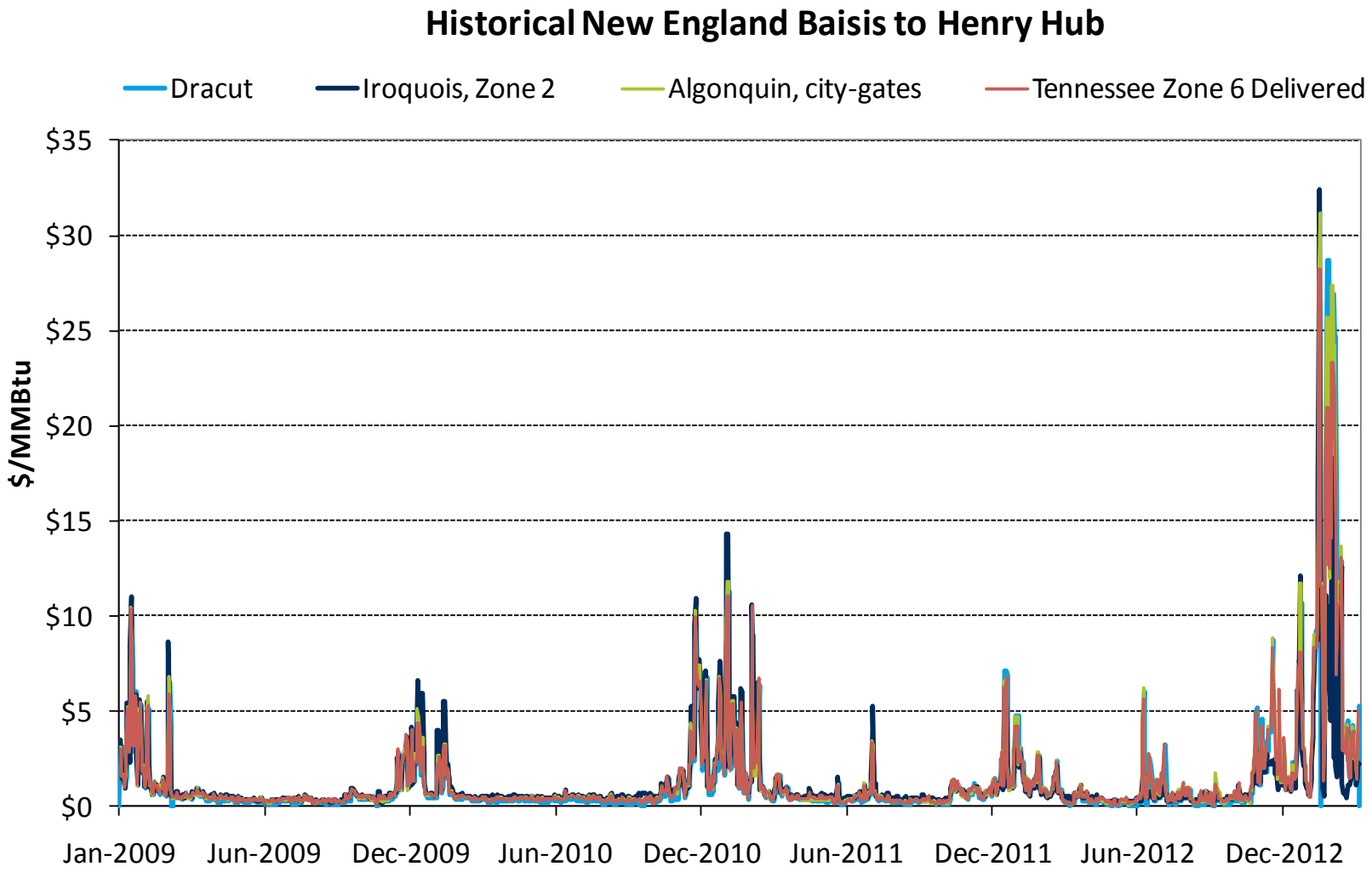
Phase II: Analyze Congestion

Forecasted Demand vs. Capacity Limit



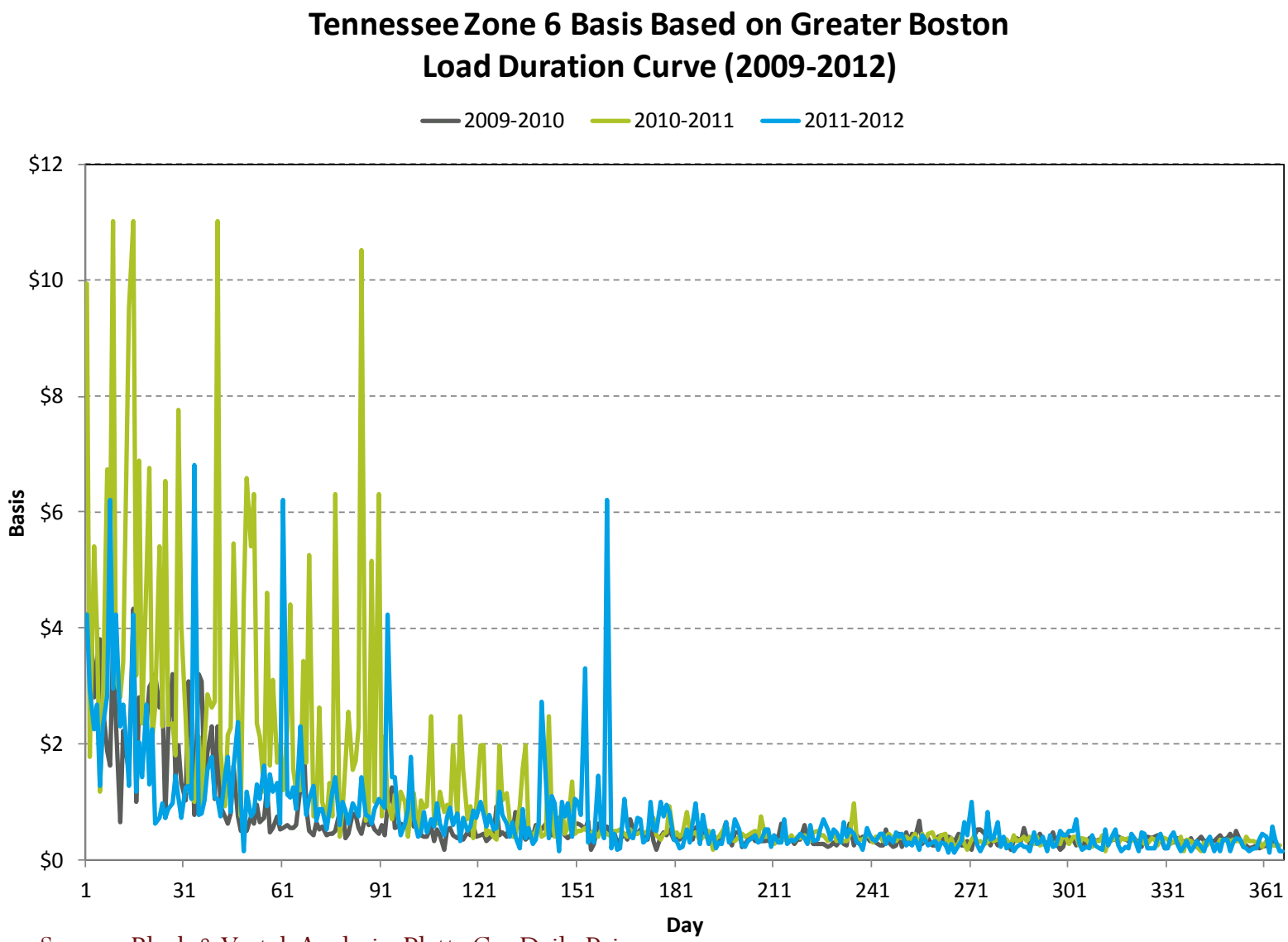
Source: Black & Veatch Analysis

Increasing Basis Volatility



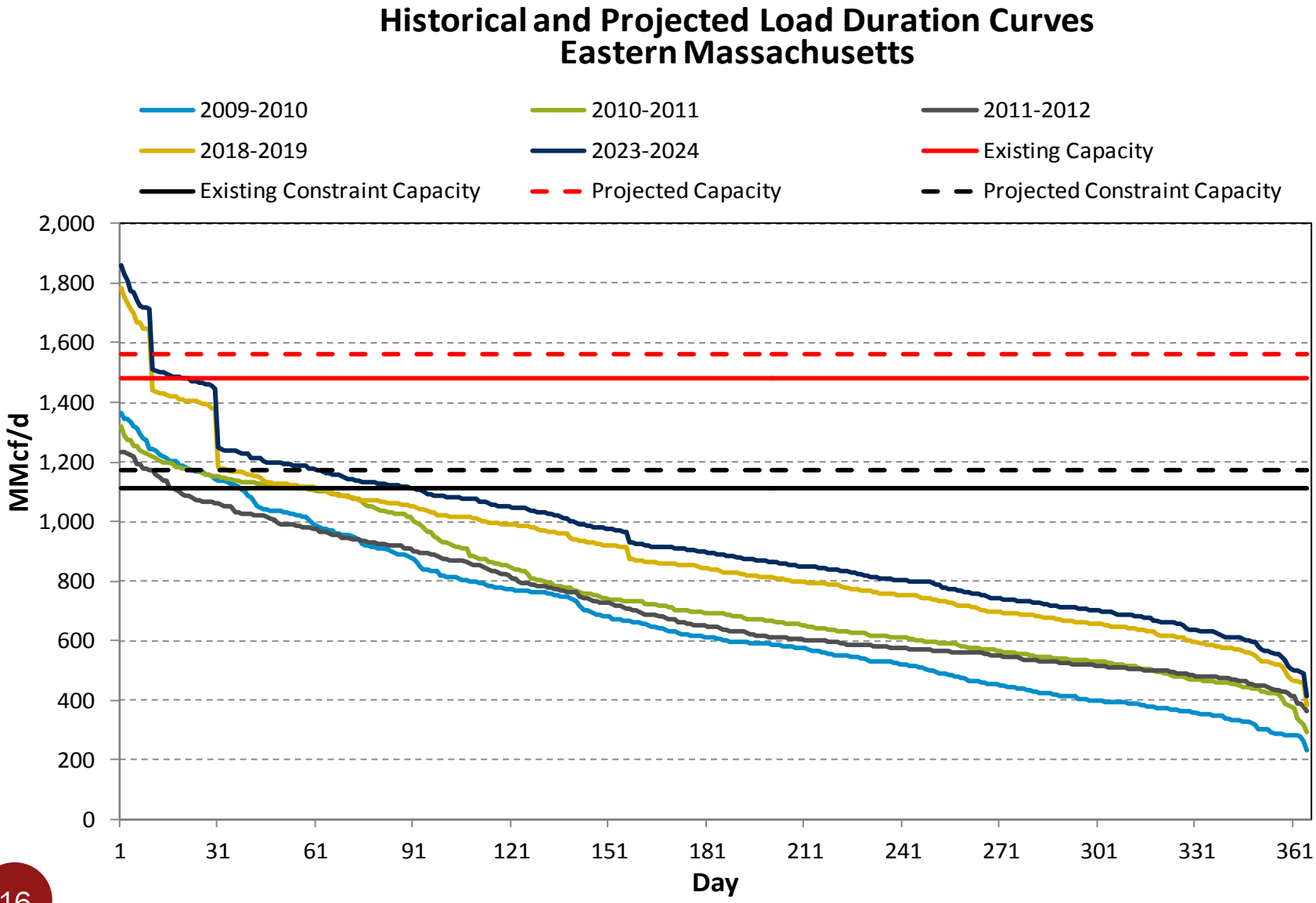
Source: Black & Veatch Analysis, Platts Gas Daily Prices

Basis Volatility Analysis



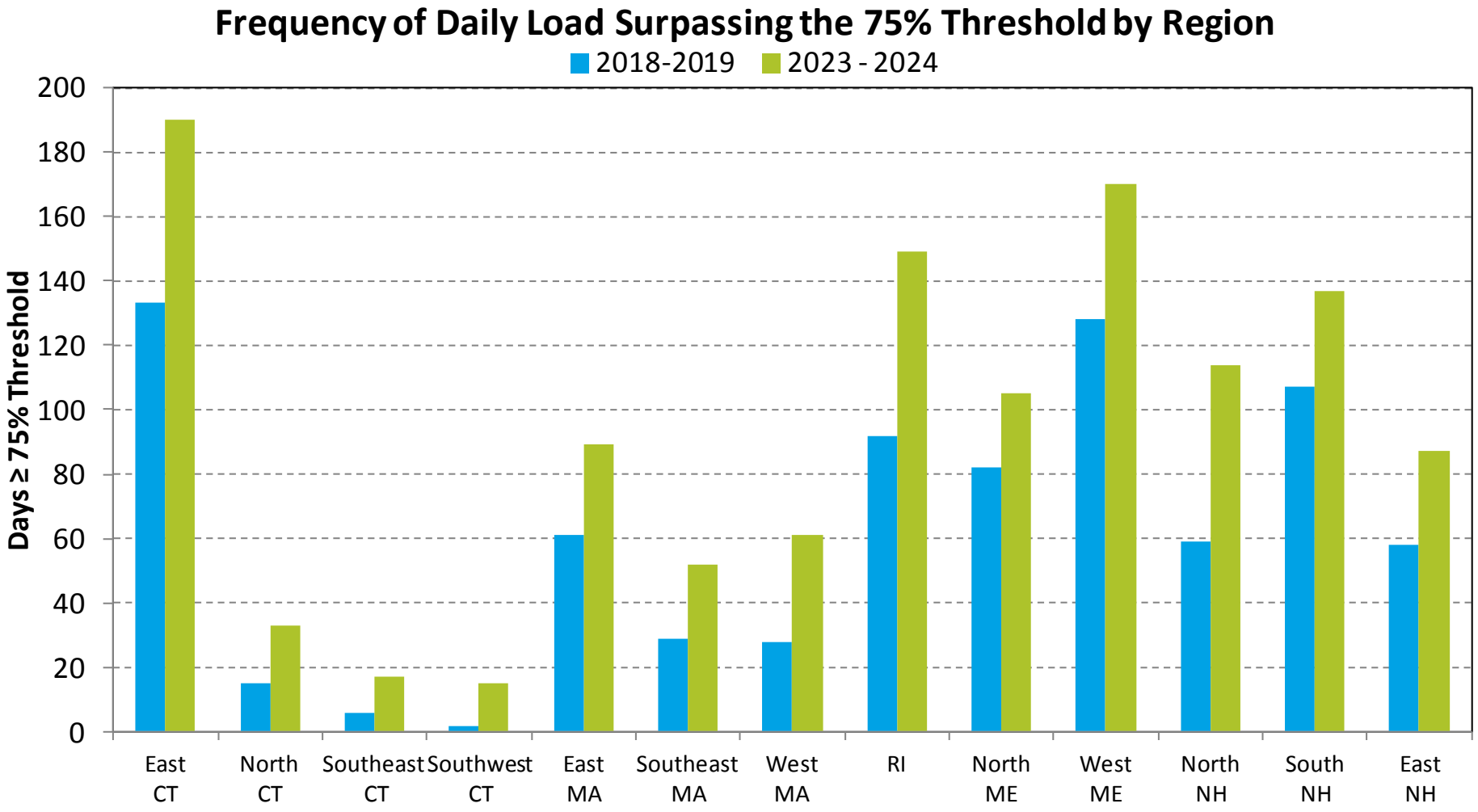
Source: Black & Veatch Analysis, Platts Gas Daily Prices

Synthesis: Basis Volatility & Capacity Limits



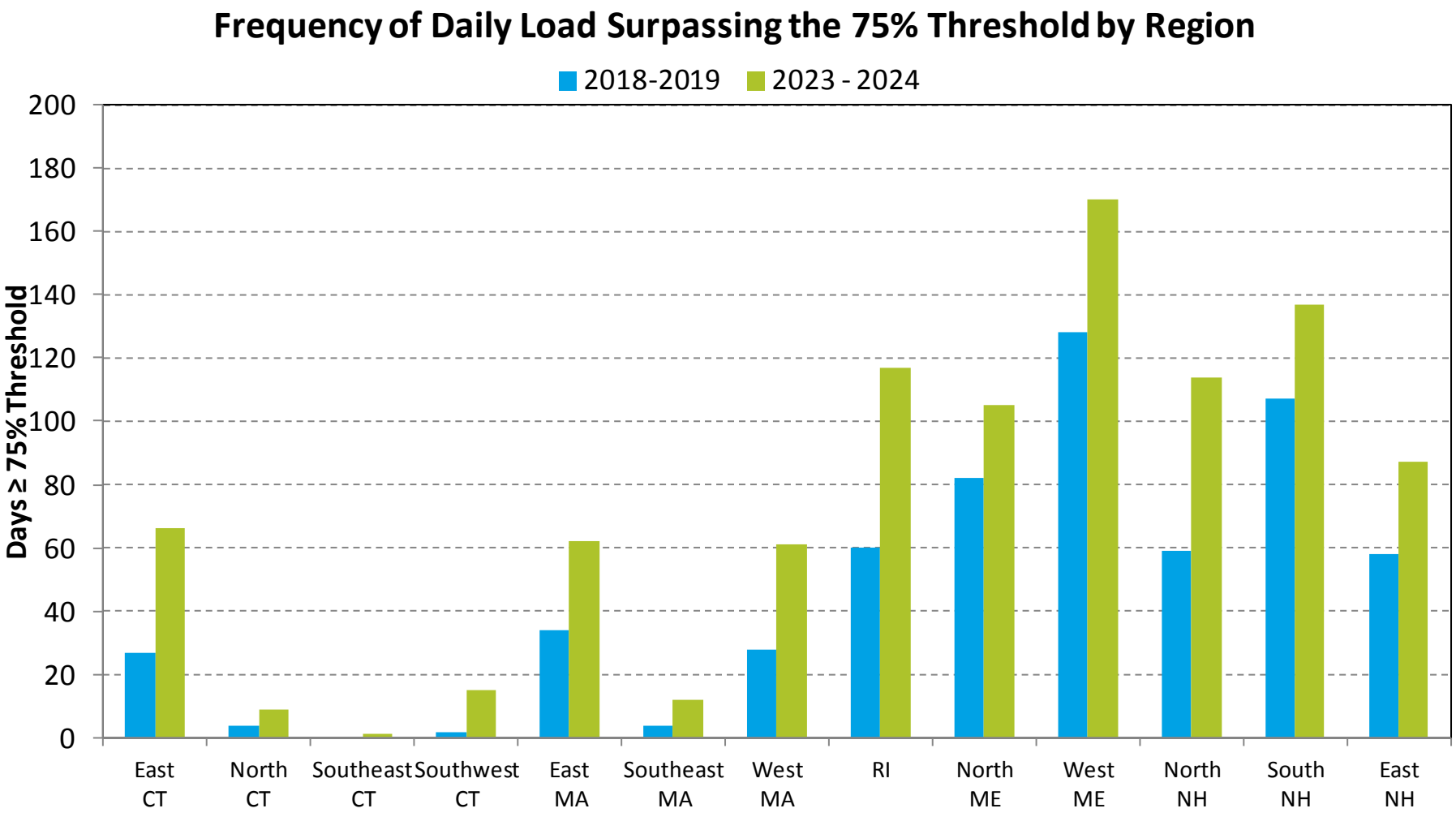
Source: Black & Veatch Analysis, Pipeline Electronic Bulletin Board

Congestion Analysis Results: Without AIM



Source: Black & Veatch Analysis

Congestion Analysis Results: With AIM



Source: Black & Veatch Analysis

Congestion Analysis Results

Existing Capacity

		Connecticut				Massachusetts			Rhode Island	Maine		New Hampshire		
		East	North	Southeast	Southwest	East	Southeast	West	RI	North	West	North	South	East
Total Load as % of New England Total	2018-2019	7.6%	4.3%	0.1%	13.7%	32.5%	6.9%	5.1%	10.8%	4.2%	3.8%	0.2%	2.9%	4.8%
	2023 - 2024	7.7%	4.2%	0.1%	13.7%	31.9%	6.7%	5.0%	11.0%	4.2%	3.7%	0.2%	3.1%	5.3%
Days Exceeding 75% Capacity	2018-2019	133	15	6	2	61	29	28	92	82	128	59	107	58
	2023 - 2024	190	33	17	15	89	52	61	149	105	170	114	137	87

With AIM's Incremental Capacity

		Connecticut				Massachusetts			Rhode Island	Maine		New Hampshire		
		East	North	Southeast	Southwest	East	Southeast	West	RI	North	West	North	South	East
Total Load as % of New England Total	2018-2019	7.6%	4.3%	0.1%	13.7%	32.5%	6.9%	5.1%	10.8%	4.2%	3.8%	0.2%	2.9%	4.8%
	2023 - 2024	7.7%	4.2%	0.1%	13.7%	31.9%	6.7%	5.0%	11.0%	4.2%	3.7%	0.2%	3.1%	5.3%
Days Exceeding 75% Capacity	2018-2019	27	4	0	2	34	4	28	60	82	128	59	107	58
	2023 - 2024	66	9	1	15	62	12	61	117	105	170	114	137	87

Source: Black & Veatch Analysis

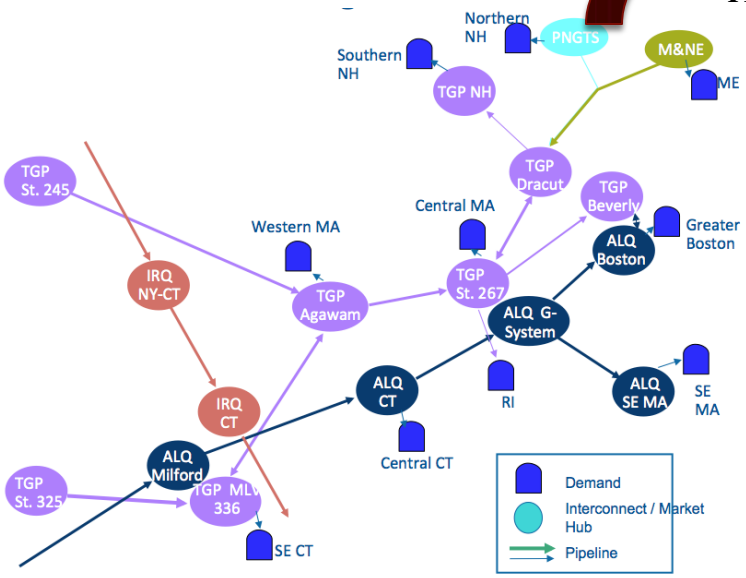
Approach for Phase III

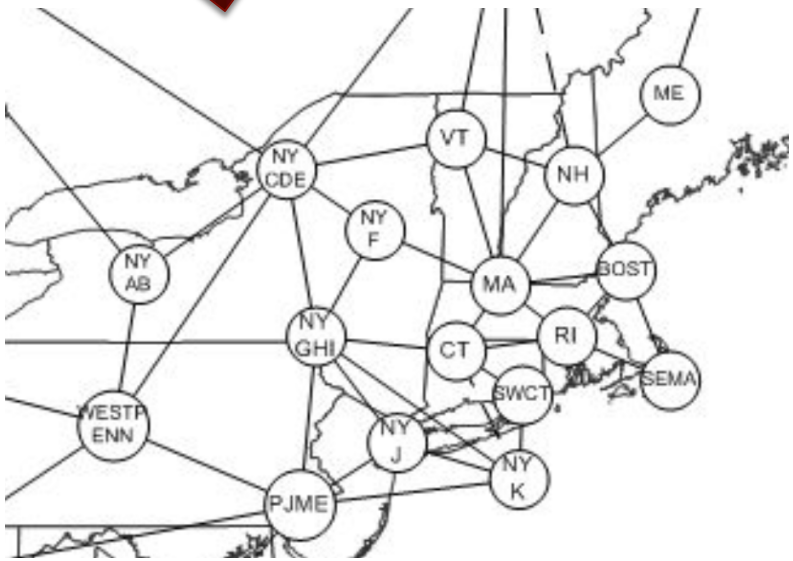
Phase III Methodology

Gas Market - GPCM

Electric Market – PROMOD

Gas Supply and Transportation Prices





Electric Sector Gas Demand

Base Case

- Power Sector Assumptions
  - Load growth and energy efficiency based on CELT
  - Environmental policies trigger oil and coal retirements
  - Federal emissions program in2022
  - Each New England state achieves RPS goals
  - Later period economic capacity additions gas-based
- Natural Gas Assumptions
  - Base Case Residential, Commercial & Industrial demand growth
  - No regulation on hydraulic fracturing
  - No stricter control on usage and treatment for water used in hydraulic fracturing
  - No collapse in natural gas liquids price
  - Easter Canadian supply decline

High Demand Case

- Power Sector Assumptions
  - Increased net load growth, relative to Base Case
  - Some New England states do not attain RPS goals
  - Nuclear retirement earlier than license expiration
  - Otherwise, same as Base Case
- Natural Gas Assumptions
  - High case Residential, Commercial & Industrial demand growth with increased policy initiatives
  - Higher LNG export at Gulf Coast and West Coast, multiple terminals
  - MN&P Pipeline reversal
  - Otherwise, same as Base Case

Low Demand Case

- Power Sector Assumptions
  - Limited demand growth
  - Otherwise, same as Base Case
- Natural Gas Assumptions
  - Limited demand growth
  - Otherwise, same as Base Case

Scenarios and Sensitivities

High Demand	Base Case	Low Demand
• Pipeline • LNG Import • Imported Canadian Electricity • Colder Weather (Design Day)	• Pipeline • LNG Import • Imported Canadian Electricity • Dual Fuel and Demand Response	• LNG Peak Shaving • Imported Canadian Electricity • Dual Fuel and Demand Response • Negative Growth

Study Limitations

- The study is designed to provided policymakers with economic analysis
  - It is not a plan
  - It will not simulate gas pressures or power flows – not a hydraulic model
- The study relies on simplistic representations of the natural gas pipeline network & of the electric transmission system
  - Computer models use city gates (gas) & load zones (electric) to develop prices
    - Forecasts of gas market prices are on a monthly basis.
    - Forecasts of electricity prices are on an hourly basis.
- Input assumptions & cost estimates are not facts
  - Fuel prices, whether & when generators may retire or expand, implications of environmental requirements & the extent to which states achieve policy objectives are subjective
  - Assumptions in this study are based on NESCOE's best judgment and Black & Veatch's industry knowledge & project experience

Next Steps

- Late April - May
  - Model Base Case and Associated Sensitivities
  - Refine Potential Solution Cost Estimates
- June
  - Model High Demand Case and Sensitivities
- July
  - Model Low Demand Case and Sensitivities
  - Synthesize Cost and Benefit Analyses
  - Analyze Policy Implications
- August-September 2013
  - Phase III Final Report issued

Questions?

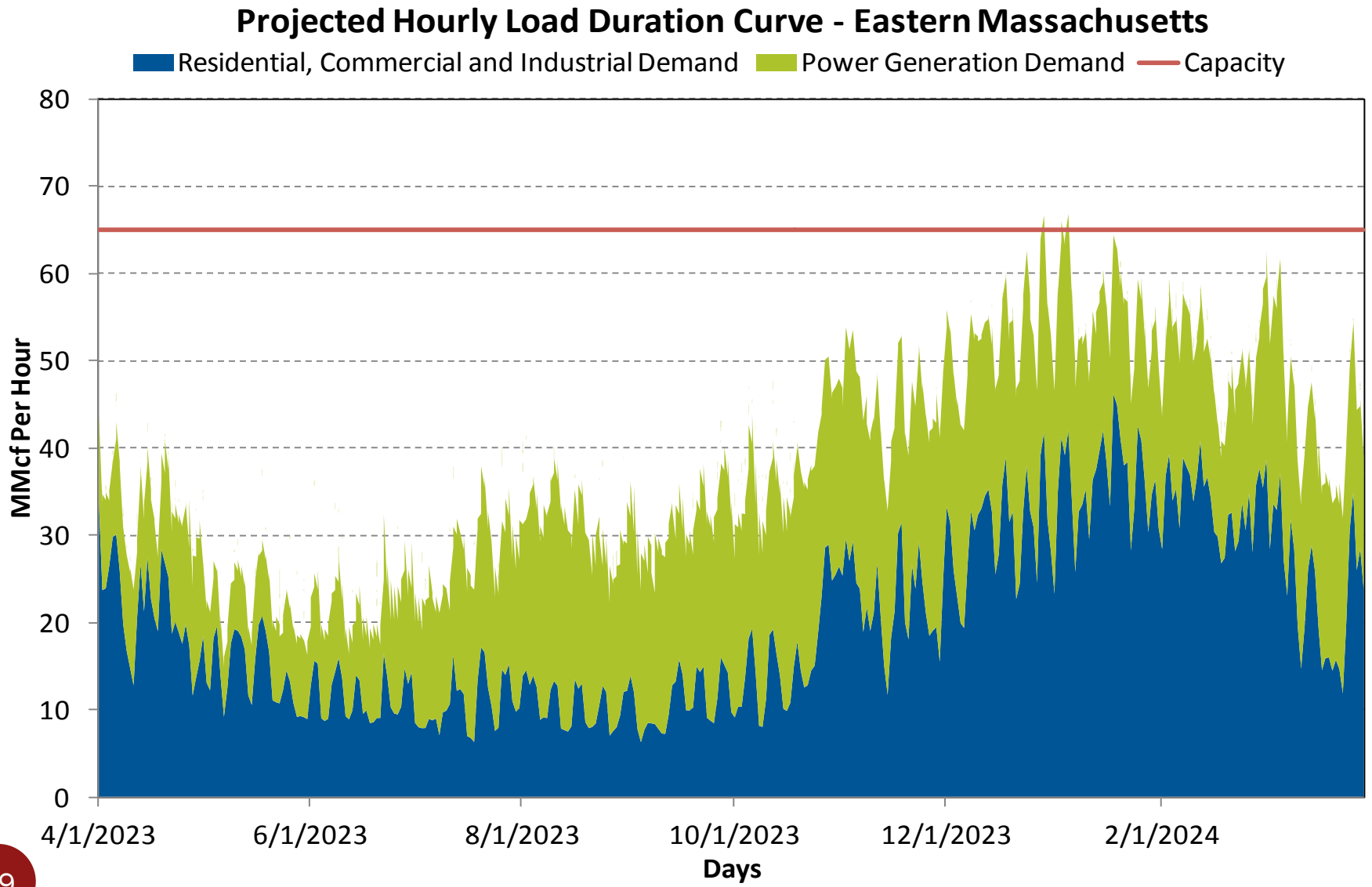
For additional information:

www.nescoe.com/Gas_Supply_Study.html

BenDAntonio@nescoe.com

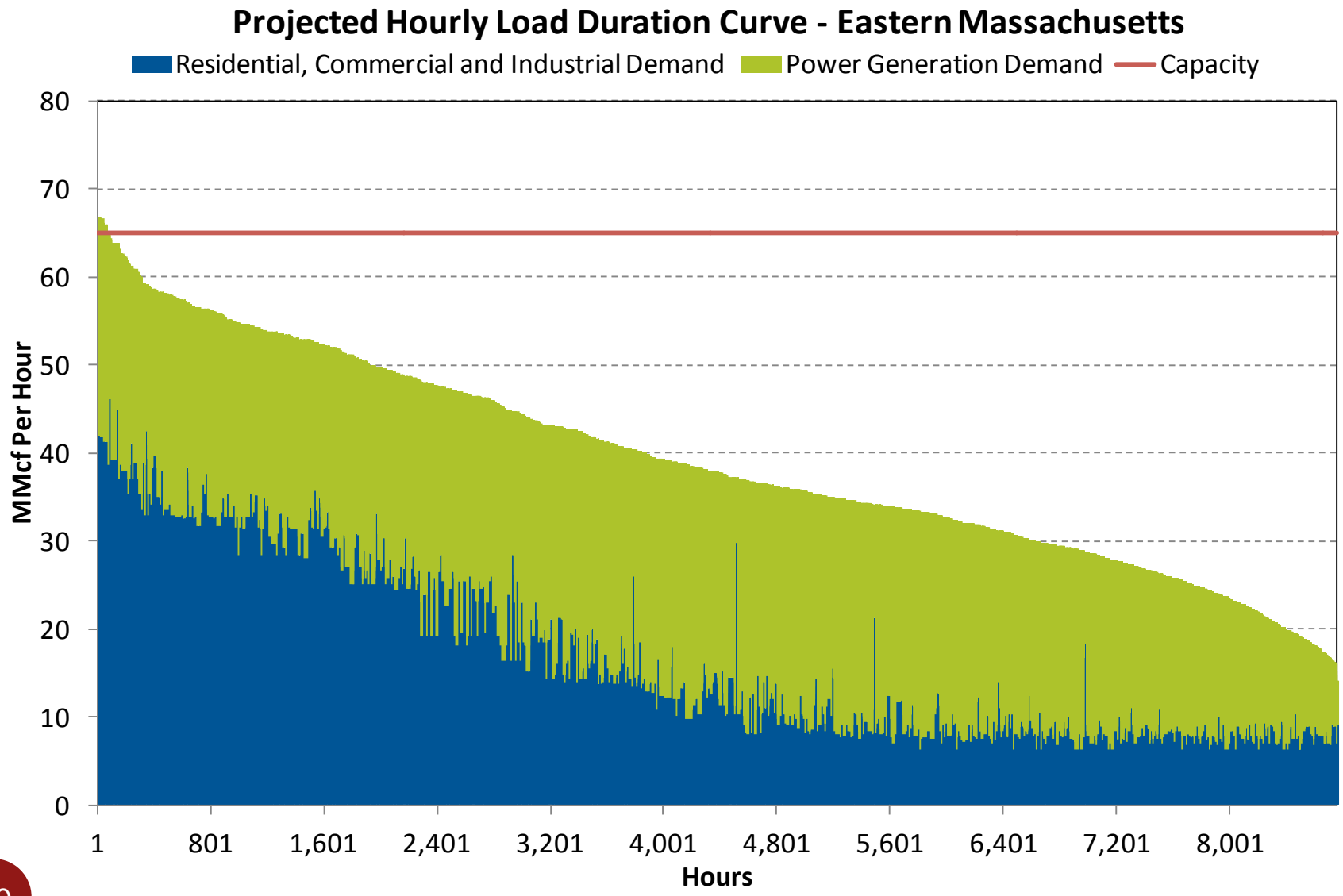
gaselectric.nescoe.com

Hourly Congestion Analysis



Source: Black & Veatch Analysis, Pipeline Electronic Bulletin Board

Hourly Congestion Analysis



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