New England Gas Electric Focus Group

Gas-Electric Study: Phase II Results and Approach for Phase III

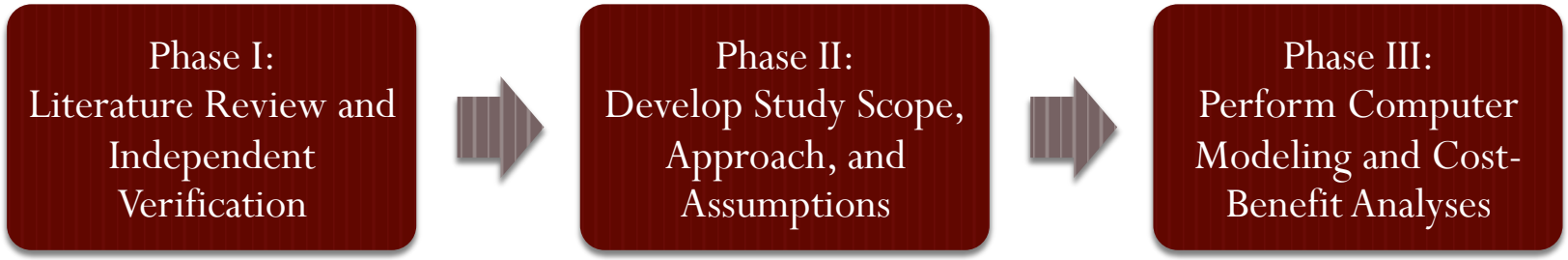
New England States Committee on Electricity

April 19, 2013

Overview

- 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

Context



- 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 responses
  - 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

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

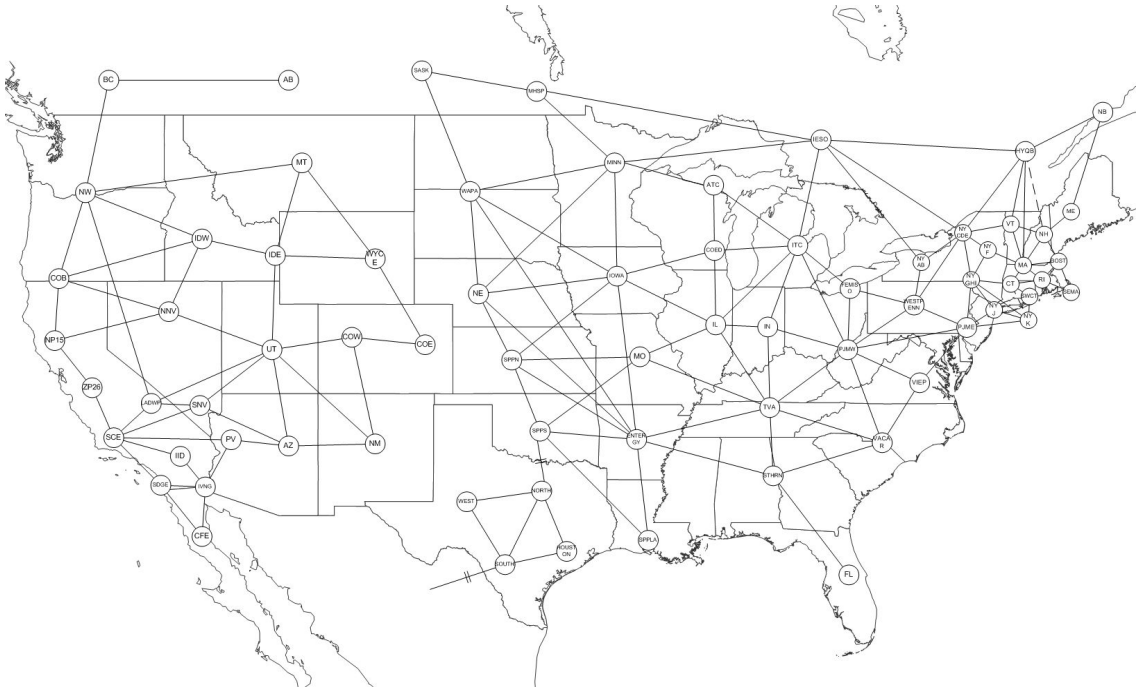
Compound Annual Growth Rate 2013-2028	Connecticut			Massachusetts			New Hampshire		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial
Average Customer Usage	-0.76%	-1.02%	2.80%	0.10%	-0.15%	-3.22%	0.32%	4.56%	13.28%
No. of Customers	2.99%	3.16%	-3.10%	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

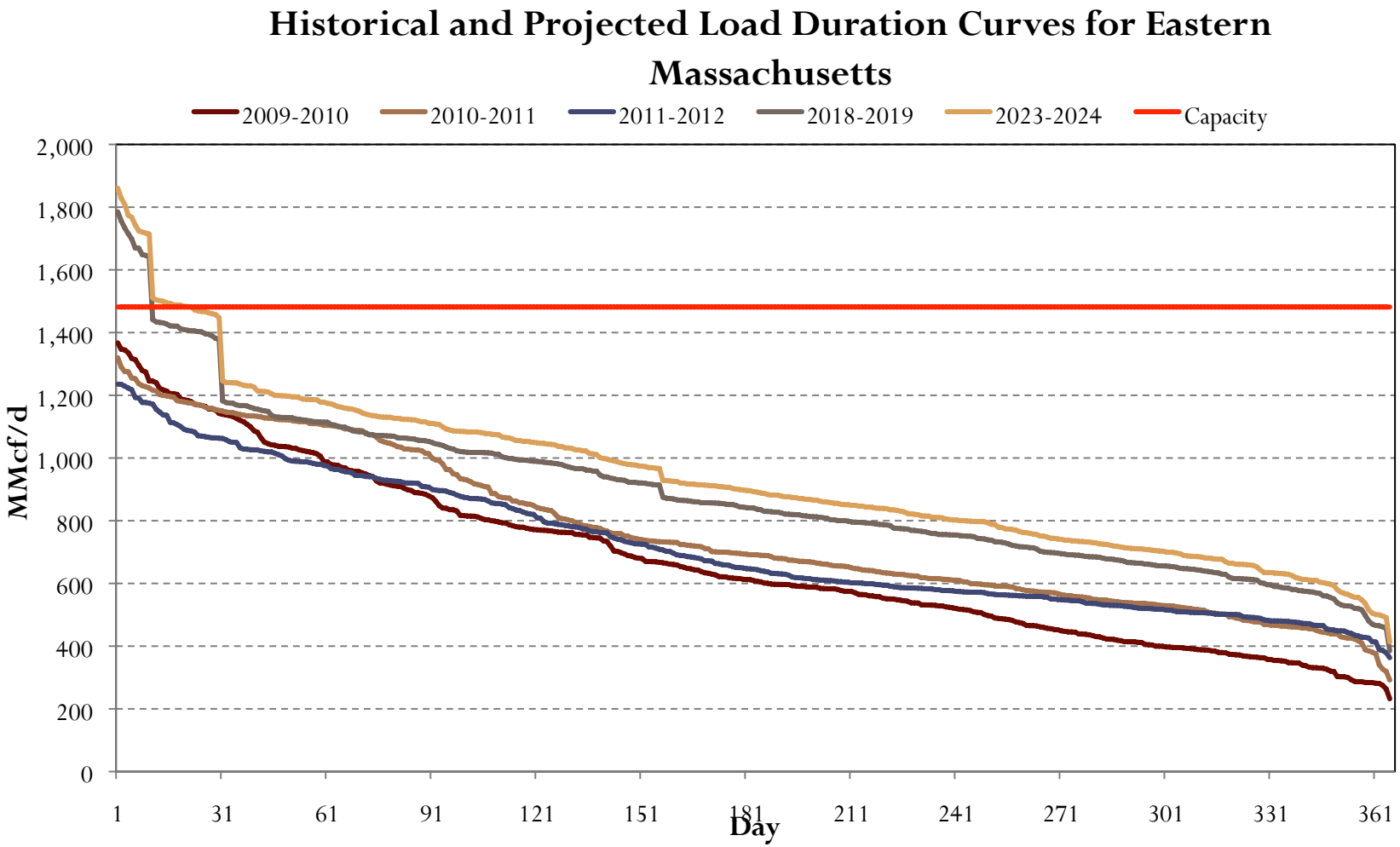
- Load Forecast
- Fuel Prices
- Environmental Compliance
- Greenhouse Gas Programs
- Renewable Portfolio Standards
- Retirements & Additions
- Incremental Transmission



Source: Black & Veatch Analysis

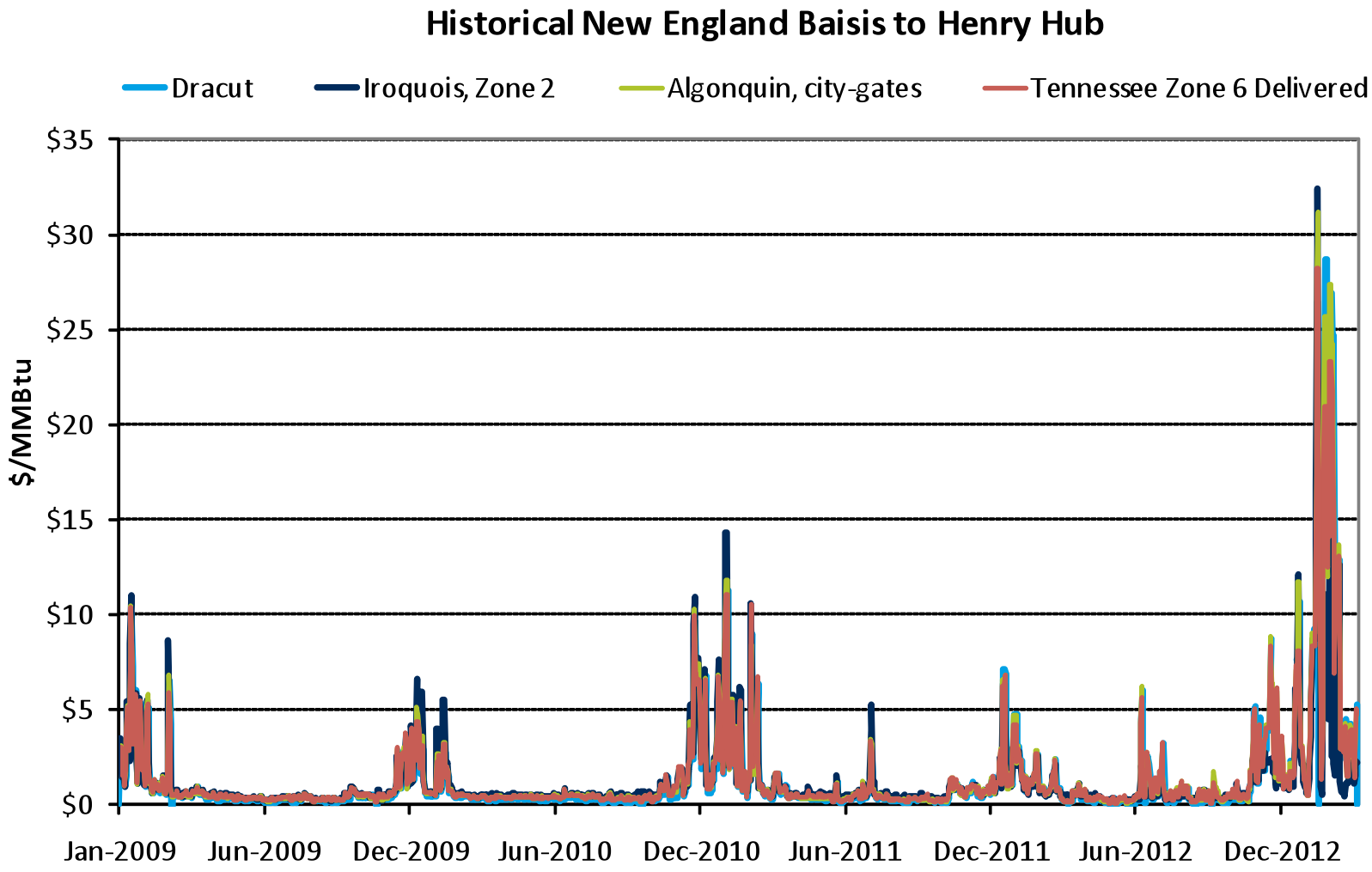
Analyze Congestion

Forecasted Demand vs. Capacity Limit



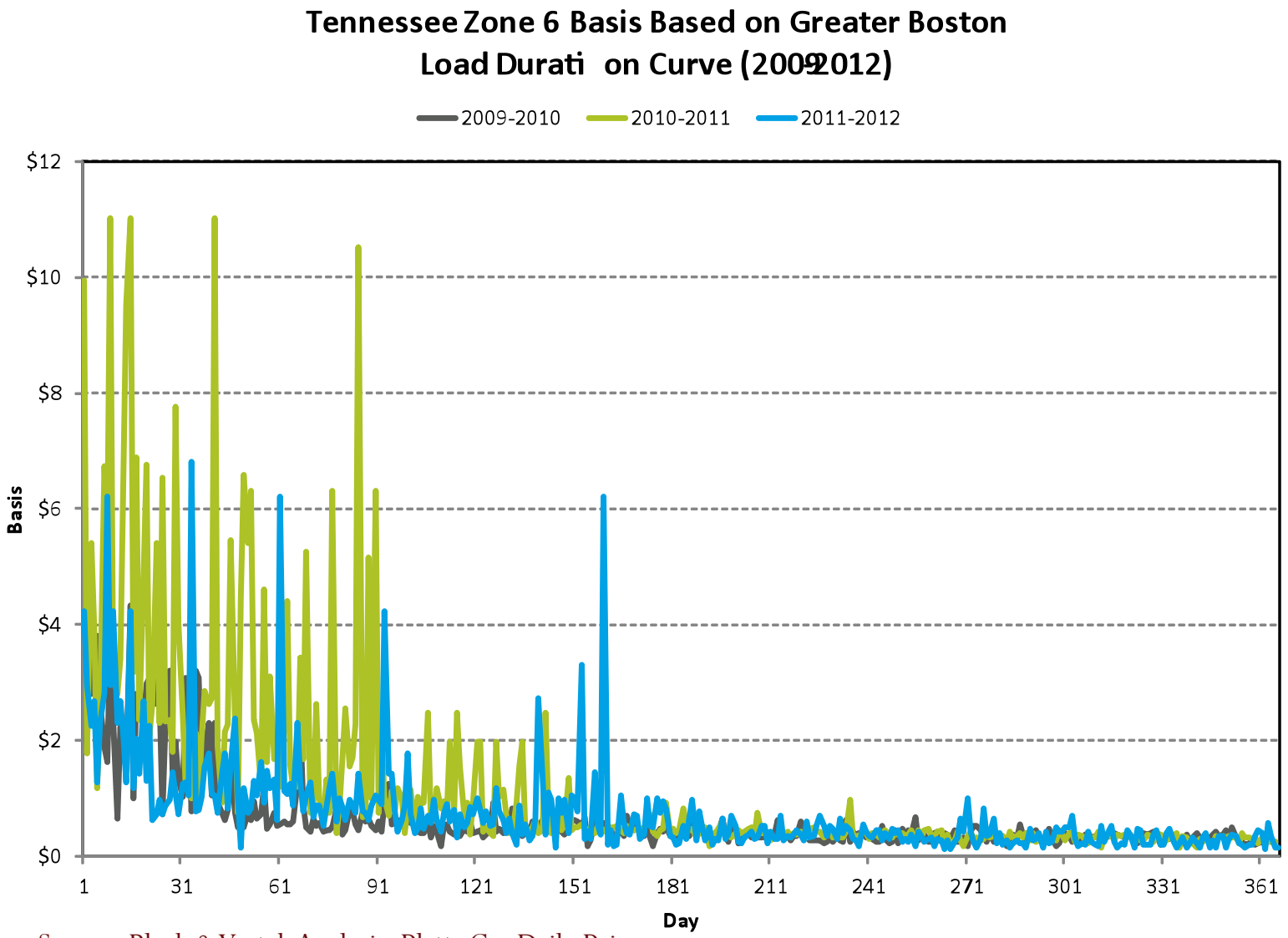
Source: Black & Veatch Analysis

Increasing Basis Volatility



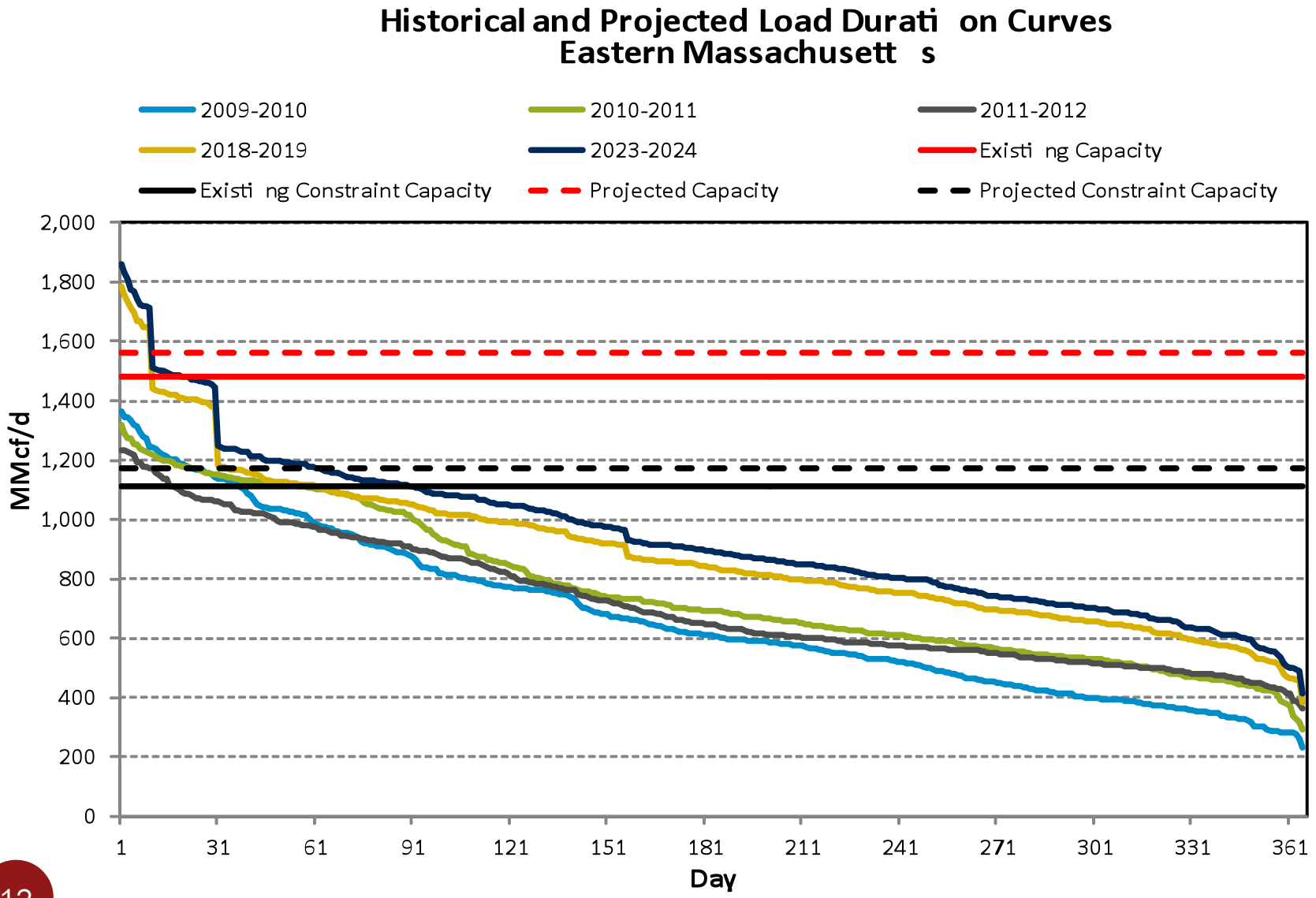
Source: Black & Veatch Analysis, Platts Gas Daily Prices

Basis Volatility Analysis



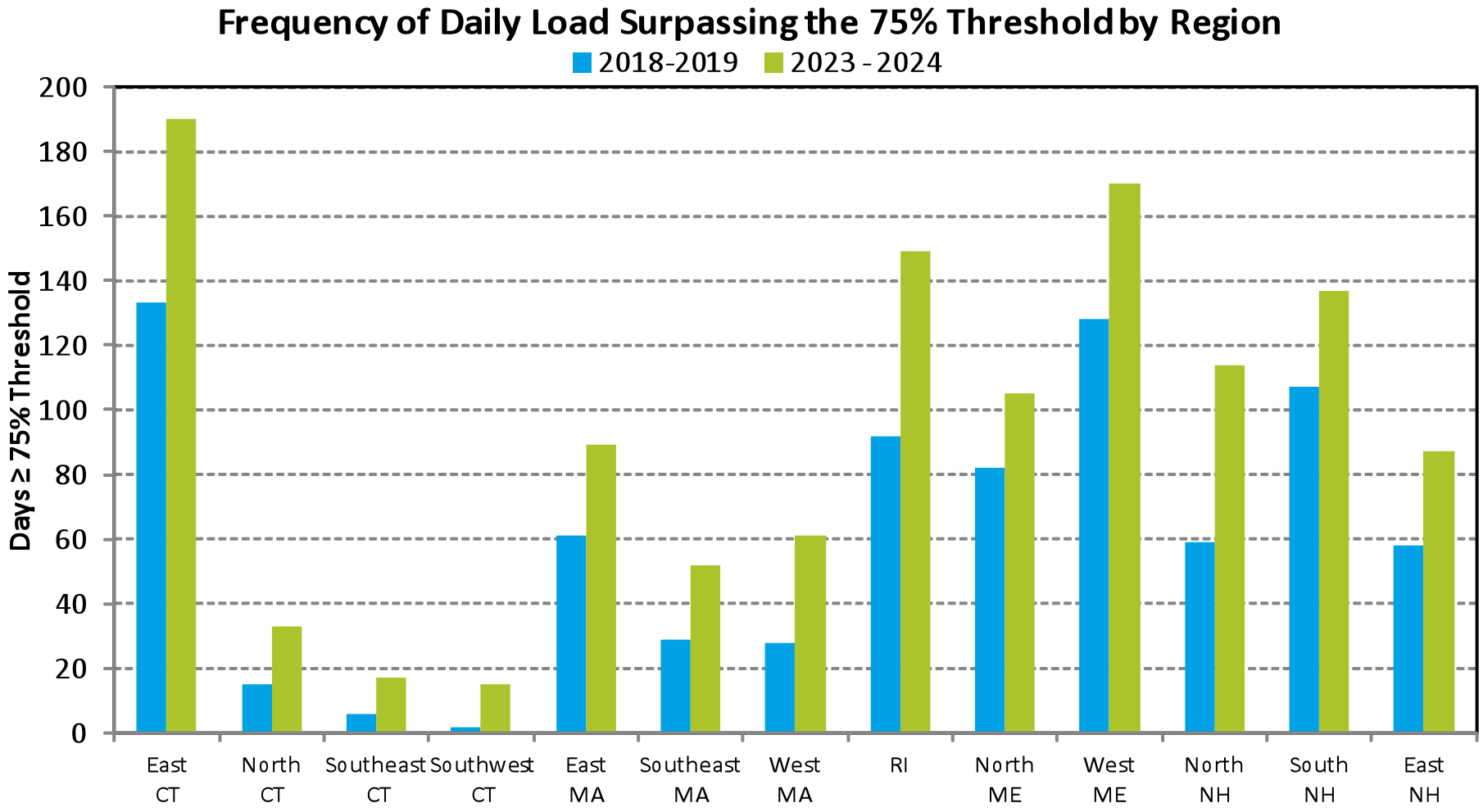
Source: Black & Veatch Analysis, Platts Gas Daily Prices

Synthesis: Basis Volatility & Capacity Limits



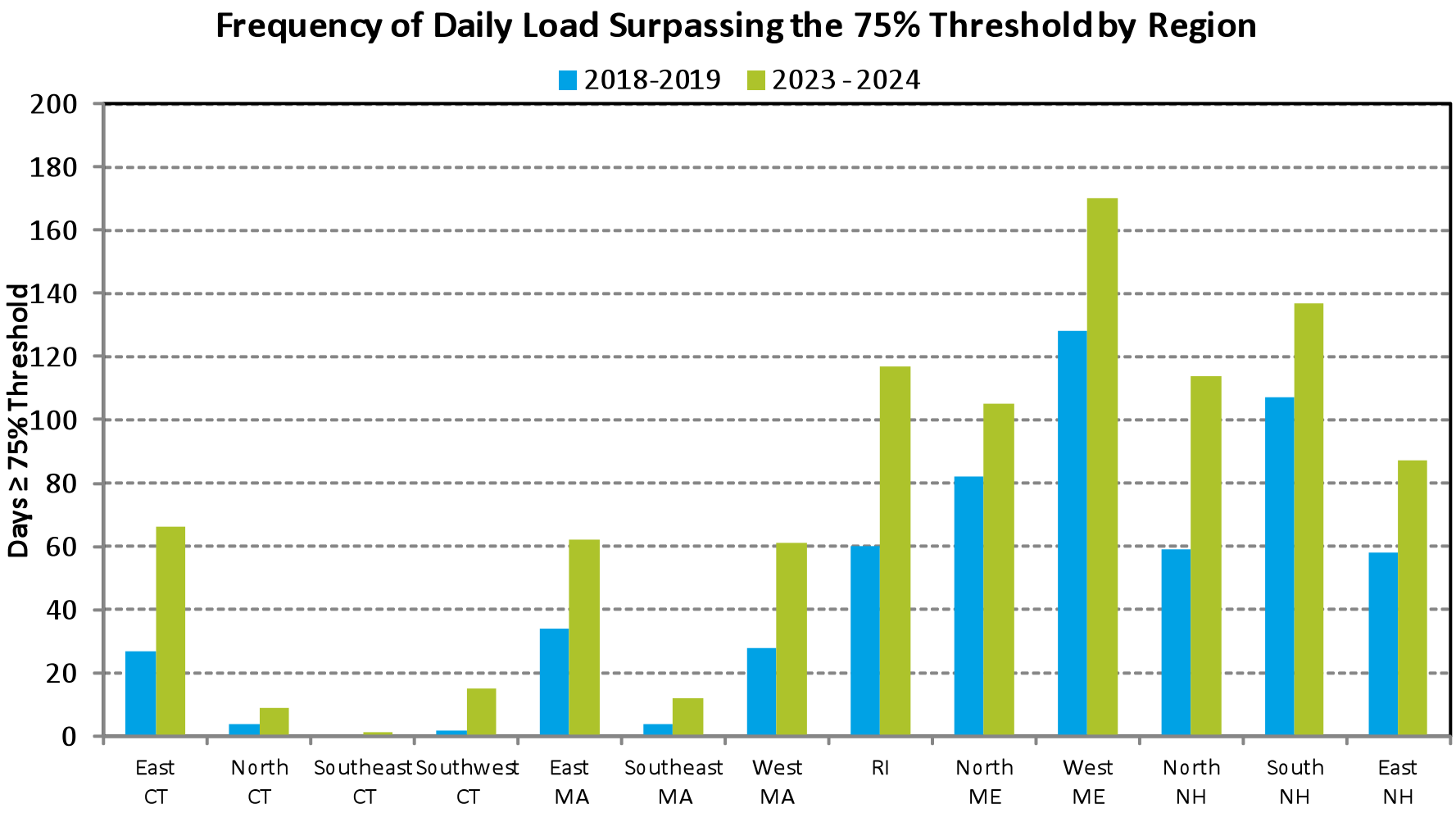
Source: Black & Veatch Analysis, Pipeline Electronic Bulletin Board

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

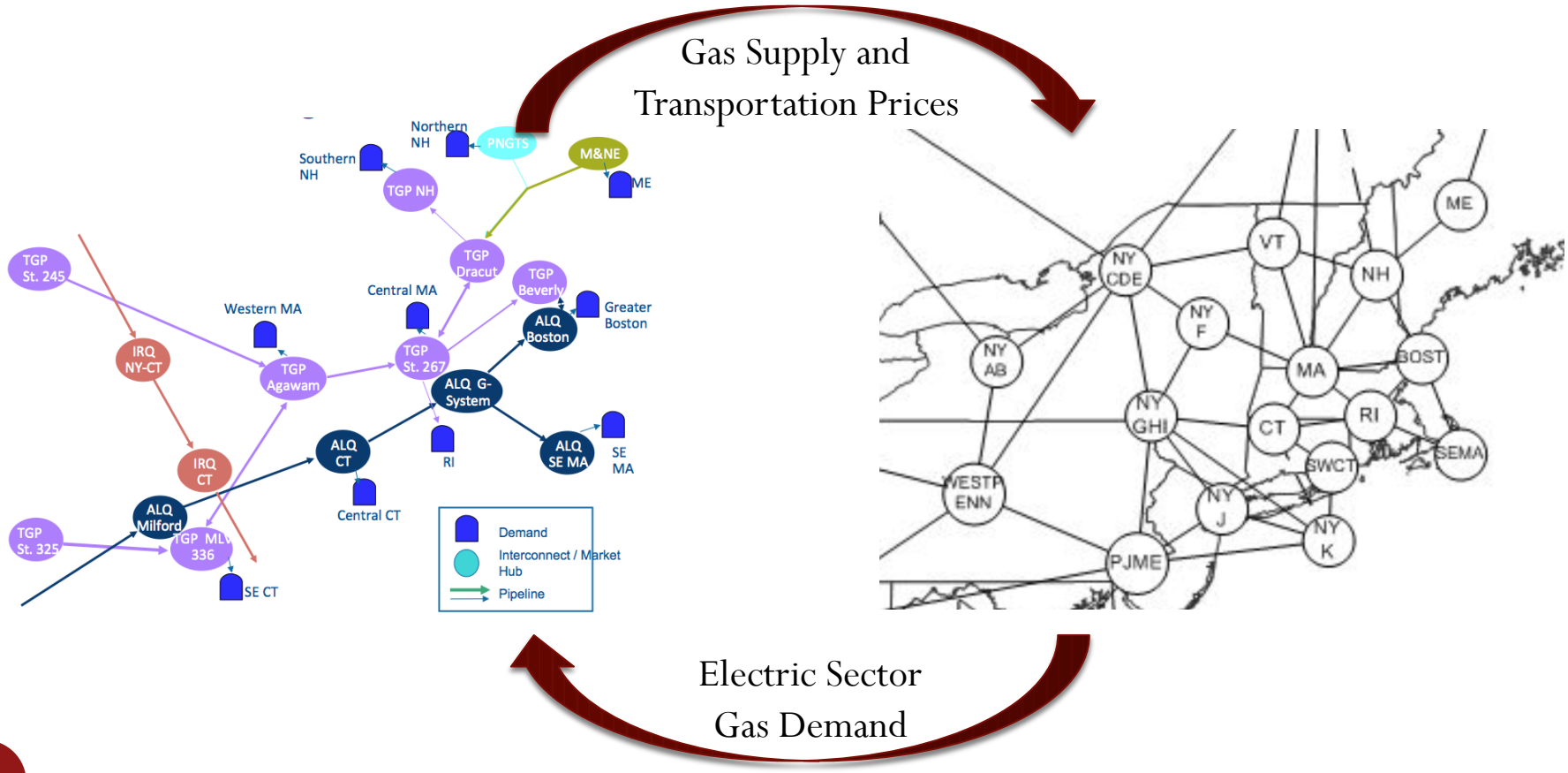
Source: Black & Veatch Analysis

Approach for Phase III

Phase III Methodology

Gas Market - GPCM

Electric Market – PROMOD



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 simple 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 & 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

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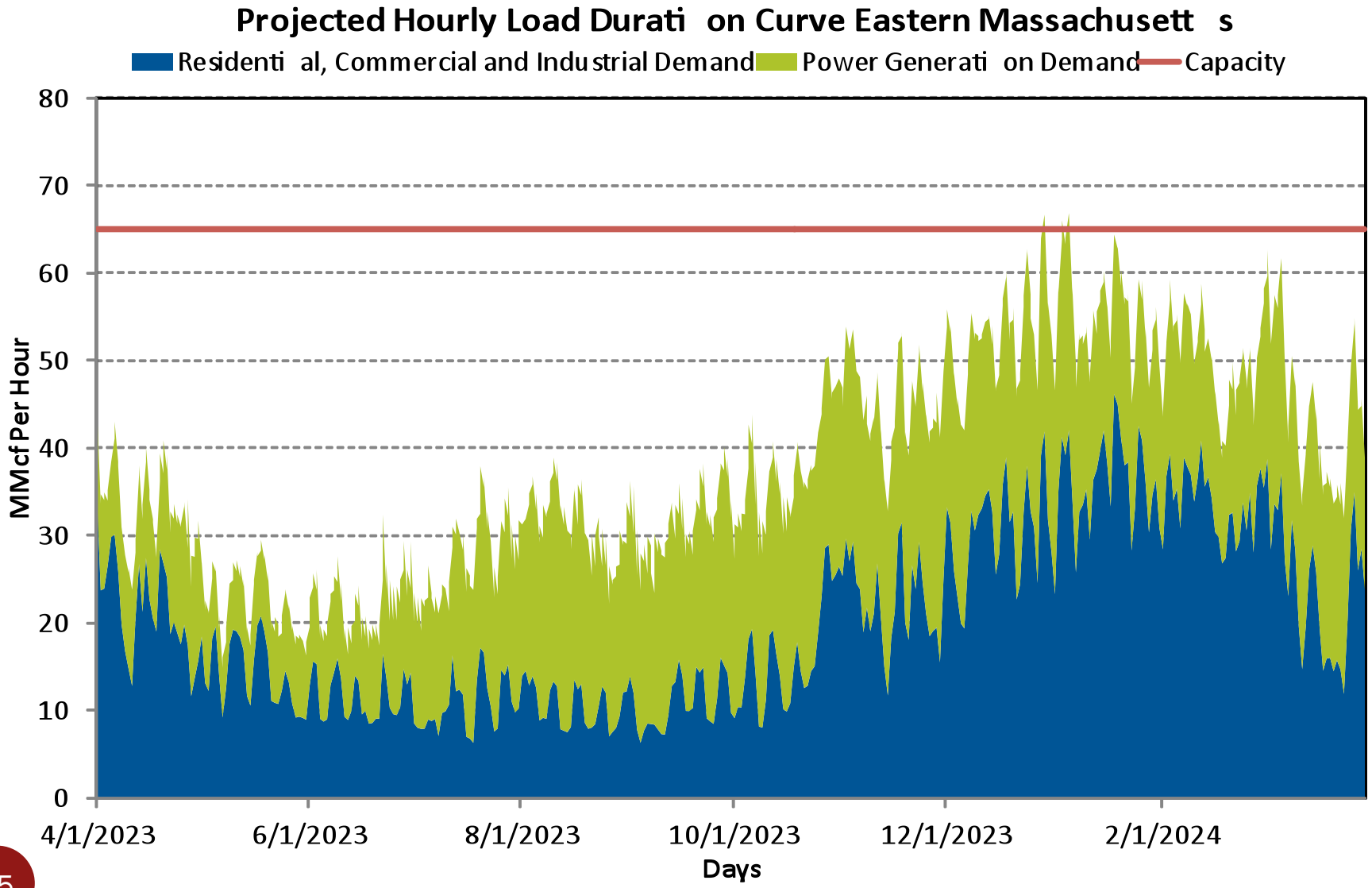
Hourly Congestion Analysis



Source: Black & Veatch Analysis, Pipeline Electronic Bulletin Board

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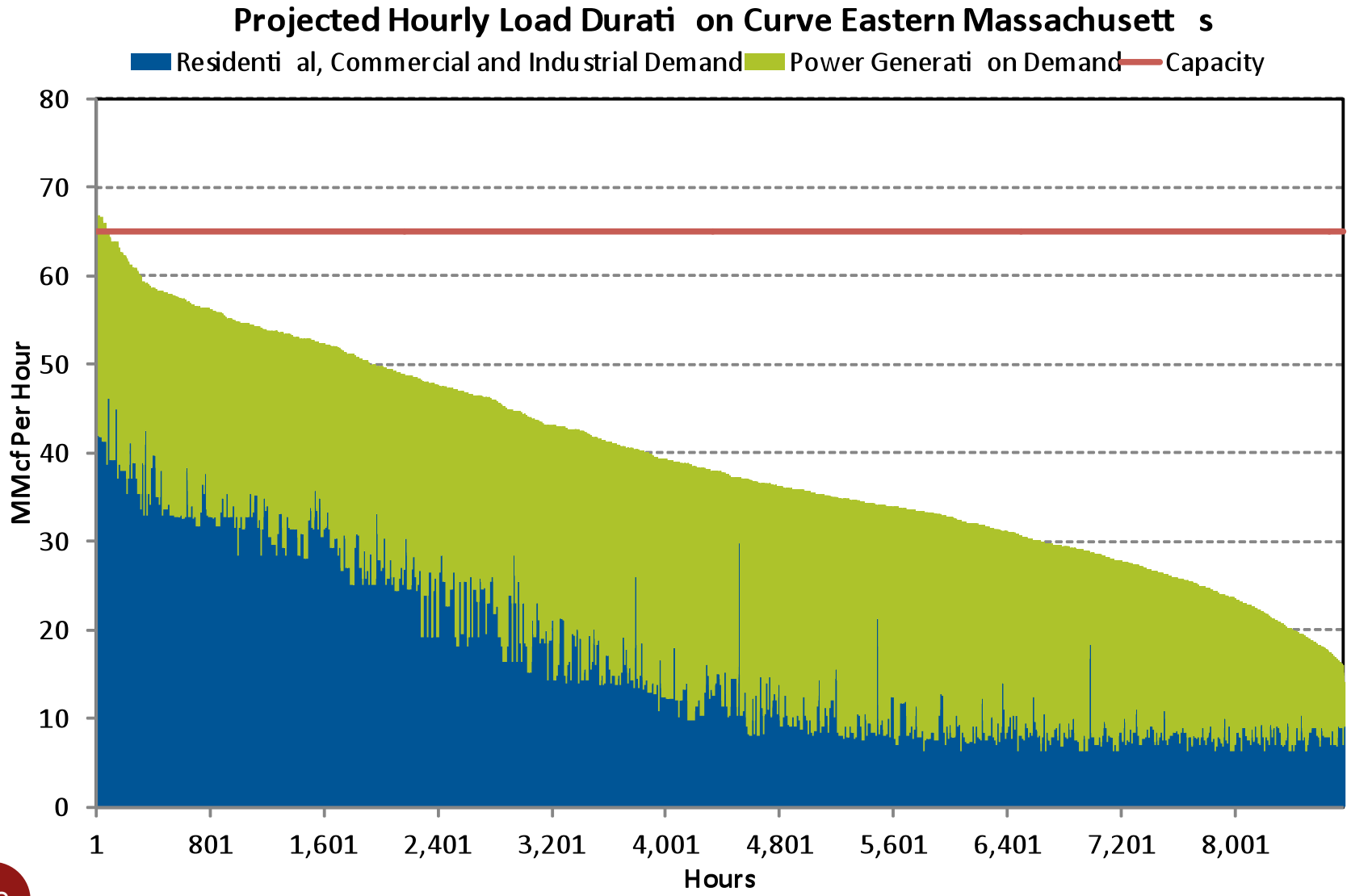

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