Fuel Assurance & Pipeline Adequacy Study
Presentation of Results

Electric-Gas Coordination Working Group

New York Independent System Operator

October 23, 2013

R.L. Levitan, P.L. Curlett, S.Wilmer

LEVITAN & ASSOCIATES, INC.
MARKET DESIGN, ECONOMICS AND POWER SYSTEMS

Task 1
Fuel Assurance Study

Study Objectives

- Identify dual-fuel capacity in NYCA
- Assess the cost of providing fuel assurance through dual-fuel capability and oil supply provisions
- Derive the incremental cost for primary FT entitlement(s) along discrete pathways to four zones
- Perform an economic comparison of dual-fuel capability v. pipeline transportation under a range of scenarios

Existing Dual Fuel Capacity – Zones F through K

LEVITAN & ASSOCIATES, INC.

Cost of Dual Fuel Capability

- Incremental costs for a 600 MW CC and a 200 MW SC were developed
- Capital cost categories include:
  - Power Island scope – manifold and burners, atomizing air, water injection, purge system, fuel conditioning skid, related instrumentation and controls
  - Fuel receiving and storage facilities – receiving bays (truck or barge), transfer pumps, storage tanks with containment walls, etc.
  - Balance of plant, i.e., demineralized water, receiving and storage systems

Cost of Dual Fuel Capability (Cont'd)

- Operating costs include:
  - Fixed operating costs, i.e., fuel and water quality staff, property taxes, and insurance
  - Variable operating costs, i.e., higher gas turbine overhaul accrual rates, water costs for injection water (CC only)
  - Costs of ULSD supply, delivery and storage
    - High cost of fuel
    - Potential reservation charges for delivery capacity
    - Volumetric delivery charges
    - Inventory carrying cost

Cost of Dual Fuel Capability – Combined Cycle

(2013$)

Zone	Capital District	LHV	NYC	Long Island
Capital Costs ($ million)				
Power Island	$ 5.1	$ 5.1	$ 5.1	$ 5.1
Field Erected Tanks	$ 2.8	$ 2.8	$ 2.8	$ 2.8
Balance of Plant	$ 9.8	$11.0	$14.4	$13.7
Subtotal	$17.7	$18.9	$22.3	$21.6
Financing Costs	$ 1.3	$ 1.4	$ 1.7	$ 1.6
Total Incremental Cost	$19.0	$20.3	$24.0	$23.3
Incremental Unit Cost	*$29/kW*	*$31/kW*	*$37/kW*	*$36/kW*
Fixed O&M Cost ($ 1,000 / year)	$ 563	$ 593	$1,508	$ 691
Incremental Unit Cost	*$0.86/kW-yr*	*$0.90/kW-yr*	*$2.30/kW-yr*	*$1.05/kW-yr*

Cost of Dual Fuel Capability – Simple Cycle

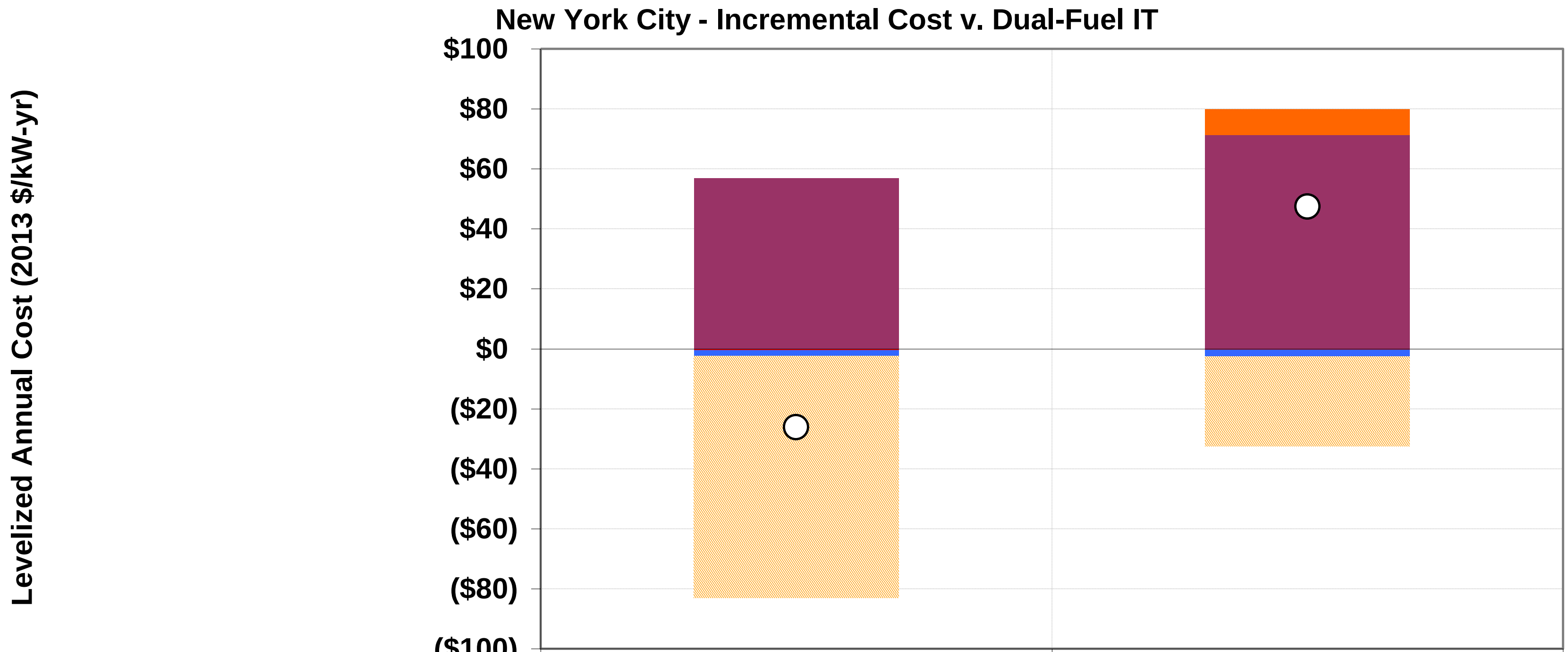
(2013$)

Zone	Capital District	LHV	NYC	Long Island
Capital Costs ($ million)				
Power Island	$ 3.1	$ 3.1	$ 3.1	$ 3.1
Field Erected Tanks	$ 1.1	$ 1.1	$ 1.1	$ 1.1
Balance of Plant	$ 3.2	$ 3.6	$ 4.5	$ 4.4
Subtotal	$ 7.4	$ 7.8	$ 8.7	$ 8.6
Financing Costs	$ 0.5	$ 0.5	$ 0.6	$ 0.6
Total Incremental Cost	$ 7.9	$ 8.3	$ 9.3	$ 9.2
Incremental Unit Cost	*$44/kW*	*$45/kW*	*$52/kW*	*$50/kW*
Fixed O&M Cost ($1000 / year)	$ 250	$ 259	$ 665	$ 295
Incremental Unit Cost	*$1.38/kW-yr*	*$1.41/kW-yr*	*$3.68/kW-yr*	*$1.61/kW-yr*

Unitized Cost of Firm Transportation Entitlements

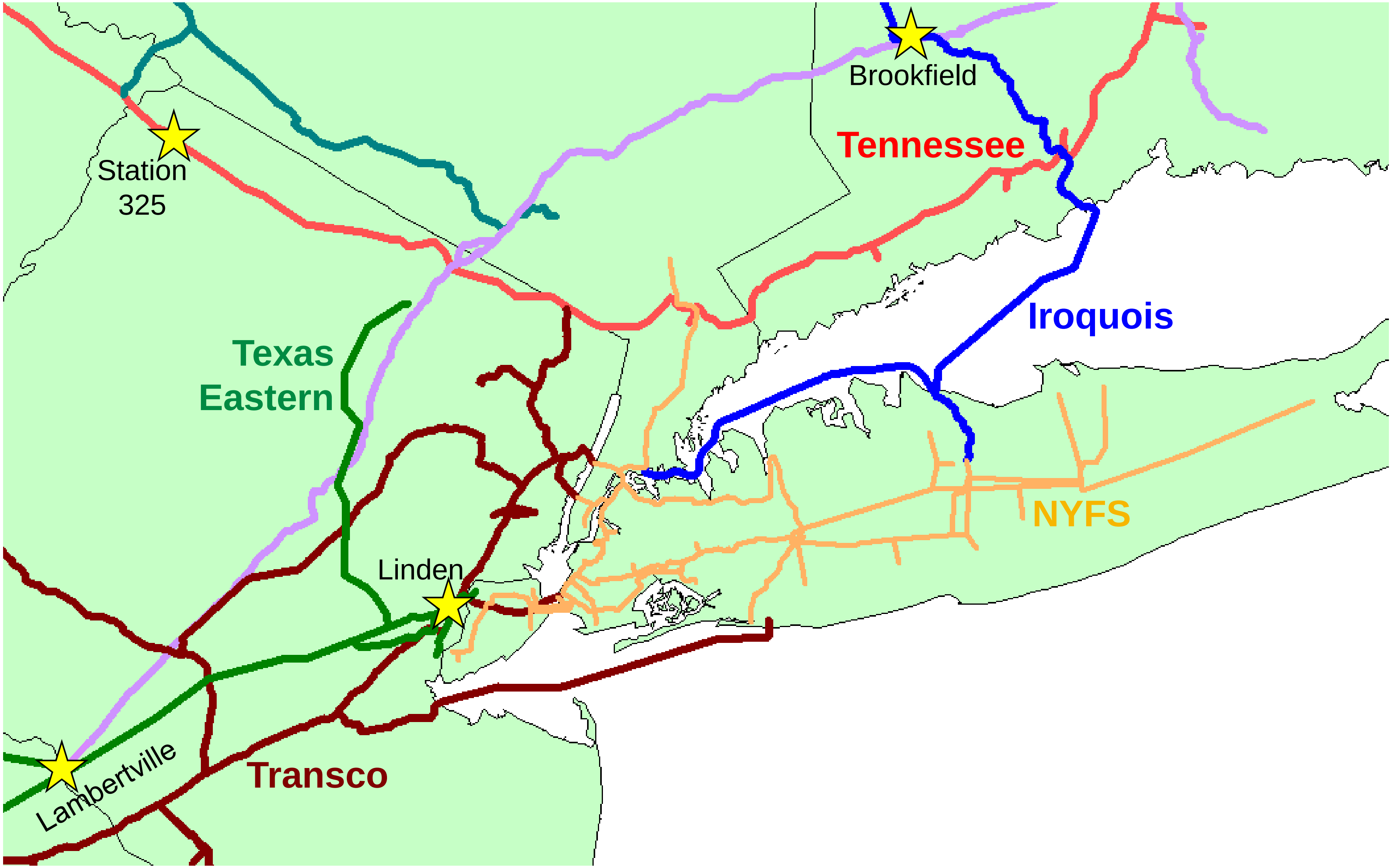
Zone	Selected Path	100% Load Factor Rate ($/Dth)	Combined Cycle		Simple Cycle	
			Annual Fixed Charges ($MM/yr)	Unitized Variable Charge ($/MWh)	Annual Fixed Charges ($MM/yr)	Unitized Variable Charge ($/MWh)
F	Dominion (from South Point)	$0.6159	$23.8	$0.16	$9.7	$0.22
G-H-I	Millennium → Algonquin	$1.0920	$43.6	$0.04	$17.8	$0.05
J	Tennessee → Texas Eastern (→ NYFS)	$1.1255	$45.0	$0.03	$18.4	$0.03
K	Millennium → Algonquin → Iroquois (→ NYFS)	$1.6325	$65.2	$0.05	$26.7	$0.07

Incremental Cost of Firm Transportation *to* NYC

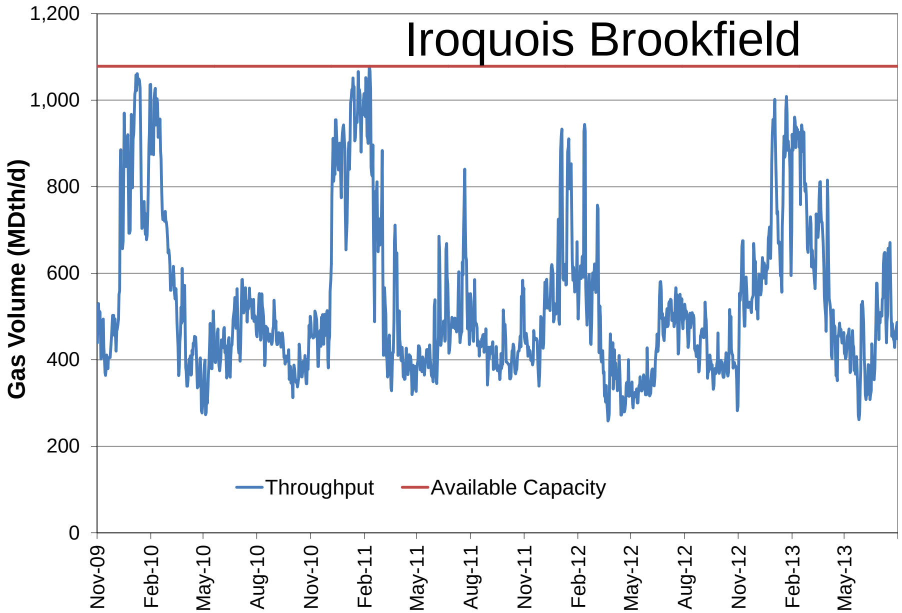


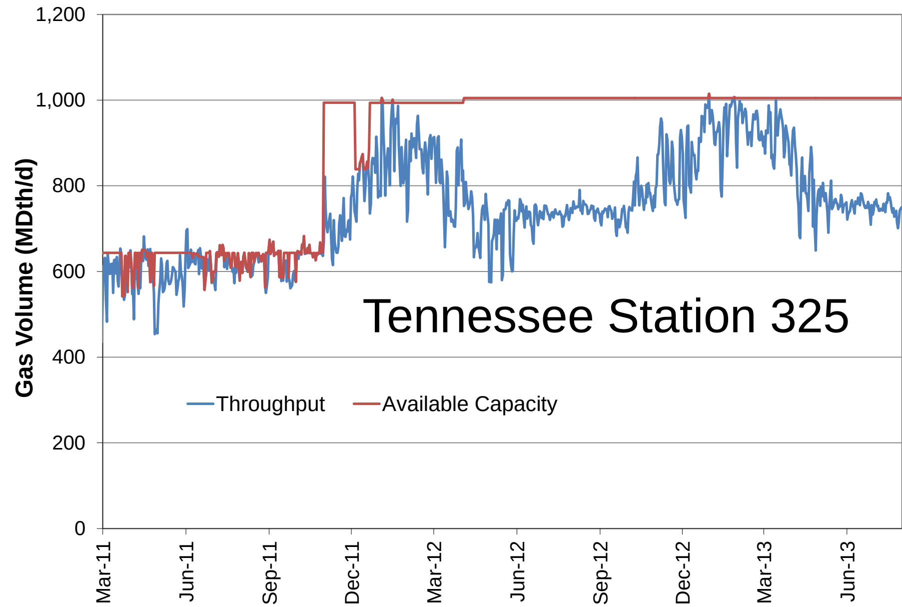
	Dual-Fuel FT Combined Cycle	Dual-Fuel FT Simple Cycle
Net Energy Margin	($80.71)	($29.86)
ULSD Delivery Capacity Reservation	$0.00	$0.00
Incremental Fixed O&M	($0.11)	($0.09)
NYFS MBO Charges	$0.00	$8.60
Pipeline Reservation Charges	$56.94	$71.29
Inventory Carrying Cost	($1.82)	($2.18)
Recovery of Incremental Capital	($0.44)	($0.34)
○ Total Levelized Cost	($26.13)	$47.42

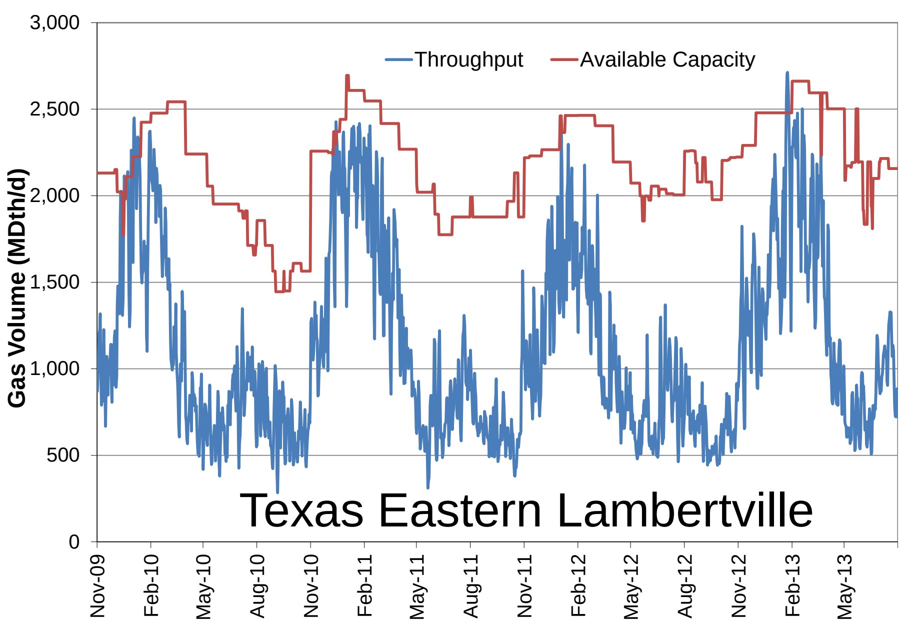
Pipelines Serving NYC and Long Island

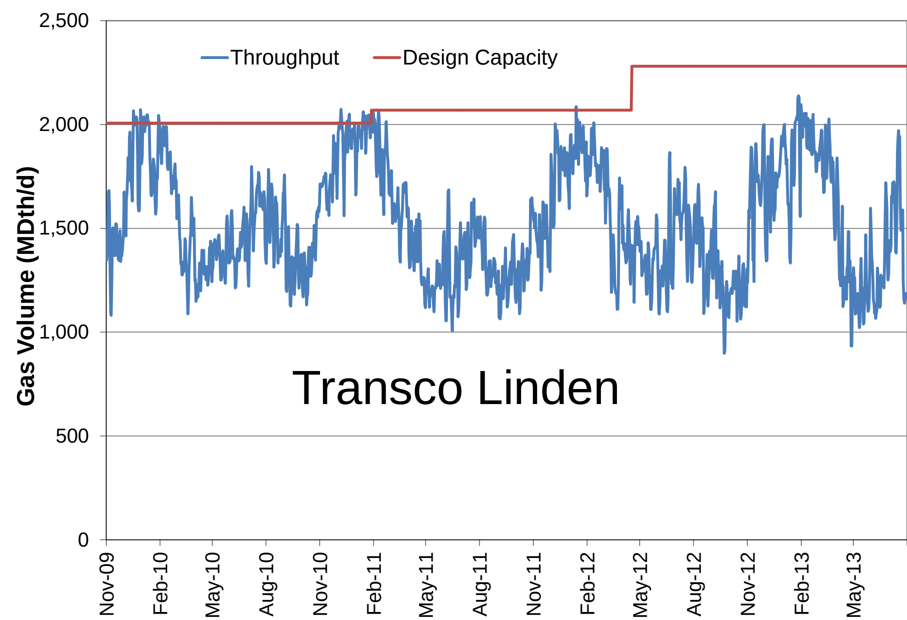


Pipeline Utilization Levels Serving NYC and Long Island

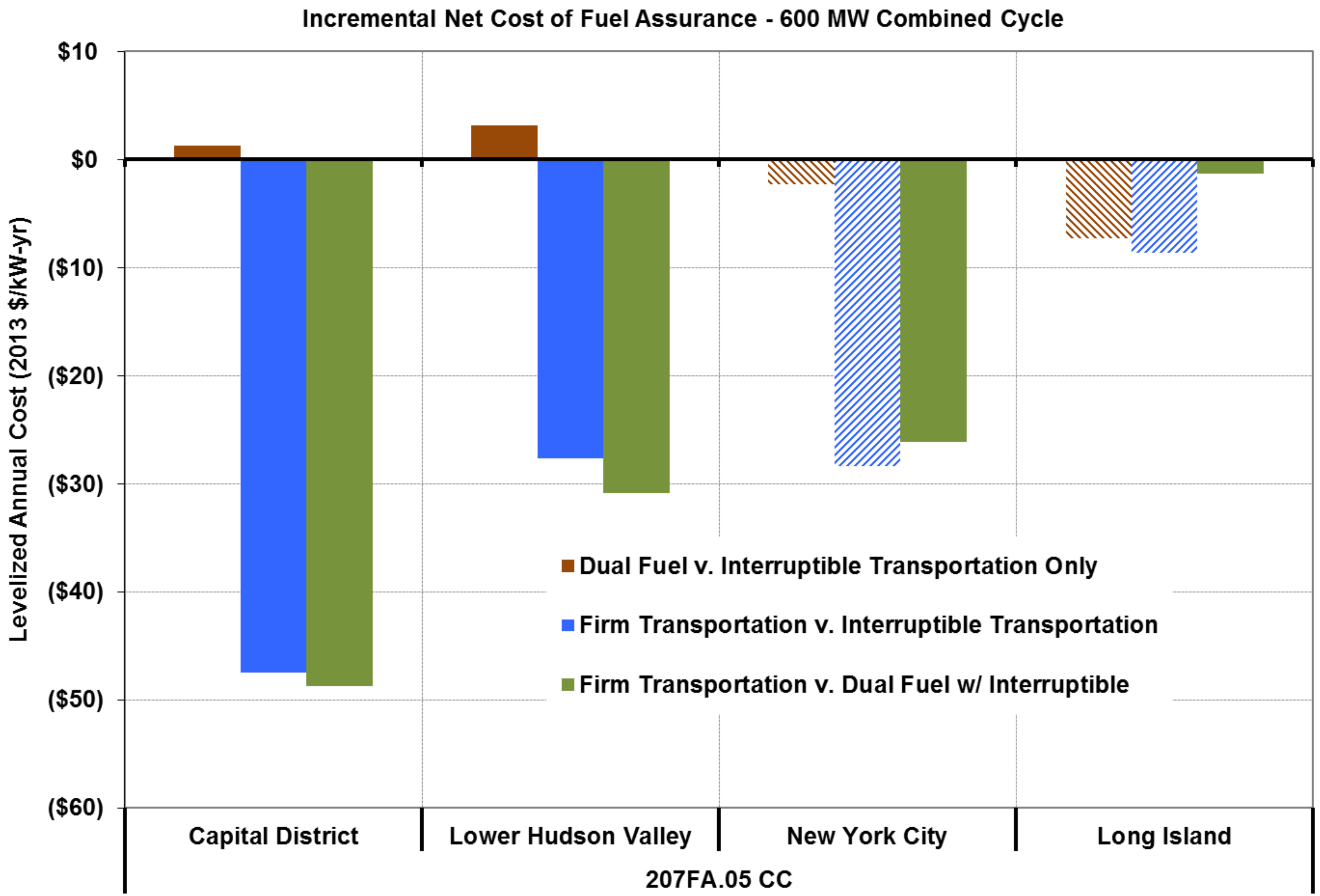




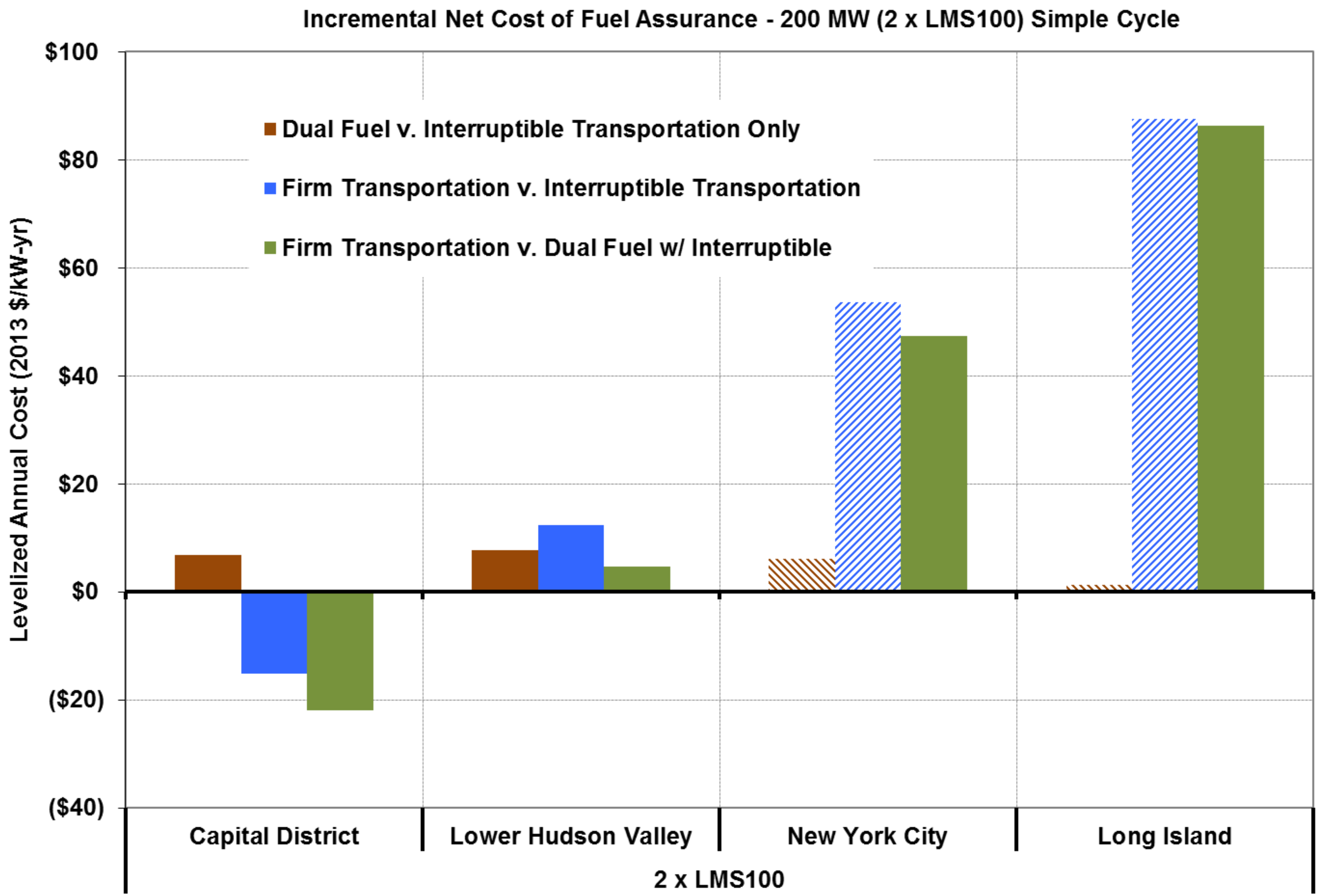




Financial Results – 600 MW CC



Financial Results – 200 MW SC



Fuel Assurance Conclusions

- Total incremental cost to add dual-fuel capability
  - CC: ~$19 million in Capital District / LHV, ~$24 million in NYC / Long Island
  - Peaker: ~$8 million in Capital District / LHV, ~$9 million in NYC / Long Island
- For new CC plants:
  - FT strategy is economic in relation to non-firm gas + ULSD in Capital District and LHV
  - FT upstream of the NYFS is economic for NYC, neutral for Long Island
- For new peakers:
  - FT strategy is economic in relation to non-firm transportation + ULSD for Capital District, uneconomic in LHV
  - FT to NYC / Long Island is uneconomic

Fuel Assurance Conclusions (cont'd)

- Most gas-fired generators across NYCA rely on short-term capacity releases and/or IT
- Generator reliance on non-firm transportation coupled with oil back-up promotes, but does not guarantee, fuel adequacy during critical conditions
- Major new P/L resources sure to improve "quality" of non-firm transportation in the Capital District & NYC
- Known and potential retirements in LHV heighten concerns re infrastructure adequacy for new CCs
- Timing of new P/L receipt point capability on Long Island into the NYFS remains uncertain
- Energy / capacity price signals and penalty structure for non-performance appear insufficient to induce generators to hold maximum oil inventory

Task 2
Pipeline Congestion and Infrastructure Adequacy Assessment

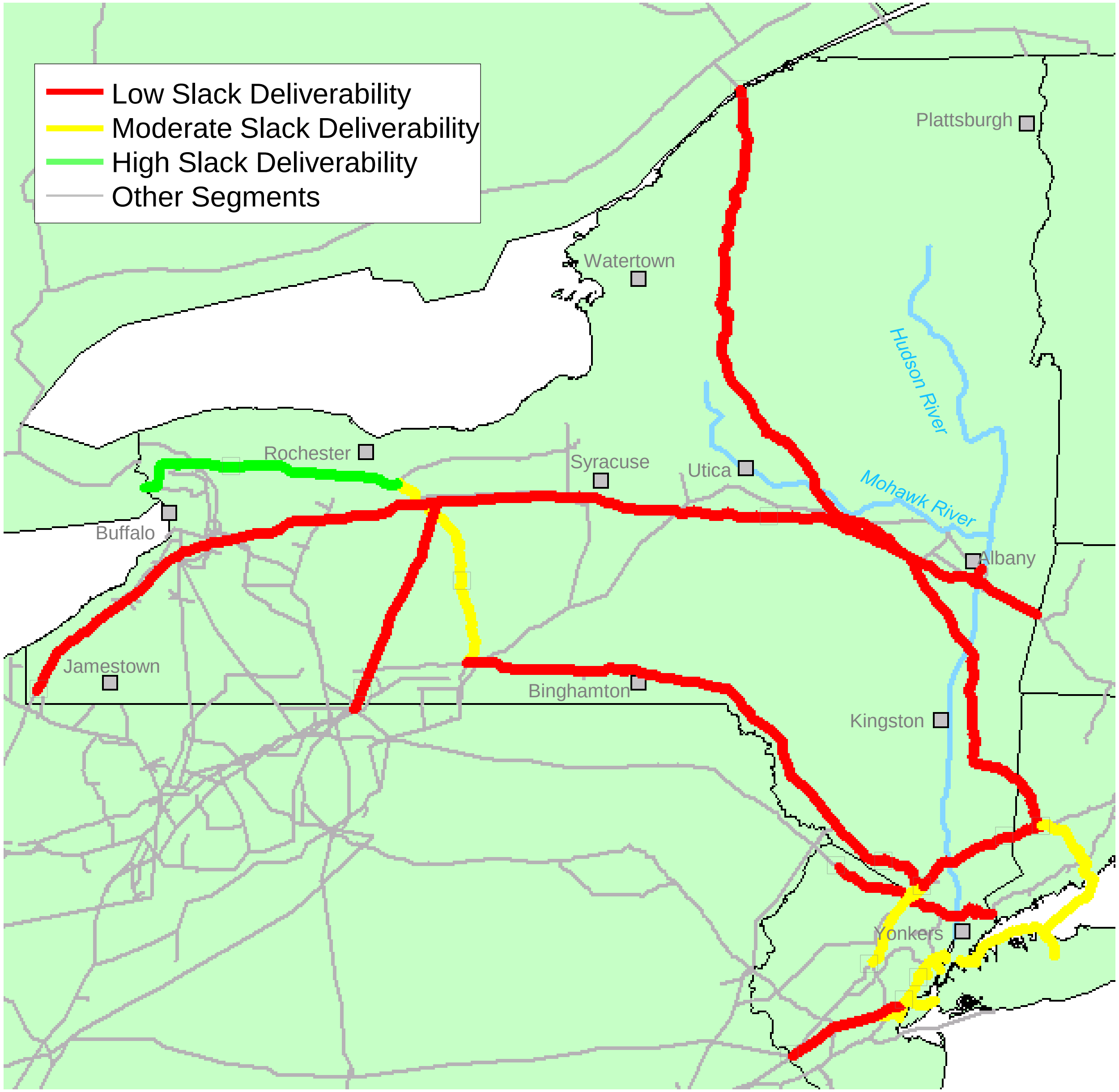
Study Objectives

- Analyze historical pipeline congestion patterns across NYCA
- Forecast supply / demand to determine available capacity to serve gas-fired generation
- Assess the impact of pipeline additions over a five-year study horizon into and across New York State
- Identify potentially disruptive gas-side contingencies across the supply chain from the producing area to the market center (CEII)

Historical Congestion Analysis Key Findings

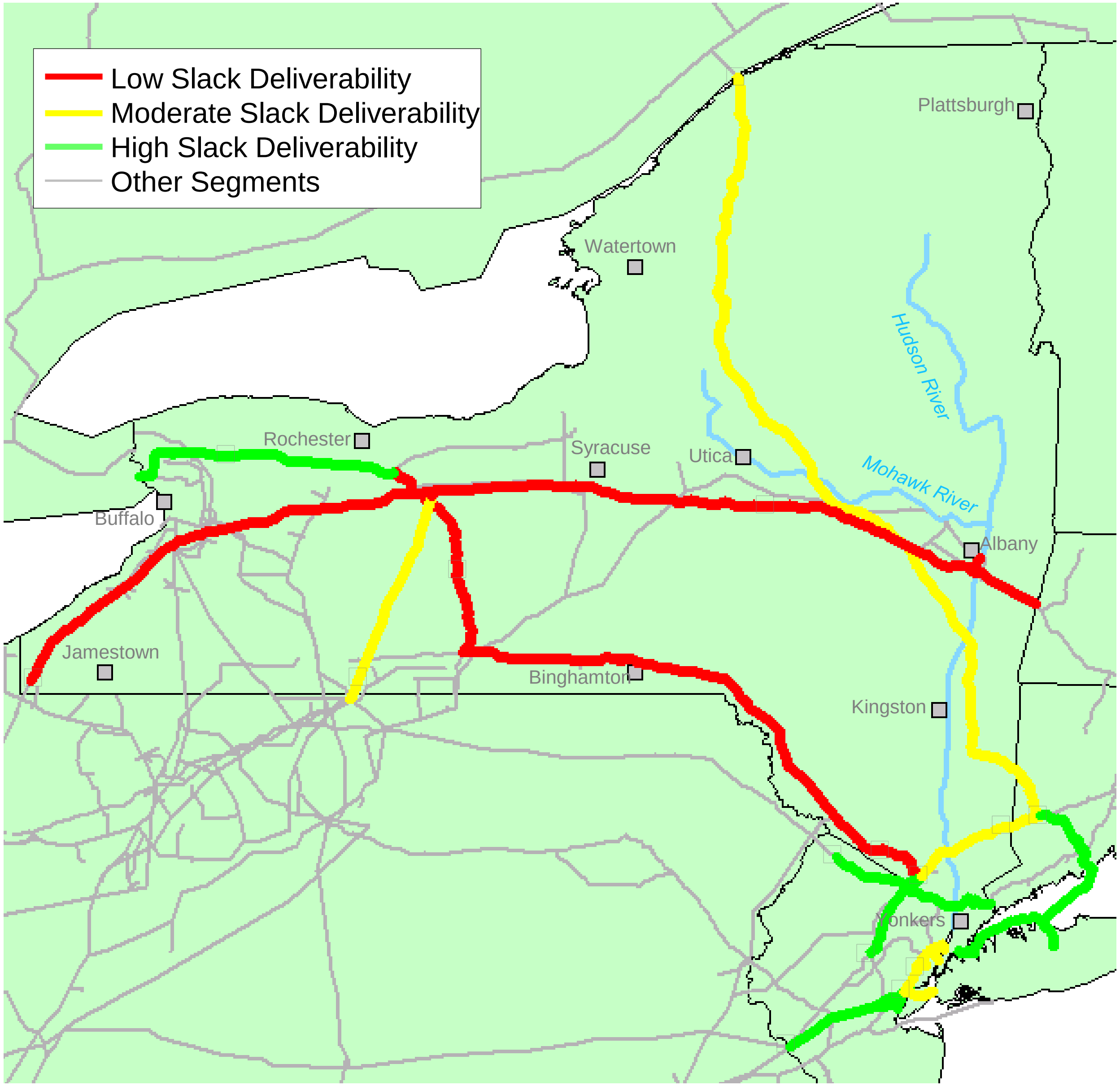
- Infrastructure serving NYFS and NYCA-at-large has been frequently constrained, Nov - March
- High oil-to-gas price ratios and environmental restrictions have increased NYC's reliance on natural gas during the summer
- Utilization levels on Empire, Algonquin and Tennessee are increasingly high, reflecting downstream demand for shale gas (core and non-core) in Ontario and New England
- Planned maintenance scheduled during shoulder months minimizes disruption to FT shippers, but can cause short term disruptions for non-core
- Forced outages rare / short duration

Heating Season Peak Day Congestion (Current)

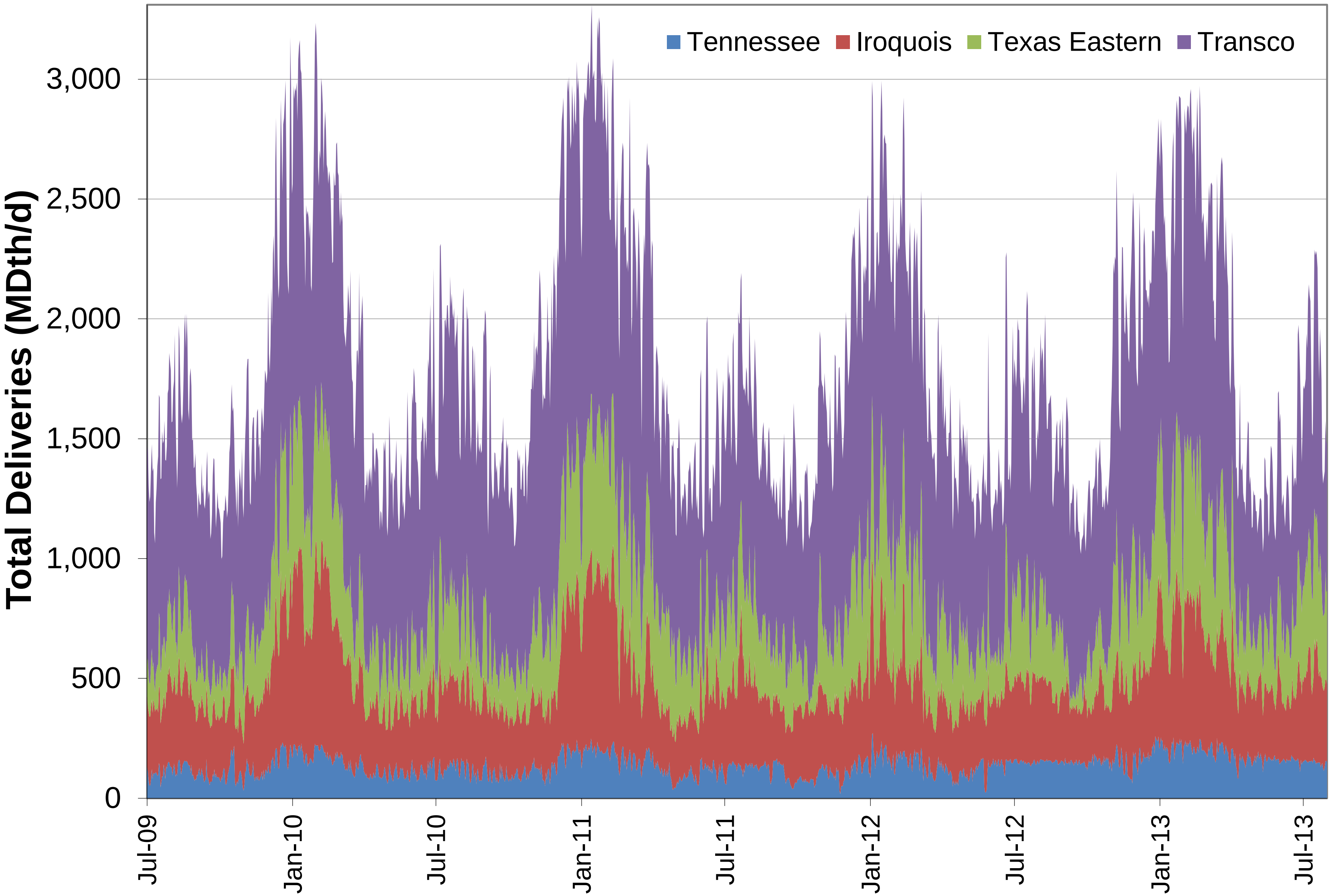


LEVITAN & ASSOCIATES, INC.

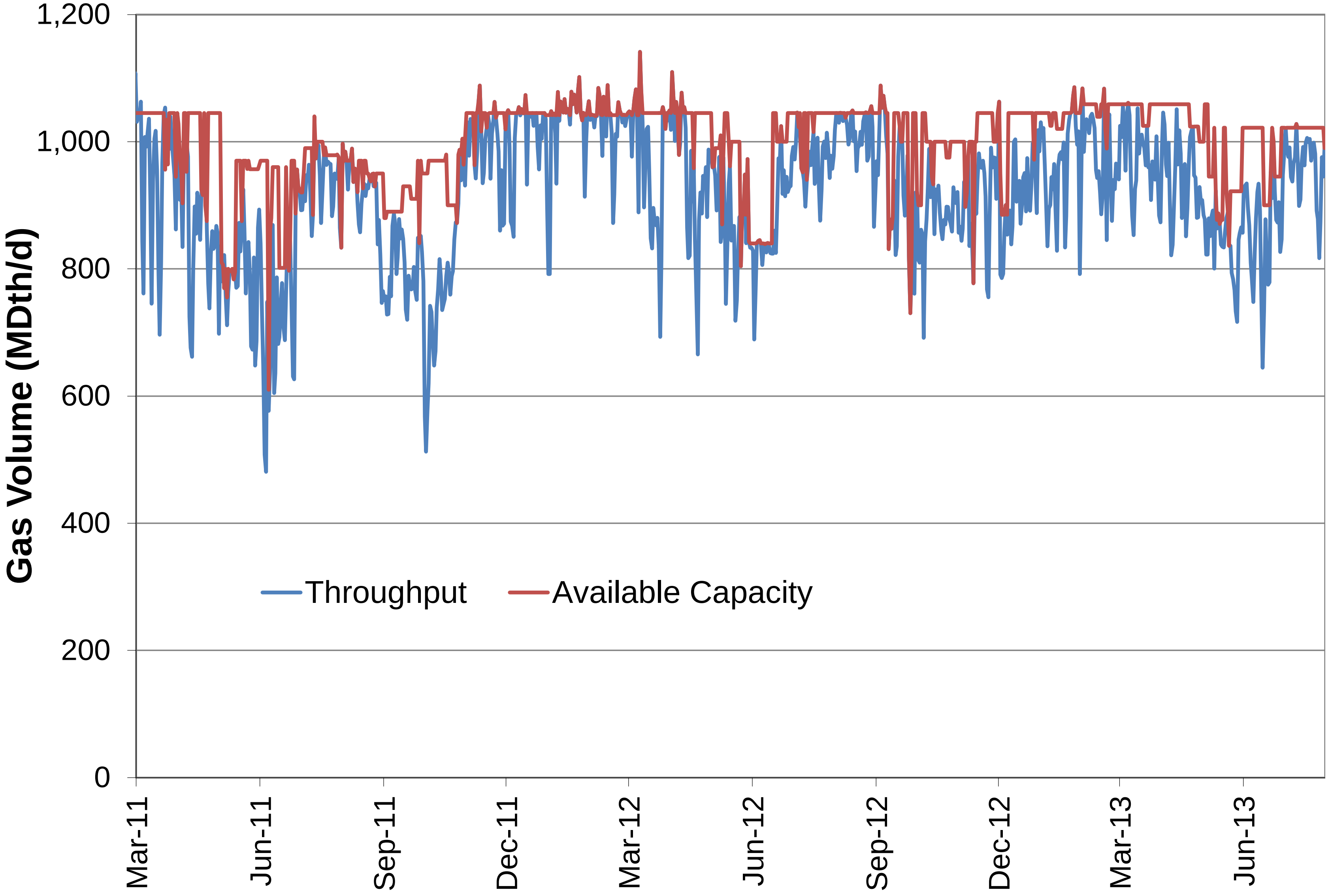
Cooling Season Peak Day Congestion (Current)



NYFS Deliveries Into NYFS

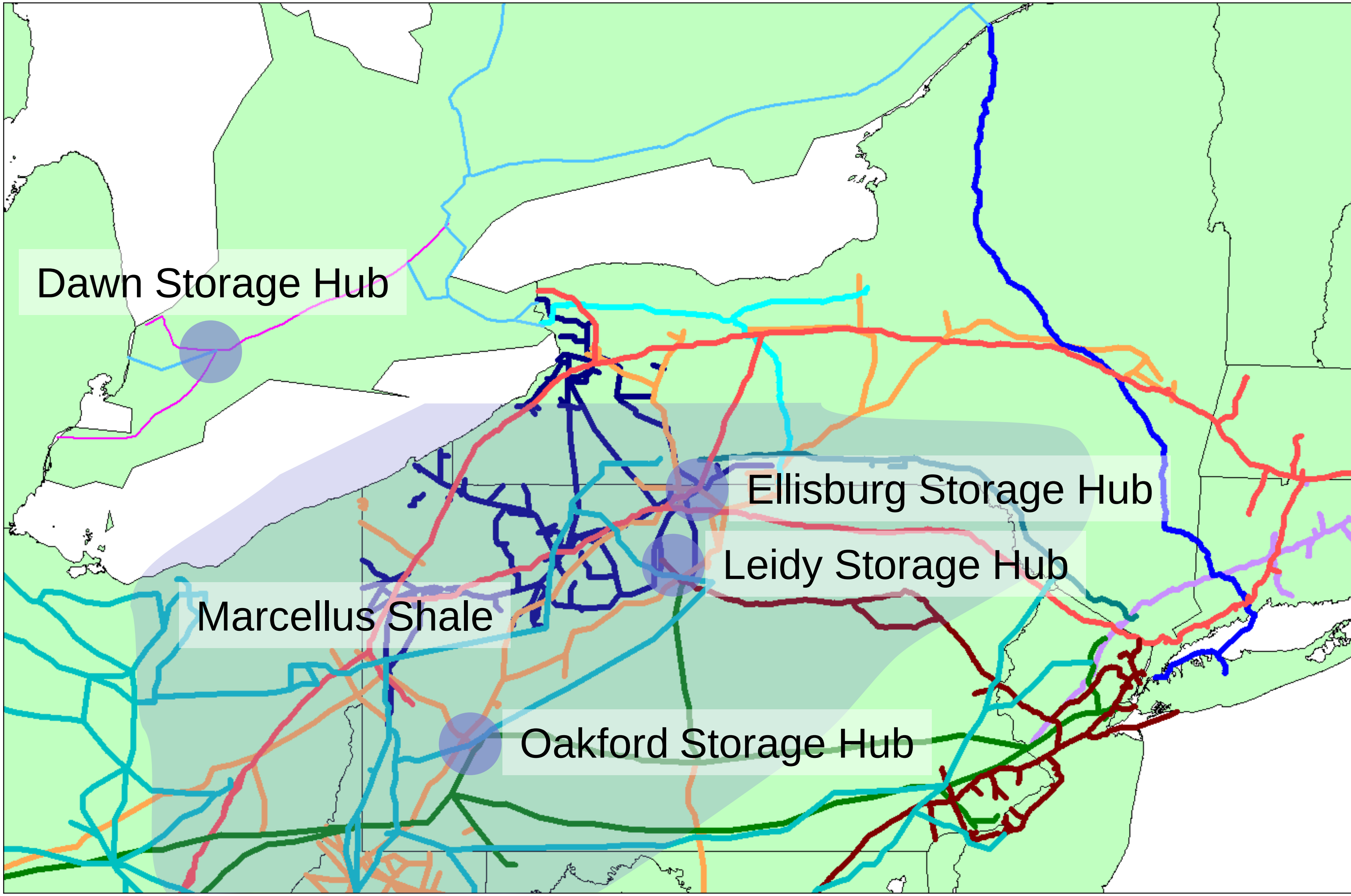


Tennessee Station 245

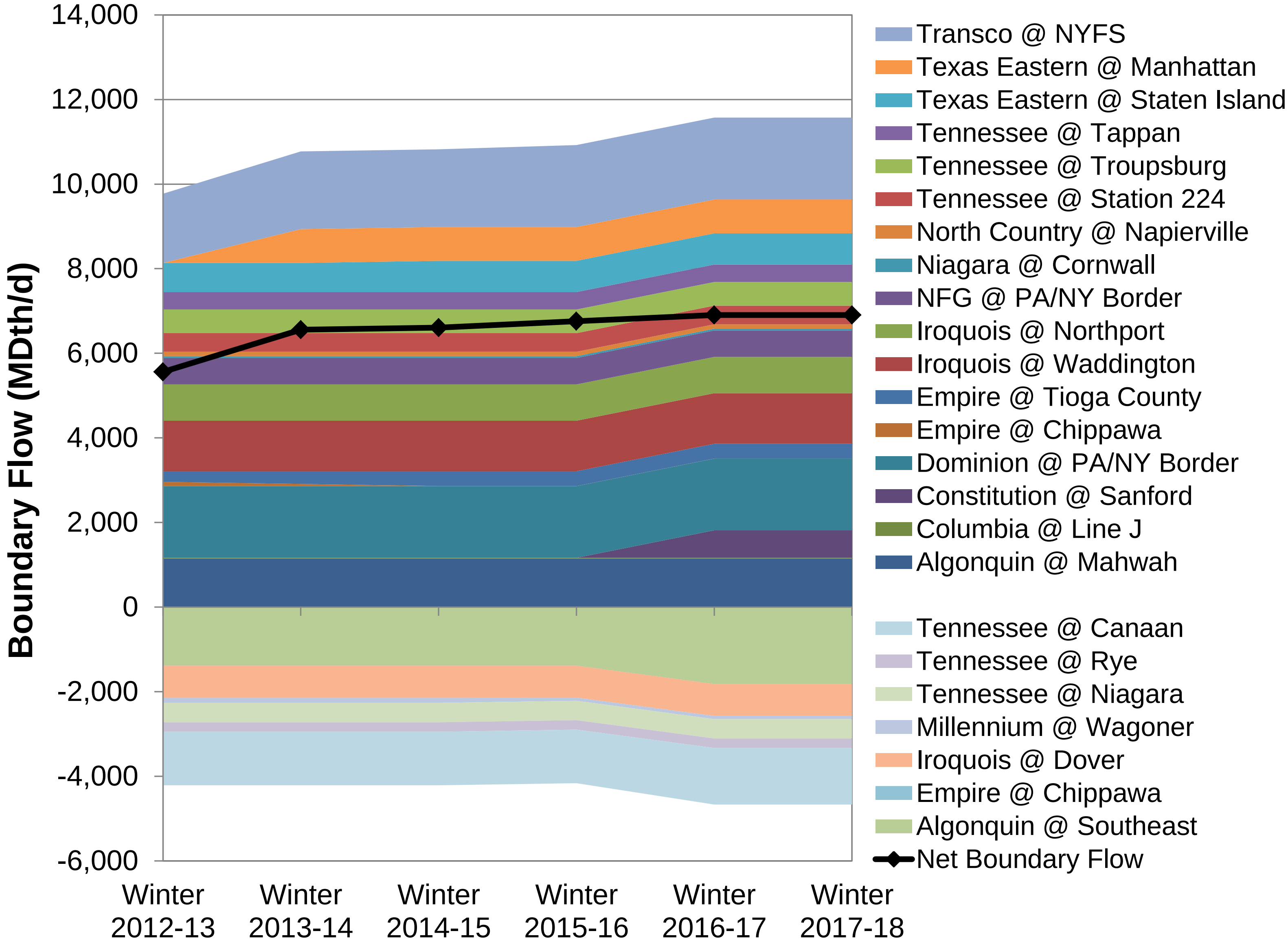


Heating Season Map Cooling Season Map

Regional Supplies – Production & Storage



Peak Day Boundary Flows Into and Out of NYCA

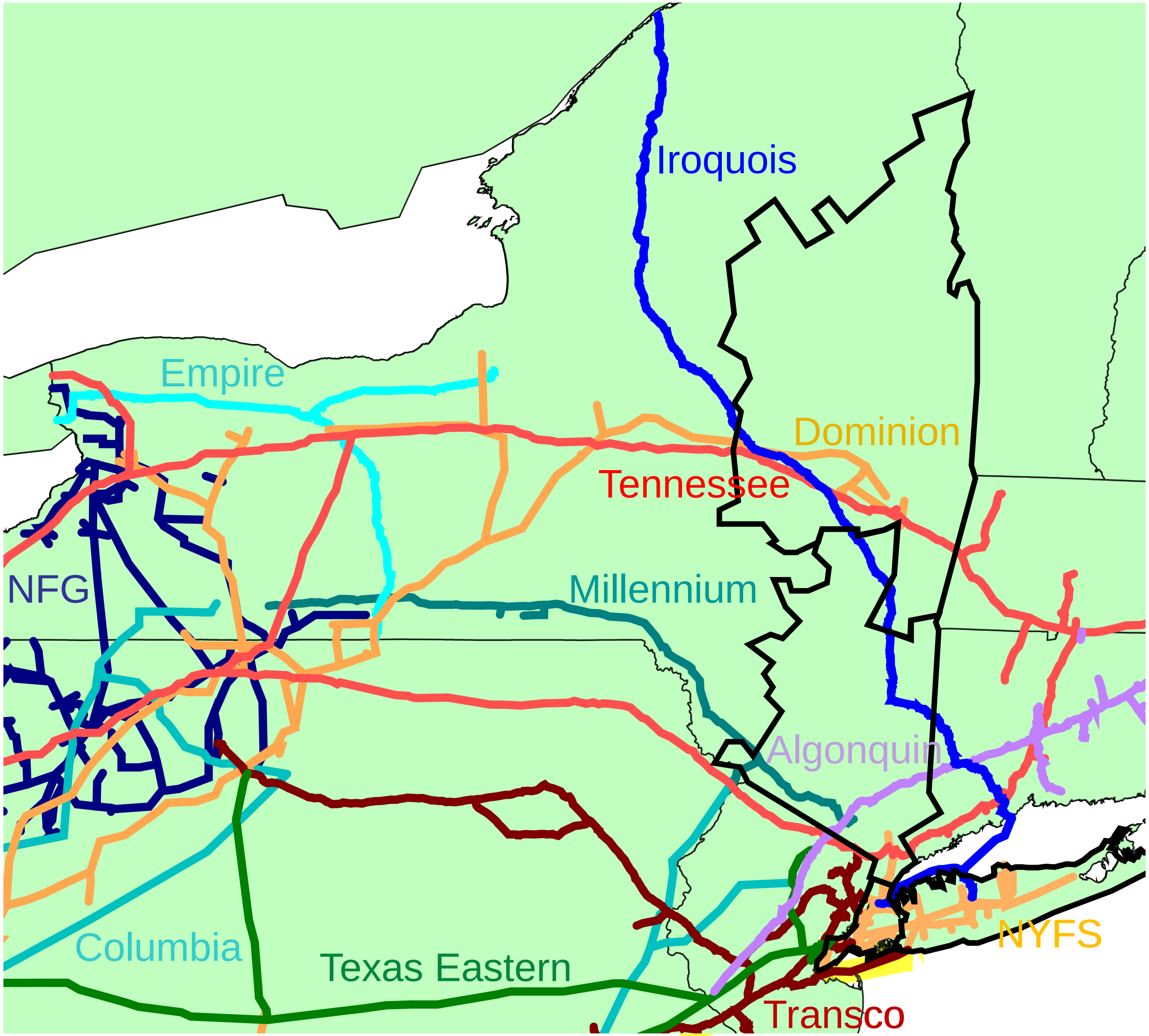


Upstream Points   Downstream Points
Upstream Points (NYFS)

Canadian Boundary Flow Dynamics

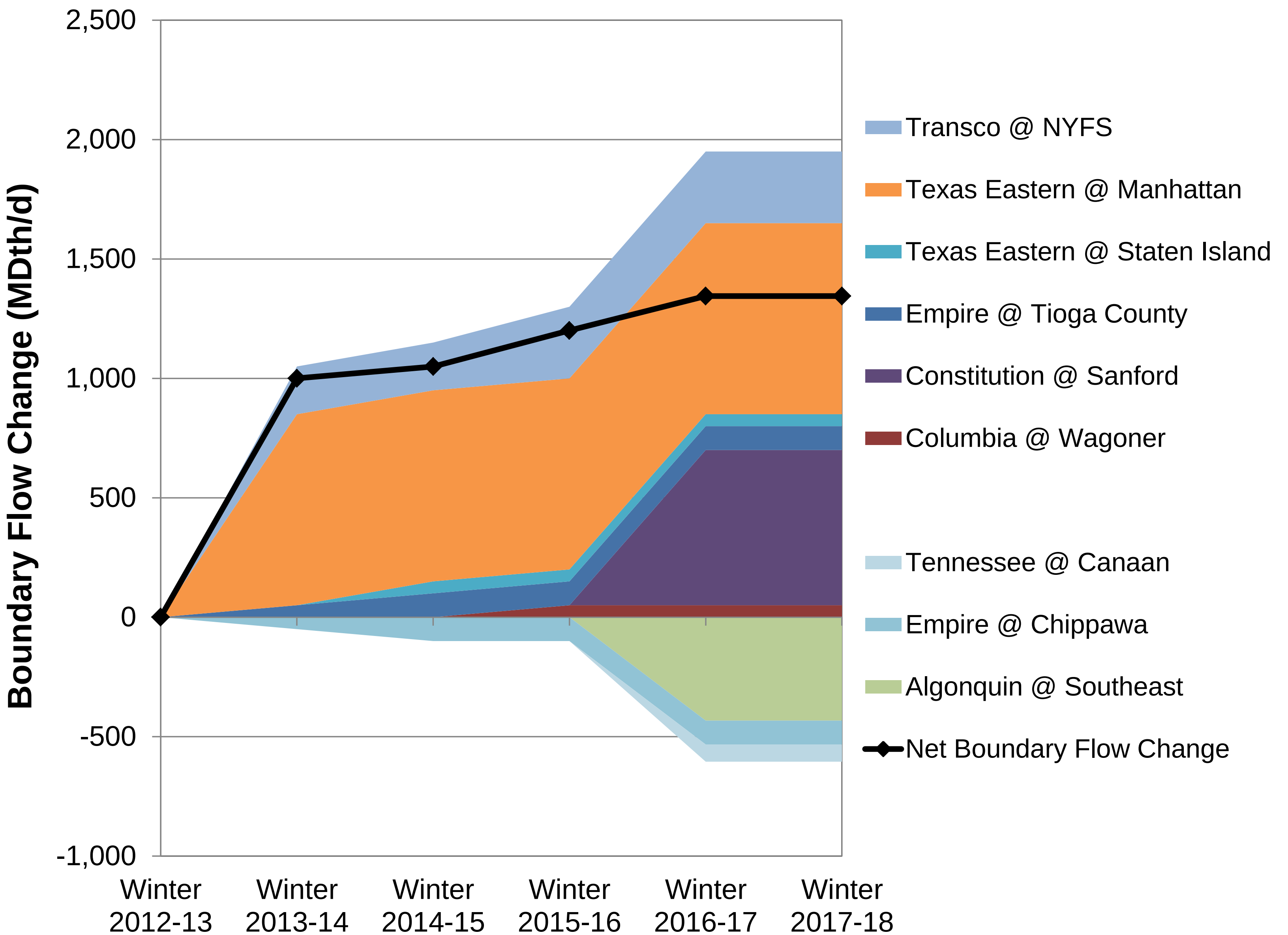
- Previously, gas delivered into NYCA at Niagara (Tennessee), Chippawa (Empire) and Waddington (Iroquois)
  - Niagara is now an export point
  - Chippawa poised for exports not imports
  - Waddington operating at full capacity only on peak days
- Canadian gas into New England materially lower
  - Decline from western Canada into Tennessee and Iroquois
  - Decline from Atlantic Canada from Sable Island
  - Very low exports from Deep Panuke
  - Low utilization of Repsol Canaport LNG terminal
  - Destination flexible LNG cargoes headed to EU / Asia

Pipeline Expansion Projects

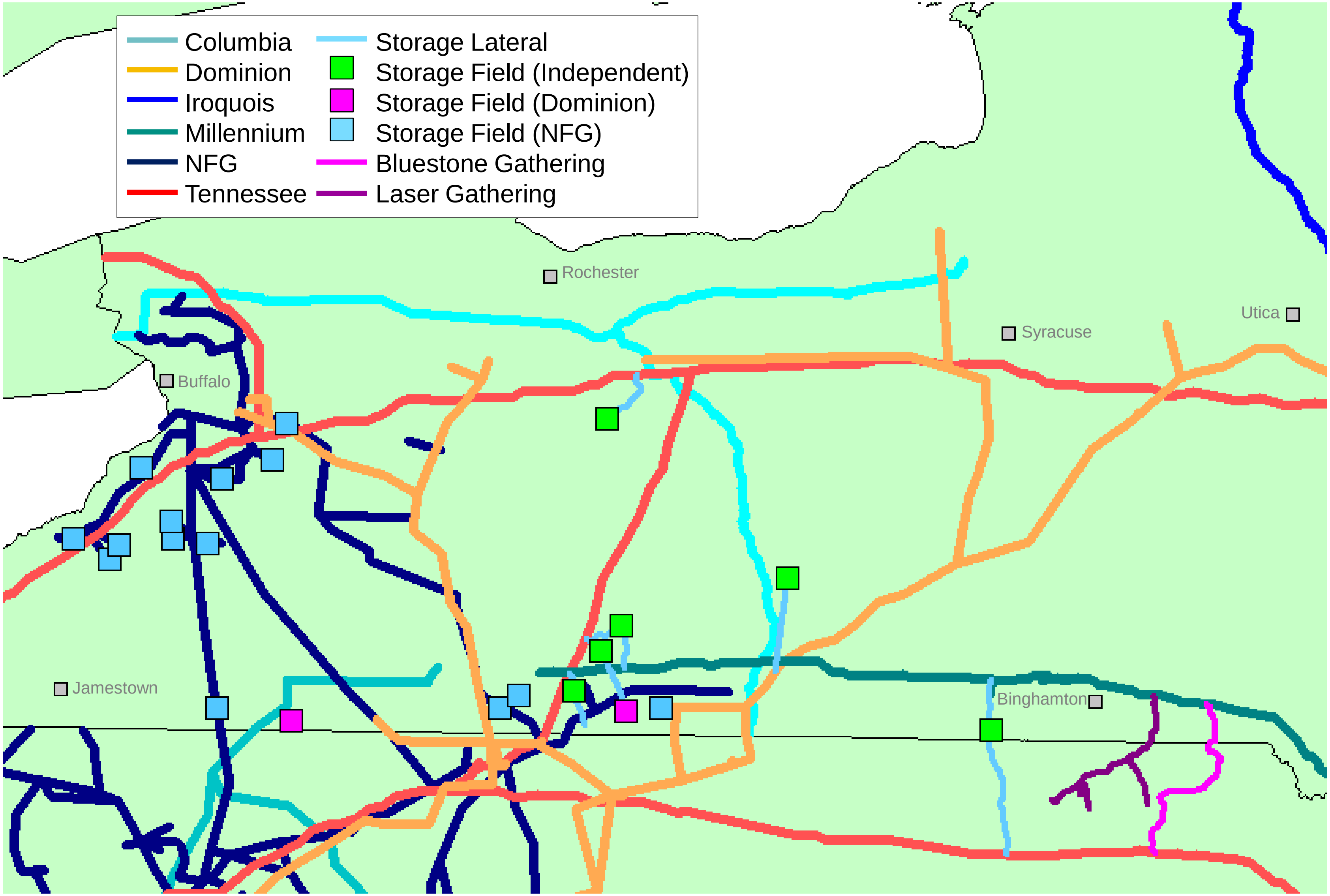


Additional Expansion Projects

Boundary Flow Changes Over Study Horizon

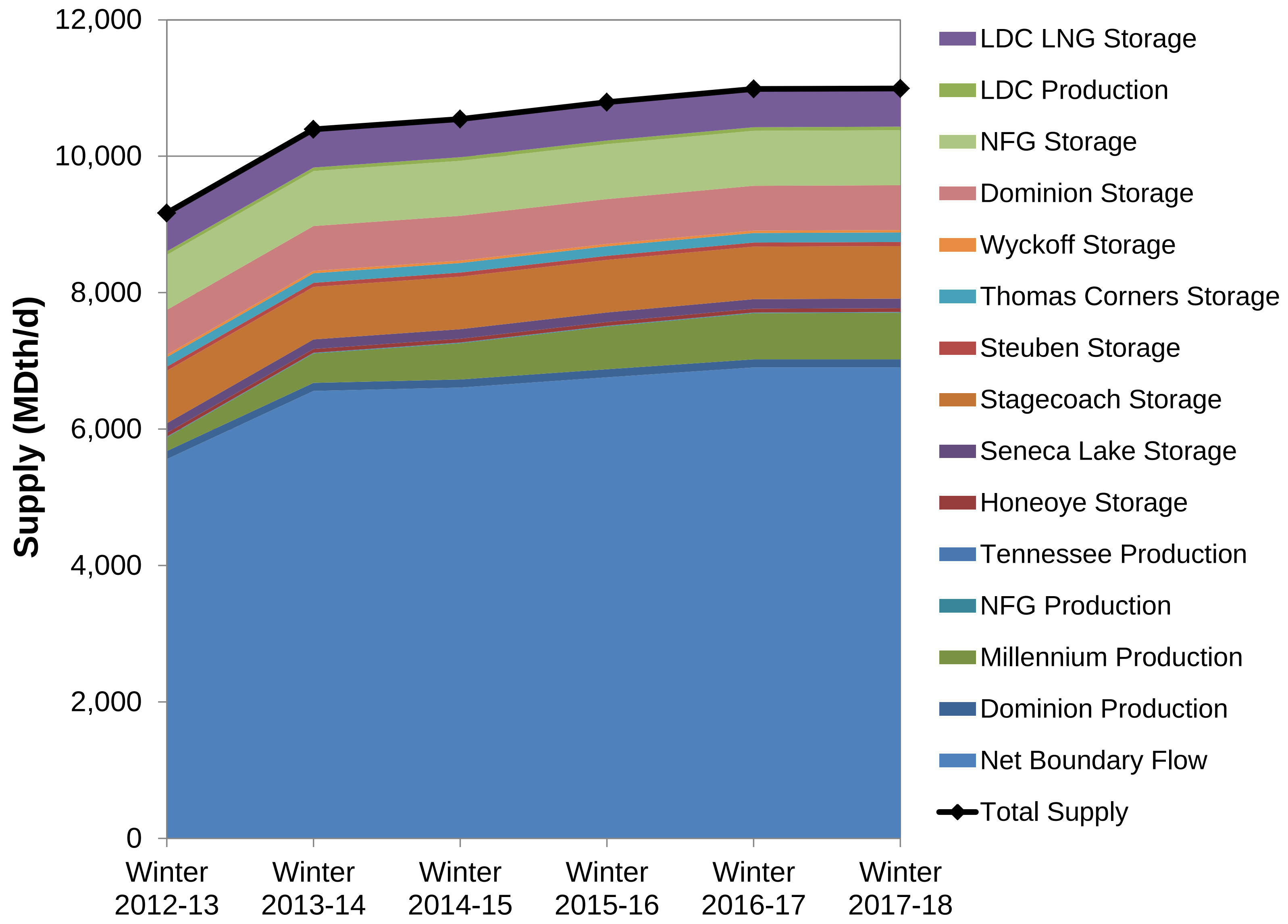


In-State Storage and Production

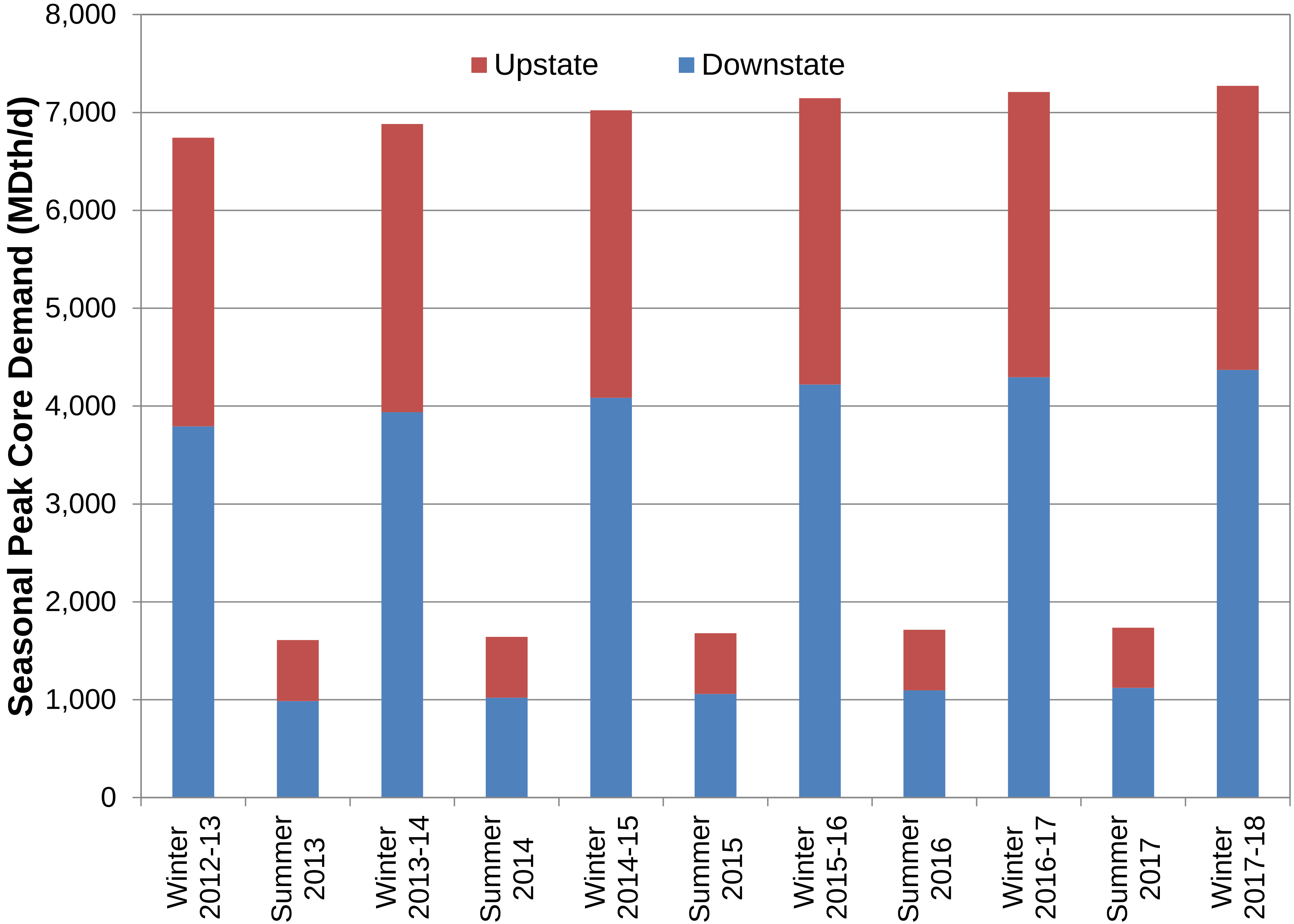


LEVITAN & ASSOCIATES, INC.

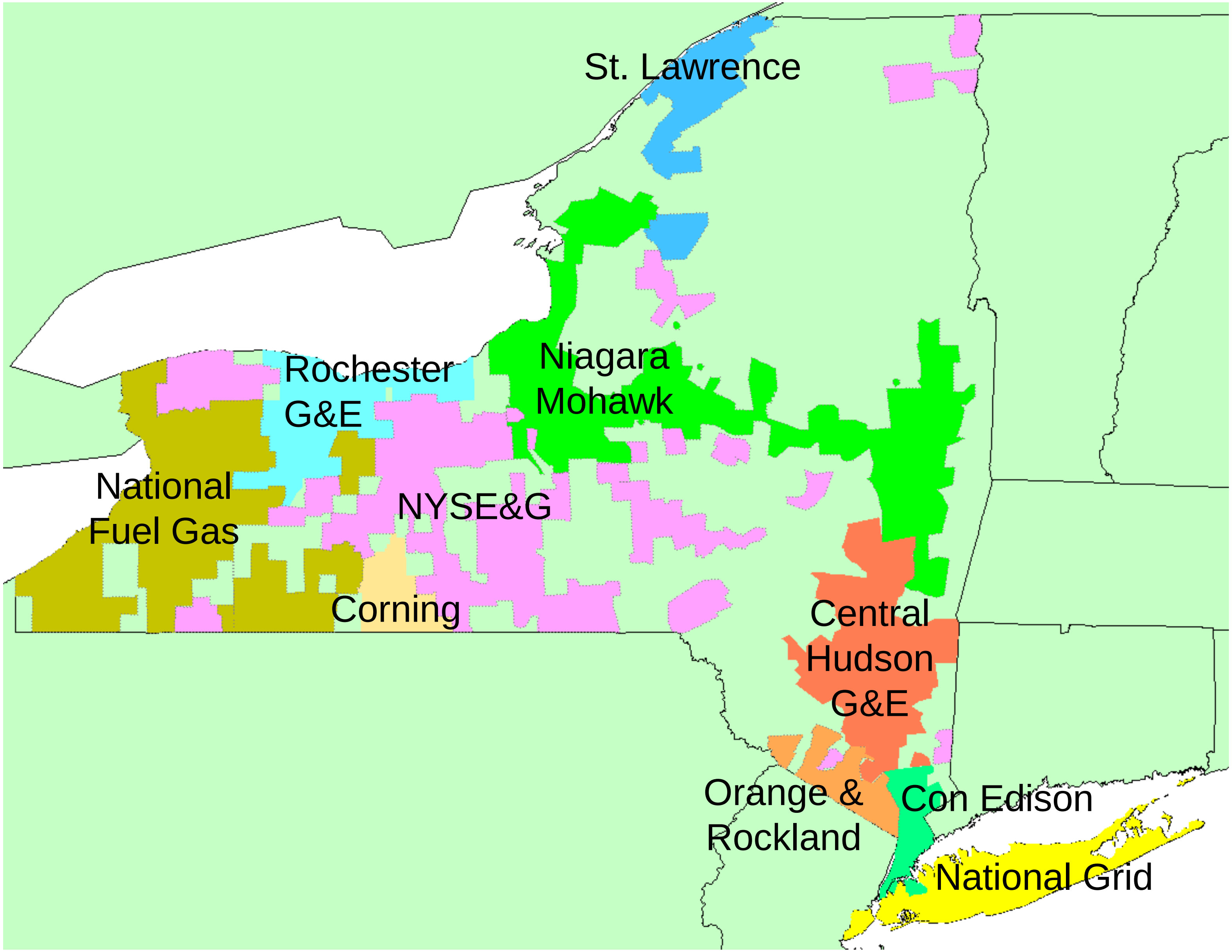
Total Supply Available to Serve Demand



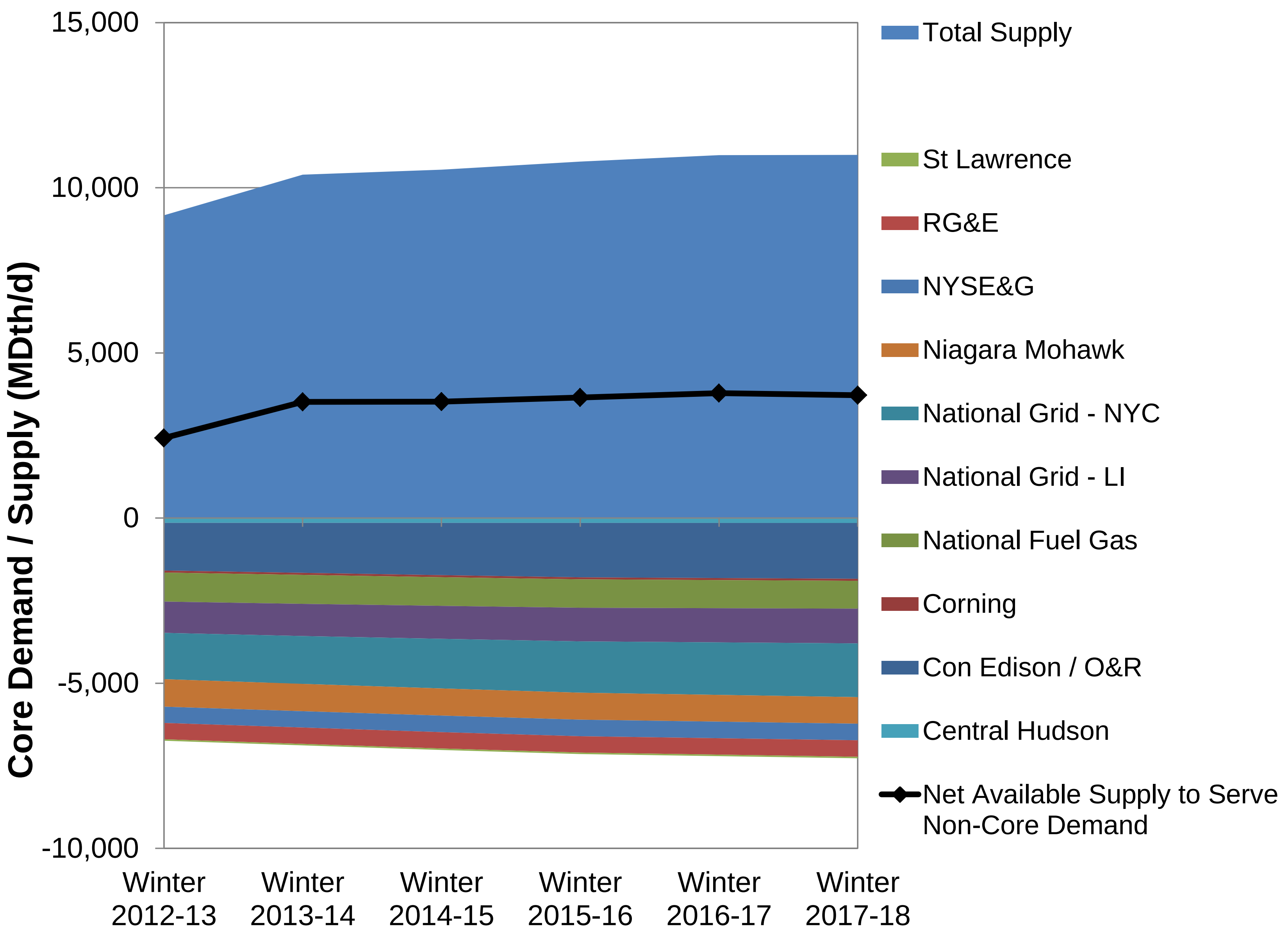
Core (LDC) Demand Forecast



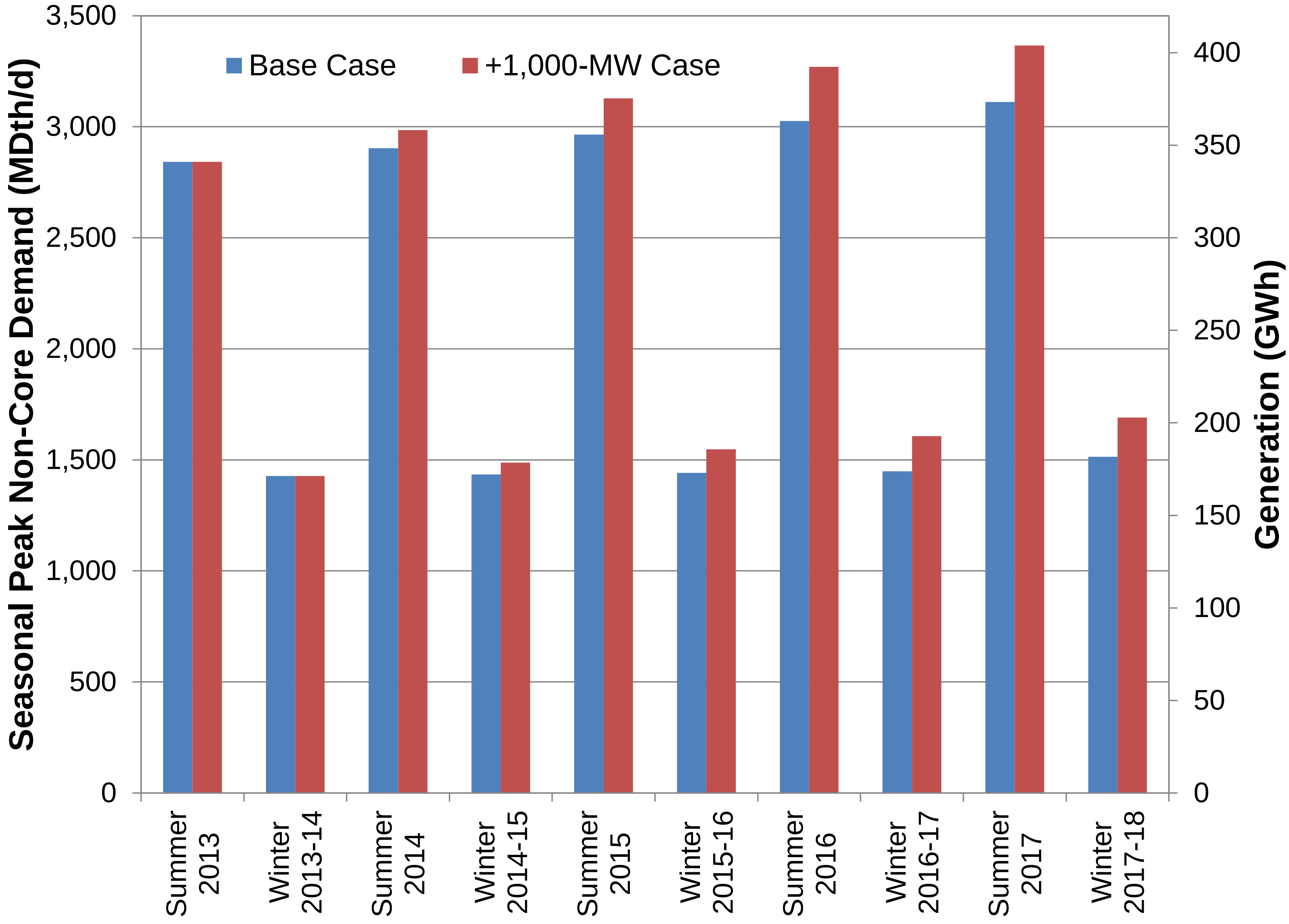
LDC Service Territories



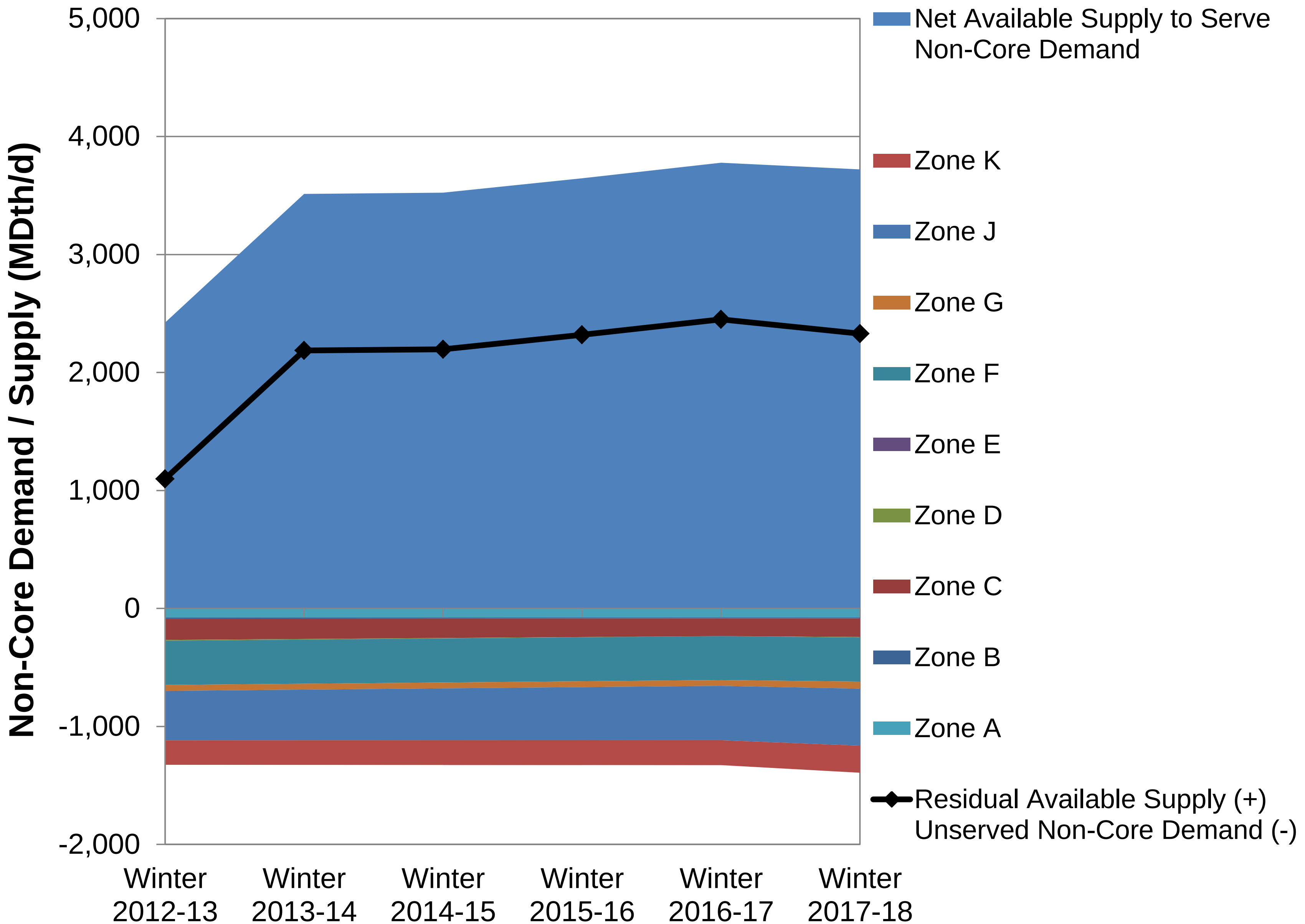
Supply Relative to Core Demand



Non-Core Demand Forecast



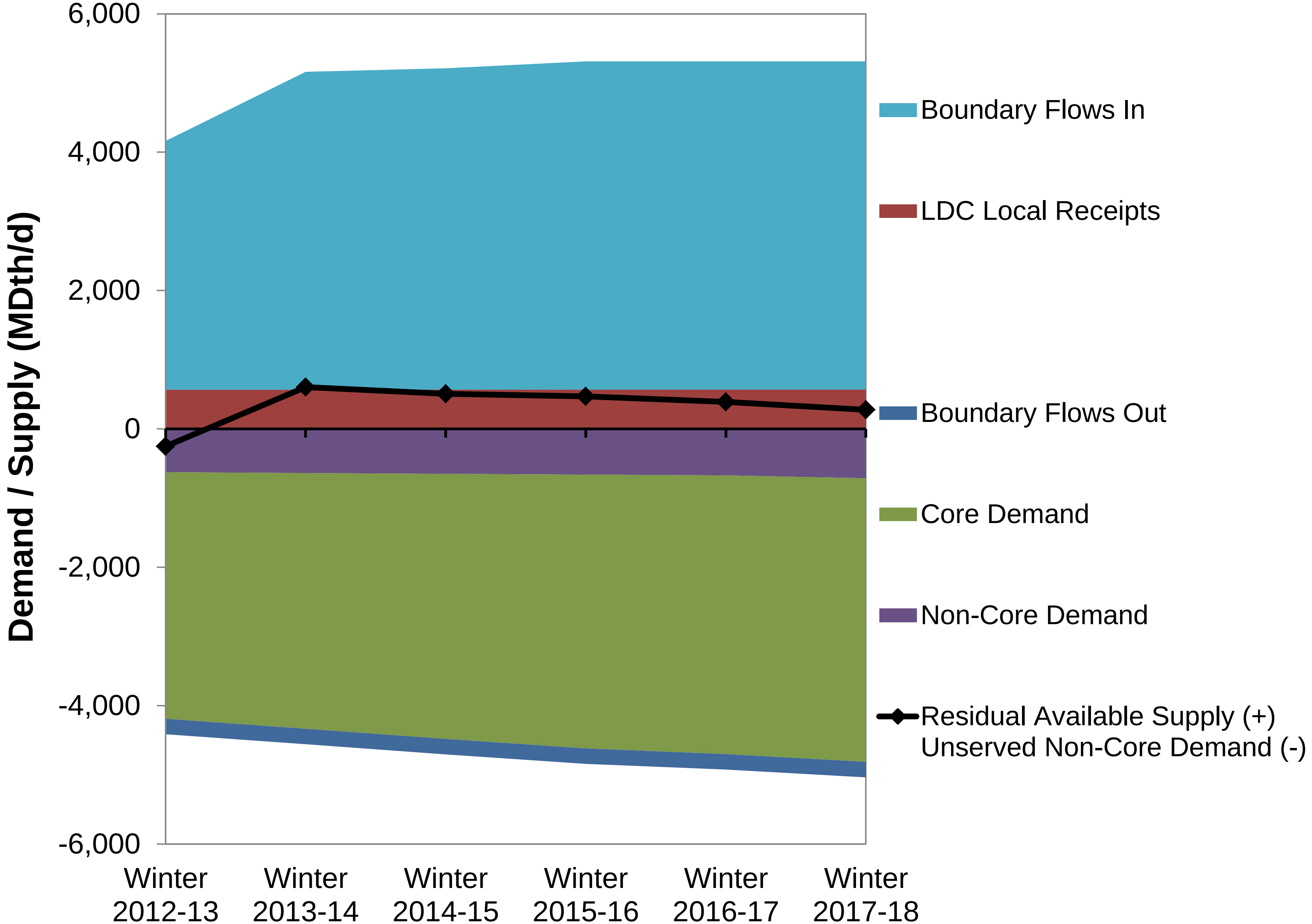
Supply v. Non-Core Demand (Base Case)



Fuel Assurance & Market Design Study

LEVITAN & ASSOCIATES, INC.

NYFS Deliverability (Base Case)



State-Wide Infrastructure Adequacy Results

- Infrastructure and supplies sufficient to meet non-core demand
  - Intra-state constraint point analysis not part of study scope
- Generation demand differential between Base and +1,000-MW Cases does not significantly impact results
- New P/L facilities to come online 11/13 will relieve downstate infrastructure constraints, but not on the NYFS
  - During January 2013 cold snap, over 500 MW of generation experienced fuel-related de-rates (Jan 22nd)

Contingency Analysis

- Active coordination between pipelines and LDCs to manage contingency response
- Identification of potential anomalies during shoulder season inspections reduces contingency occurrence during peak demand periods
- Compressor station contingencies generally resolved much faster than P/L contingencies
- Repair times were consistently underestimated

Contingency Event Durations and Causes