MMU Analysis of Gas Availability in Eastern New York

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Introduction

- This presentation was originally delivered to NYISO's ICAPWG in October 2022.
  - ✓ Slides 28-32 have been added to elaborate on the role of LNG imports.
- Gas-fired resources are currently assumed to be available in MARS in peak winter conditions regardless of whether they have firm gas or backup fuel.
  - ✓ Experience in recent winters suggests this is unrealistic.
- **This presentation discusses availability of gas for power generators in cold winter weather.**
  - ✓ **The resource adequacy model and capacity accreditation should reflect gas limitations in the winter.**

Overview

- This presentation includes the following sections:
  - ✓Geography of gas supply limitations
  - ✓Regional gas supply and core demand on peak winter days
  - ✓Analysis of gas available to power generators
  - ✓Implications for marginal capacity value of gas generators

Gas Pipeline Geography in the Region

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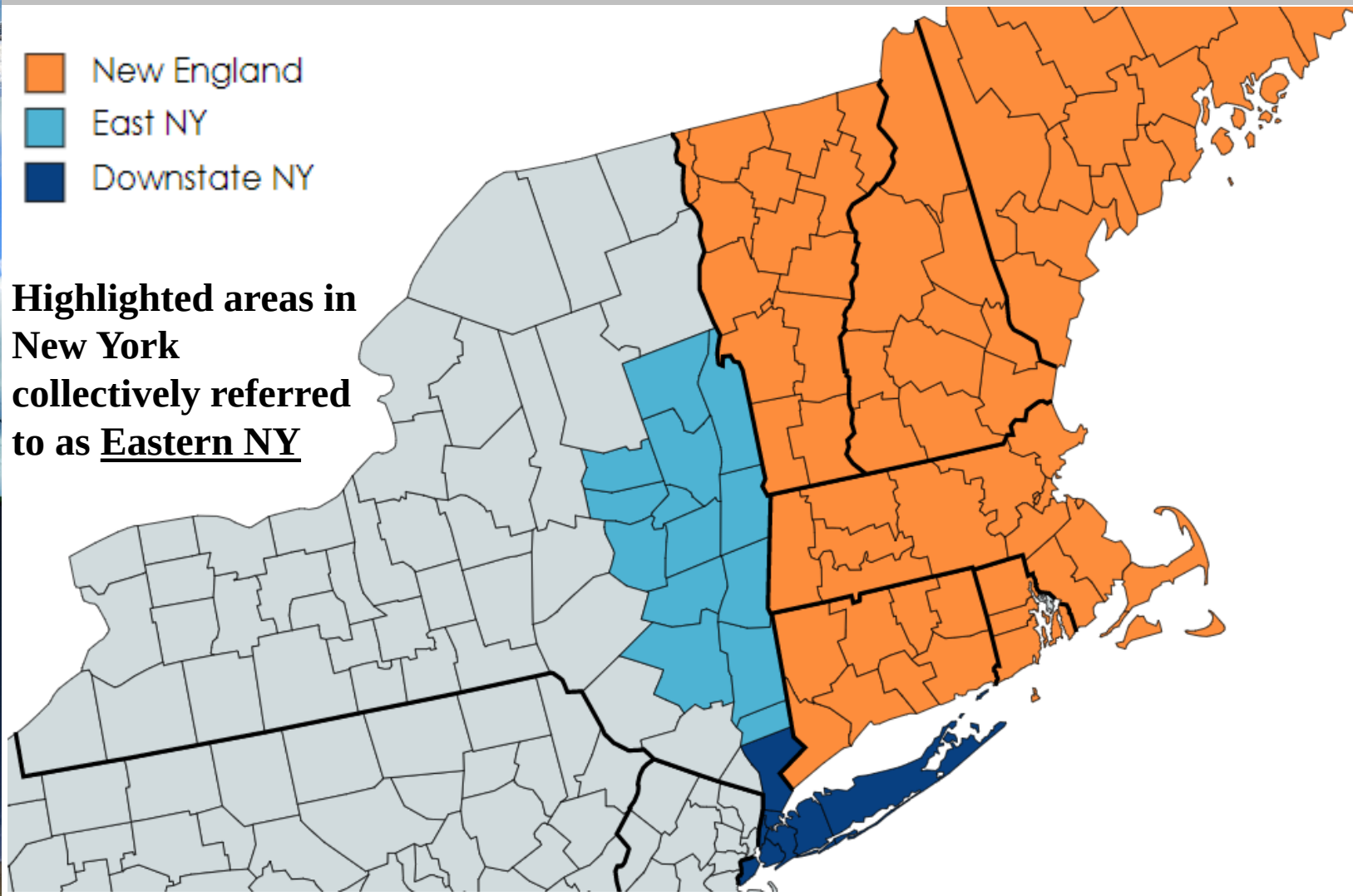
Definition of Region

- We focus on availability of gas to eastern New York and New England.
  - ✓ Pipeline constraints limit total flows into this region.
  - ✓ Pipeline capacity is less constrained west of this region.
- Served by 8 interstate pipelines:
  - ✓ 6 entering New York from the west/north
  - ✓ 2 entering New England from Canada
- Local Distribution Companies (LDCs) have local distribution systems that serve many power generators.

Region of Focus

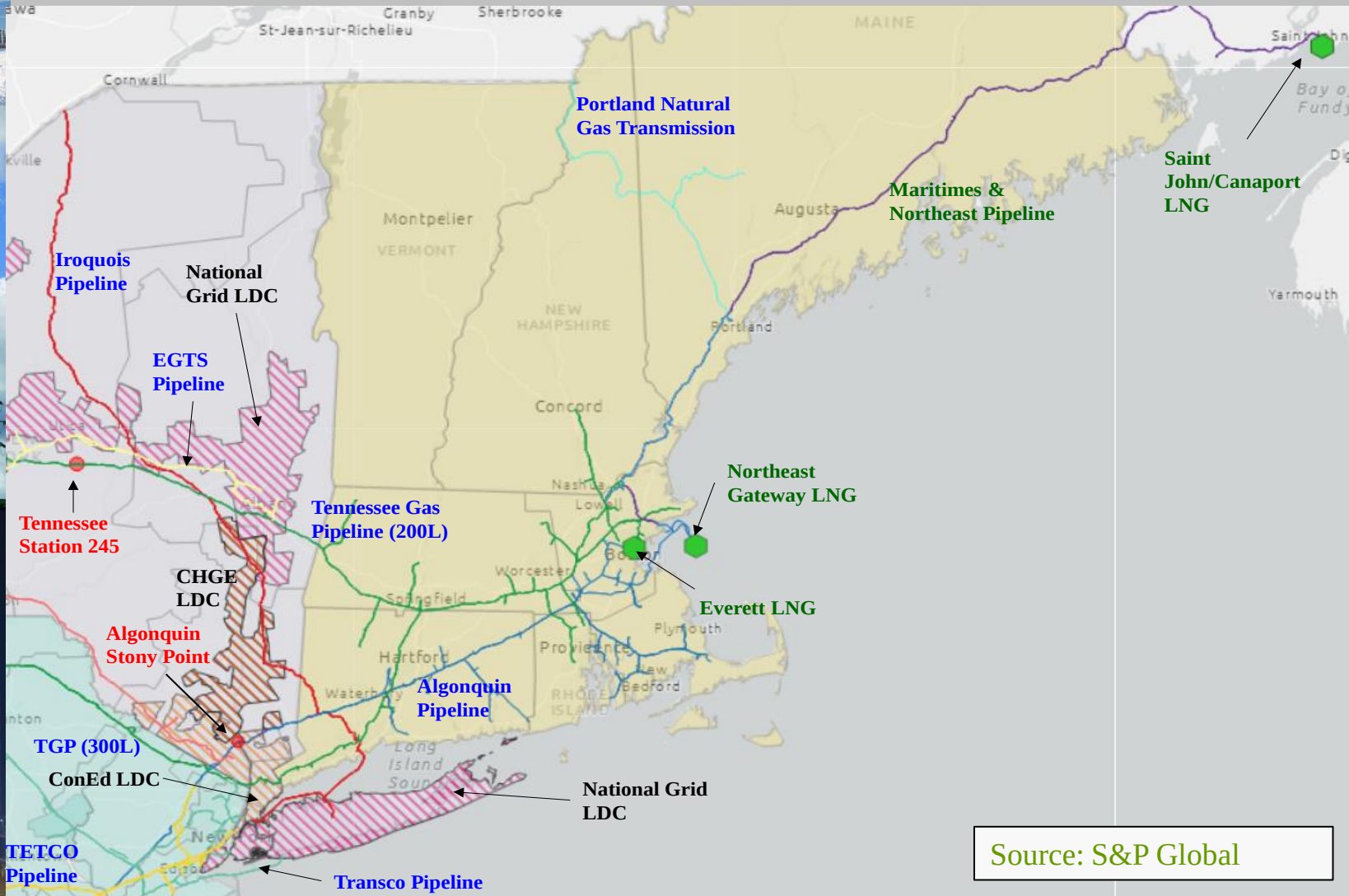


Highlighted areas in New York collectively referred to as <u>Eastern NY</u>

Interstate Pipelines Serving Region

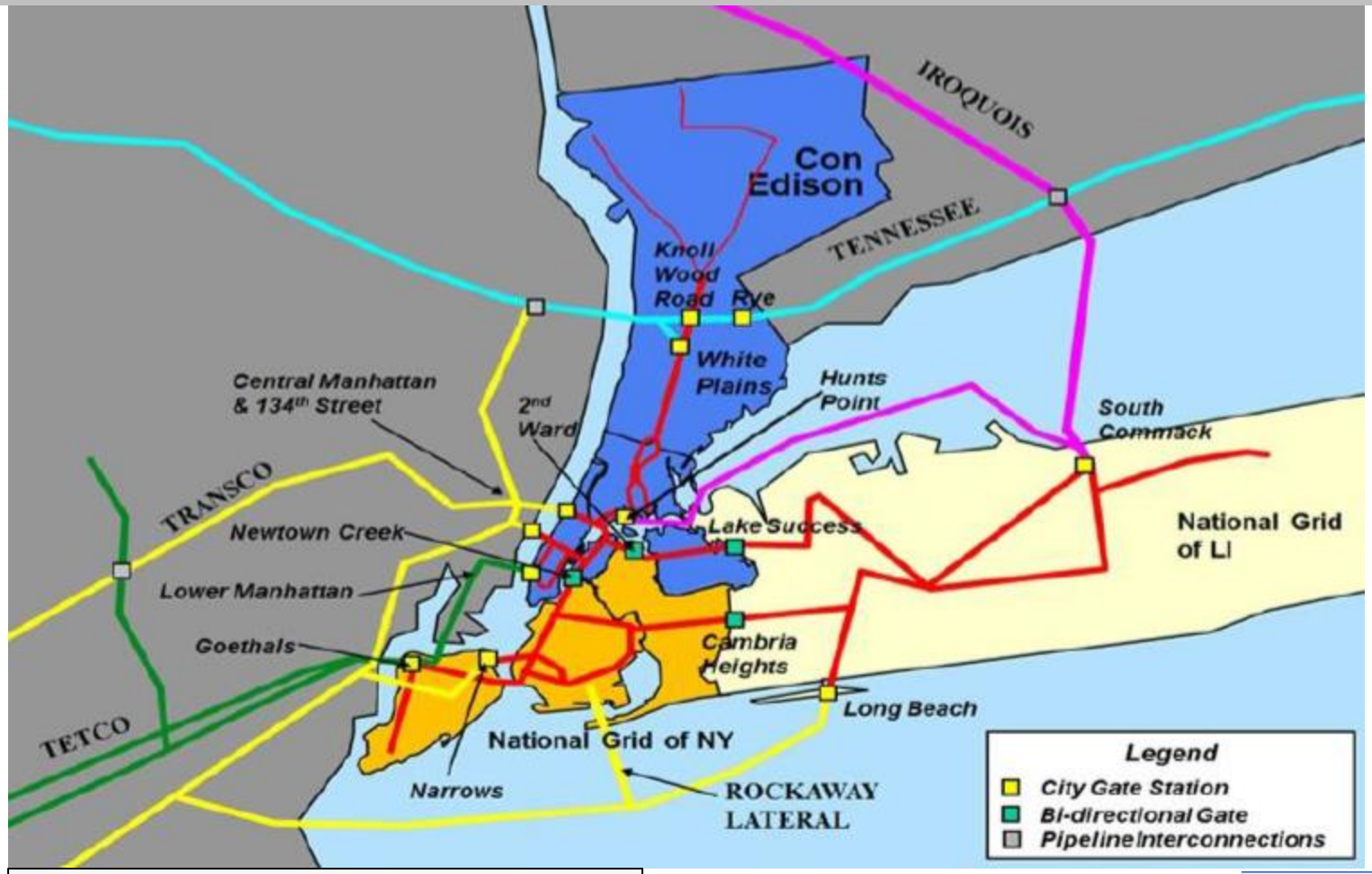
Pipeline	Relevant Points/Bottlenecks
Transco	Endpoints in NYC and Long Island
TETCO	Endpoints in NYC
Tennessee (TGP)	200 Leg: Segment 245 entering Capital region 300 Leg: Segment 324 entering Westchester
Algonquin	Stony Point station (Rockland/Westchester border)
Iroquois	Deliveries at/south of Wright (Capital region)
Eastern Natural Gas Transmission (EGTS)	Endpoints in Capital region, deliveries to Iroquois and TGP
Portland Nat. Gas Transmission System (PNGTS)	Receipts from Canada border into New England
Maritimes & Northeast	Receipts from Canada border into New England (LNG imports from Saint John terminal)

Interstate Pipelines Serving Region



Source: S&P Global

Downstate NY Pipelines and LDC System



Source: National Grid

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Summary of Regional Gas Supply and Core Demand

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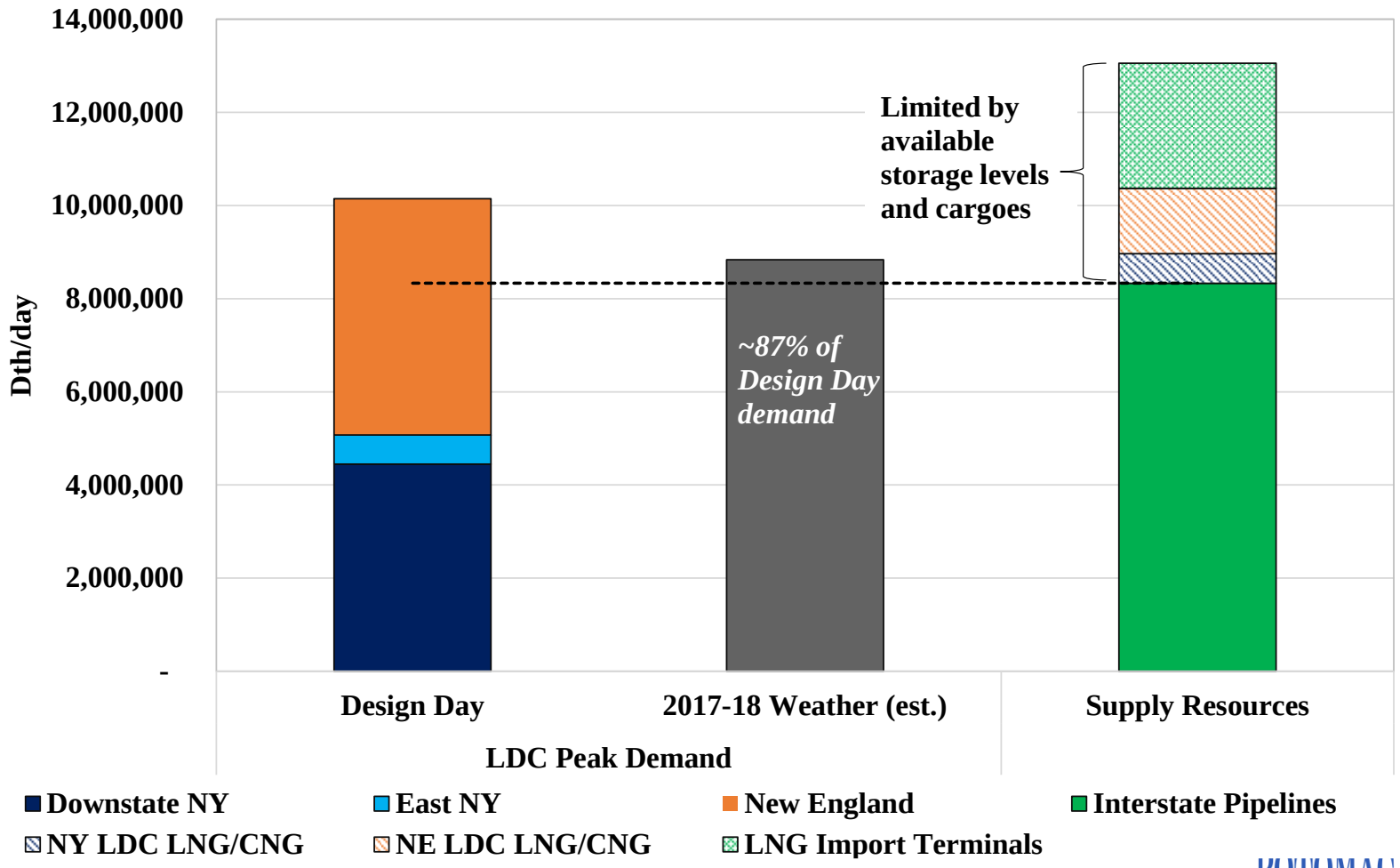
Regional Pipeline Capacity

- Slide 12 compares estimated Design Day gas demand of regional gas LDCs to available supply sources.
  - ✓ LDCs secure supply to meet firm demand on unusually cold winter "Design Day" (e.g. 1-in-33 year) conditions.
    - – Power plant demand generally treated as non-firm by LDCs.
  - ✓ We also show estimated peak demand in weather comparable to 2017/18 cold snap.
- Slide 13 shows maximum regional pipeline imports (excluding LNG) in winters 2017-18 through 2021-22.
  - ✓ Values shown are for coincident maximum of all pipelines each winter (joint import limit).
  - ✓ Some pipelines added incremental capability over this period
  - ✓ Import limit slightly higher in warmer winters (2019, 2020).

LDC Winter Peak Demand Exceeds Pipeline Capability



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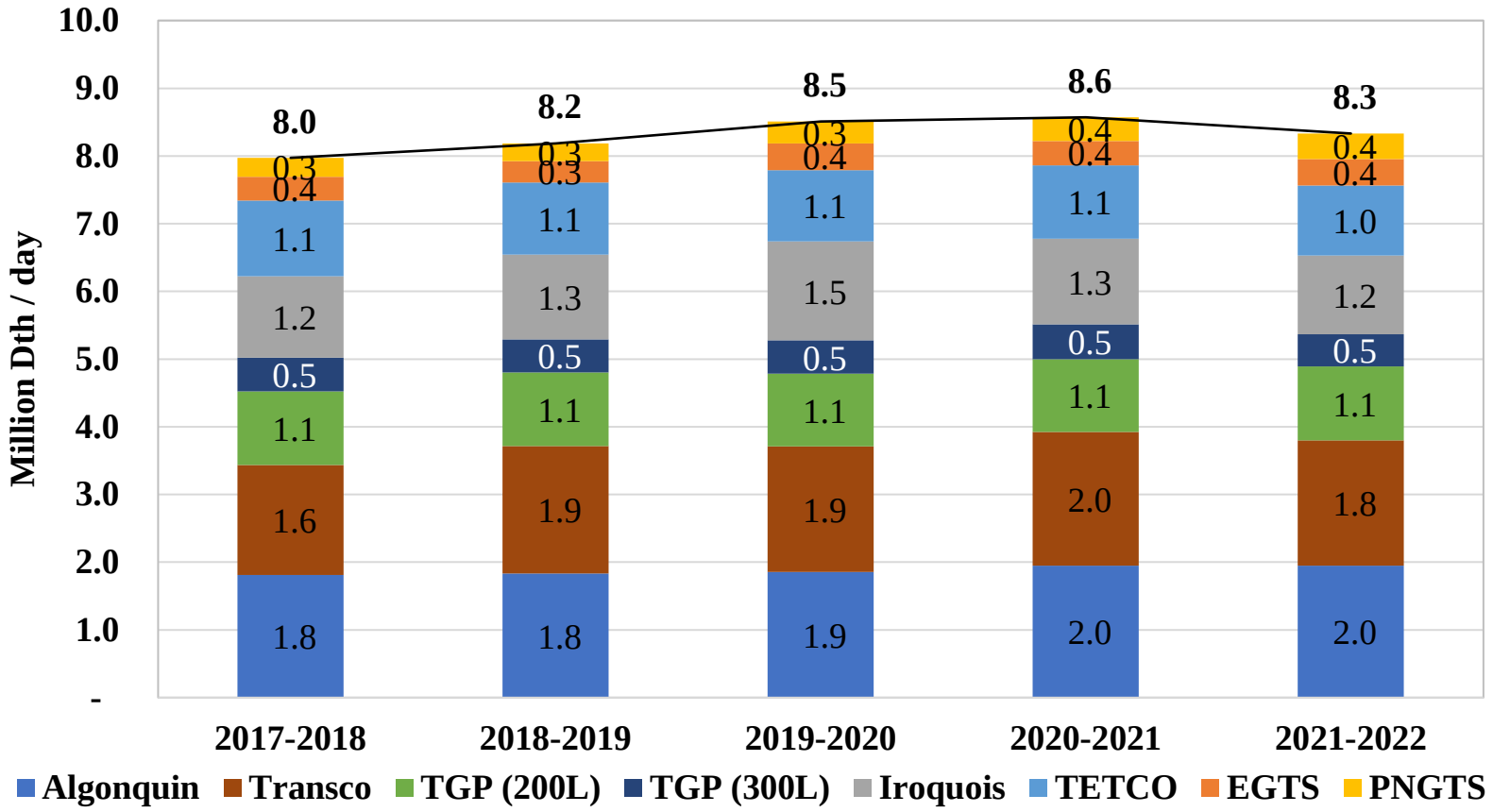
Interstate Pipeline Summary
Max Simultaneous Imports to Eastern NY/NE



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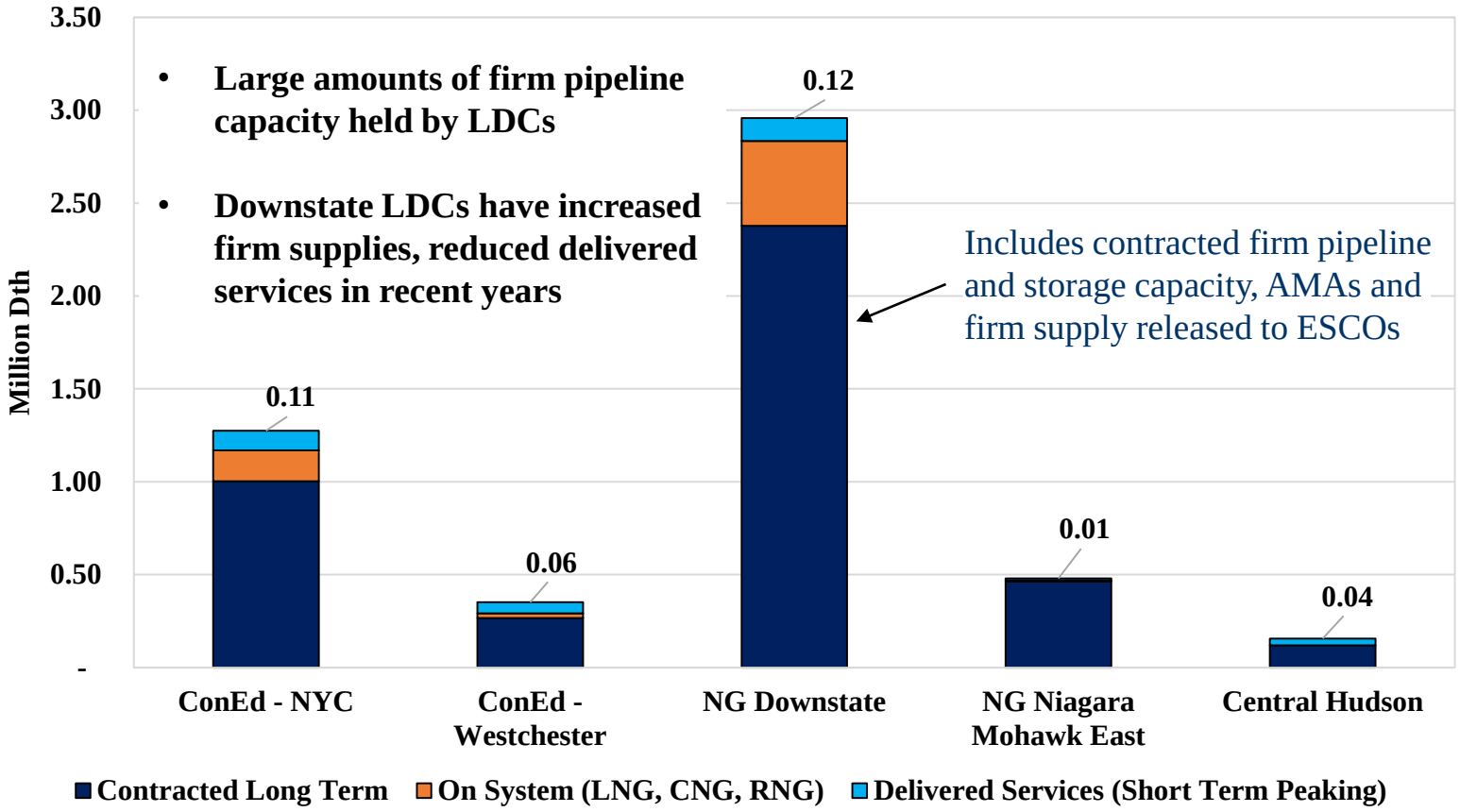
Eastern New York LDCs' Supply Sources

- **Large amounts of firm pipeline capacity held by LDCs**
- **Downstate LDCs have increased firm supplies, reduced delivered services in recent years**



Includes contracted firm pipeline and storage capacity, AMAs and firm supply released to ESCOs

Source: LDC winter fuel supply filings with NY DPS

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LNG Storage and Imports

- **LNG storage/imports provide vital peaking supply.**
  - ✓ LDCs in Eastern NY and New England maintain on-system storage tanks that are filled during non-winter months.
  - ✓ Three import terminals can send imported LNG to pipelines serving New England.
- **LNG importers generally do not provide speculative supply or short-notice cargoes.**
  - ✓ Shippers typically require a contract months before winter.
  - ✓ Excess LNG stored/delivered to terminals (e.g. firm supply not needed by LDC) may increase gas available to generators.
    - – It is dangerous to assume this will occur in a very cold period, since most LNG supplies are contracted to meet a firm customer's demand.

Summary of LNG Import and Storage Capability

LDCs' LNG Storage Facilities	Vaporization Capability (million Dth/day)	Storage (million Dth)	Liquefaction Rate (million Dth/day)
New York	0.6	3.3	0.017
New England	1.4	16.0	0.044

LNG Import Terminals	Maximum Sendout (million Dth/day)	Storage (million Dth)
New England		
Everett[1]	0.7	3.4
Northeast Gateway[2]	0.5 - 0.8	0
New Brunswick		
Saint John	1.2	9.9

LDCs' LNG refill rates are very slow – months to refill

[1] Includes 0.3 million Dth from Everett sent directly to Mystic power plant.

[2] Maximum sendout depends on number of FSRUs at terminal (1 or 2).

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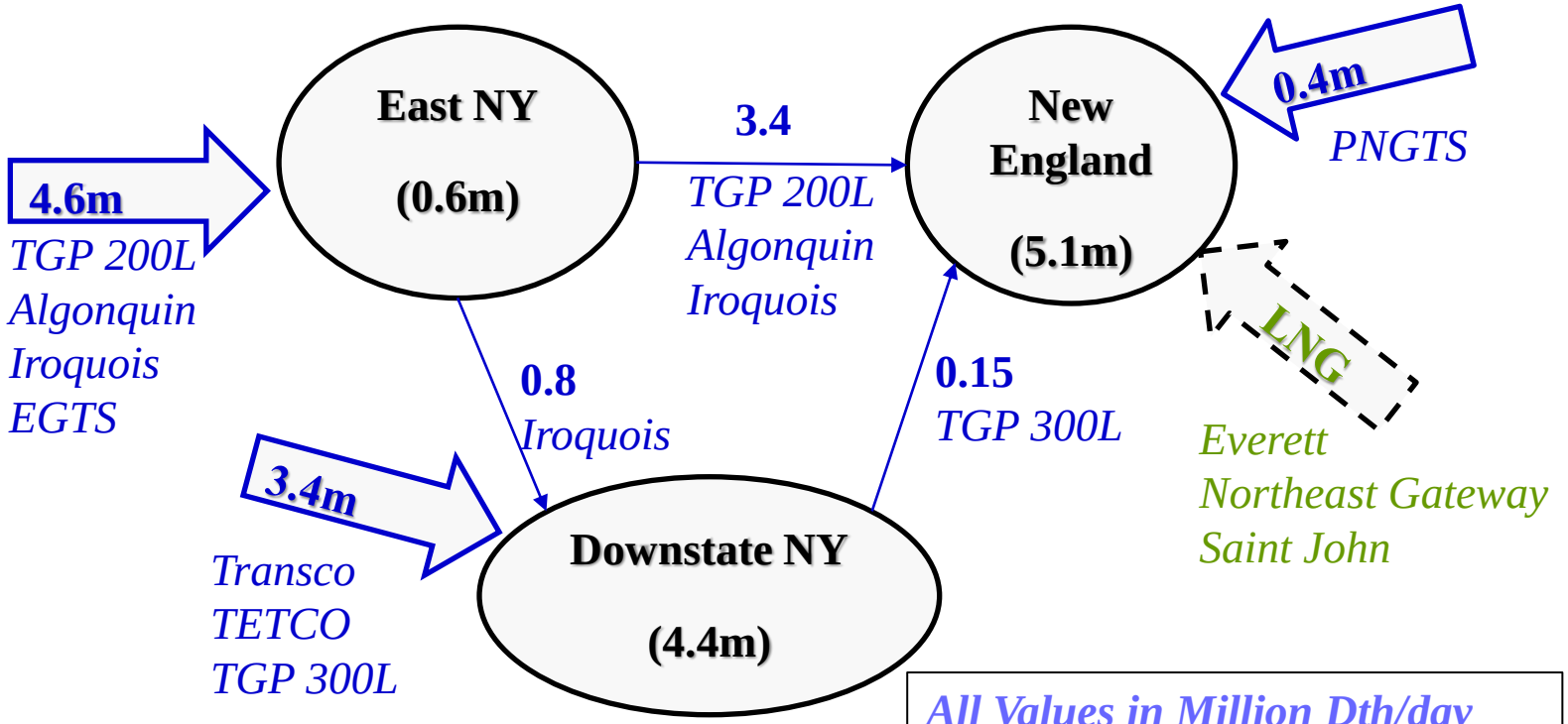
External and Internal Pipeline Limits

- **Stored/imported LNG is needed to satisfy *regional* peak gas demand.**
- **Transport through NY to NE may be limited on the margin…but does not lead to significant surplus gas in eastern NY.**



All Values in Million Dth/day
LDC Design Day Demand
Interstate Pipelines (excl. LNG)

Pipeline limits based on simultaneous max in 2021/22 winter.

Regional Gas Supply & Core Demand: Conclusions

- Under severe winter conditions, LDC demand is expected to exceed pipeline capability to the region.
  - ✓ Incremental firm gas will likely require additional LNG imports to the region.
  - ✓ LNG imports must be arranged many months before the winter.
- In a typical winter, LDCs' actual demand is lower than Design Day demand.
  - ✓ Thus, firm pipeline capacity often becomes available to power generators on a short-term basis.
  - ✓ However, we should not assume that short-term firm capacity will be available under severe winter conditions.

Analysis of Gas Available to Generators

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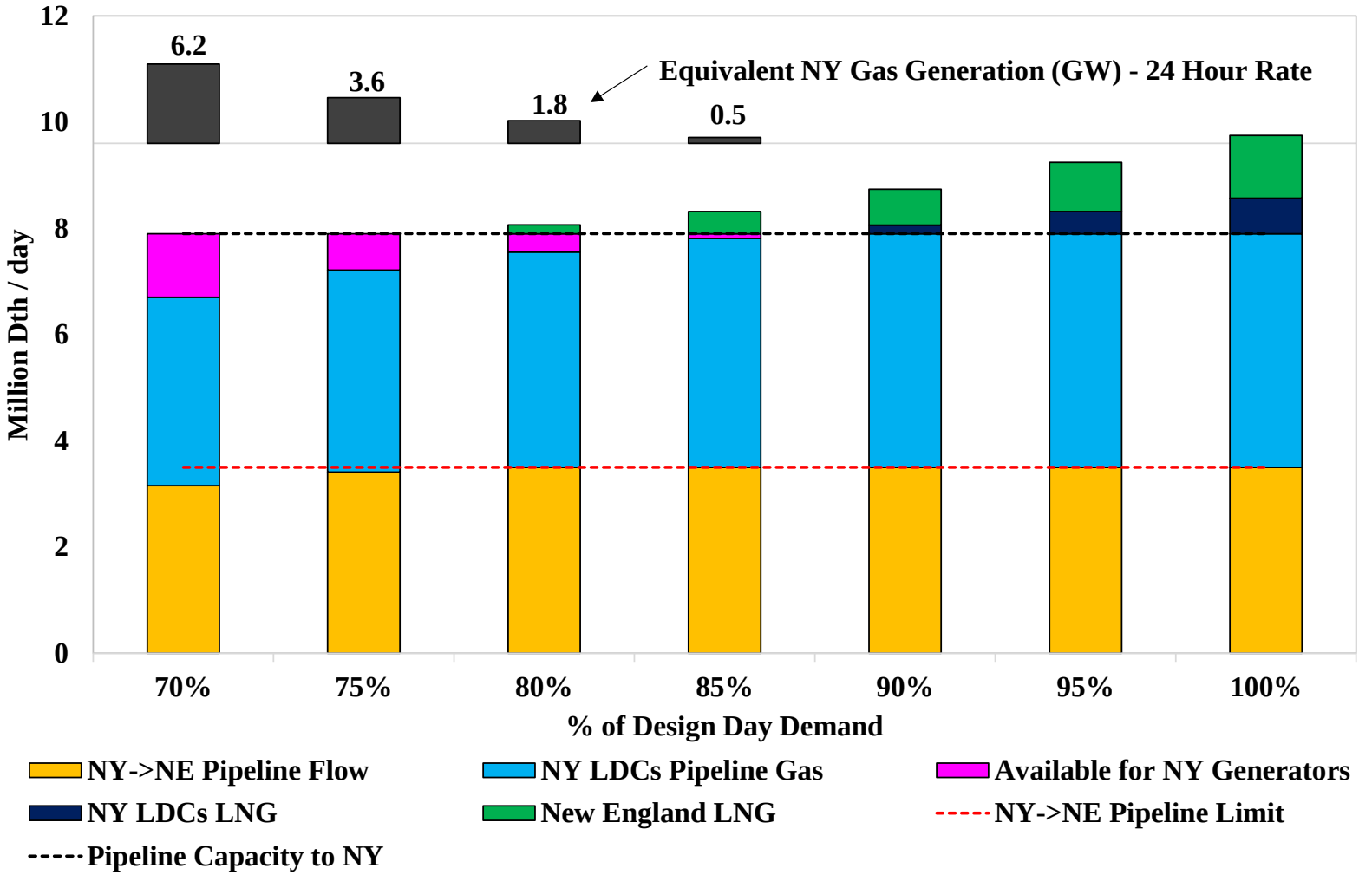
Illustration of Gas Available to Generators

- The following slide illustrates approx. gas available for NY generators as a function of winter weather.
  - ✓ We assume pipeline gas first satisfies LDCs' firm demand, then excess capacity is sold to generators.
  - ✓ We assume New England LDCs hold contracts for firm delivery across interstate pipelines through NY.
  - ✓ LDCs use stored/imported LNG if pipeline gas is insufficient.
- **In moderately cold weather, pipeline limits to New England cause some gas to be available to generators in eastern NY.**
- **In very cold weather, the entire region depends on LNG and no pipeline gas is available to NY generators.**

Illustration of NY->NE Constraints Impact



See notes on Slide 38

Historical Gas Imports and Generation

- Slides 23 to 27 show daily interstate pipeline imports, LNG imports* and gas consumption.
- Daily LDC gas usage is estimated as total regional imports minus gas burn of generators.
- **Key takeaways:**
  - ✓ In cold weather, pipeline gas hits ceiling and LNG imports increase.
  - ✓ Margin between pipeline imports and LDCs' consumption (e.g., gas available for generators) is small on cold days.
  - ✓ Gas-fired generation has been made possible by LNG imports in recent winters.

*LNG imports include Everett and Northeast Gateway facilities plus imports via Maritimes & Northeast pipeline (sourced from Saint John LNG)

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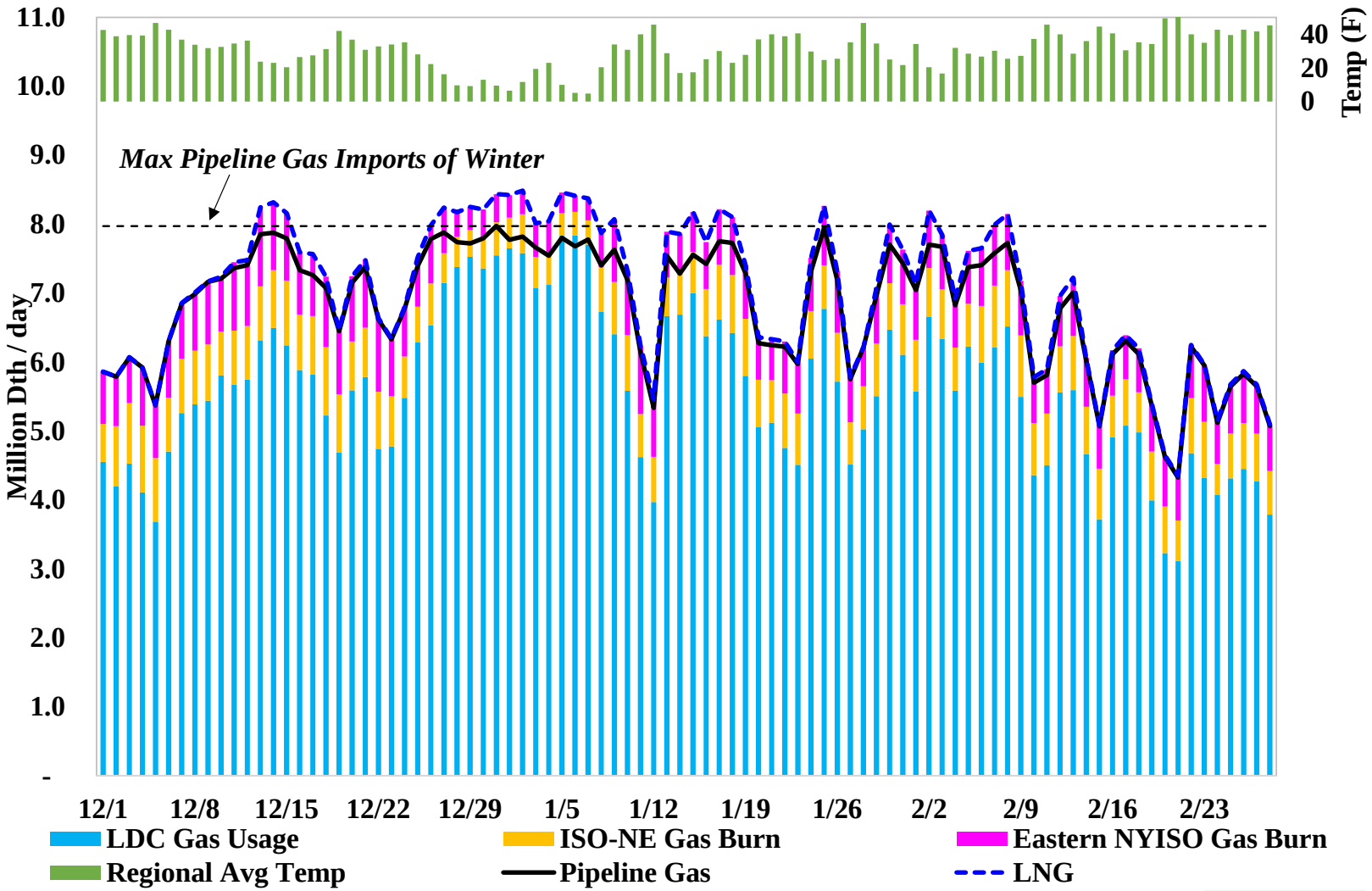
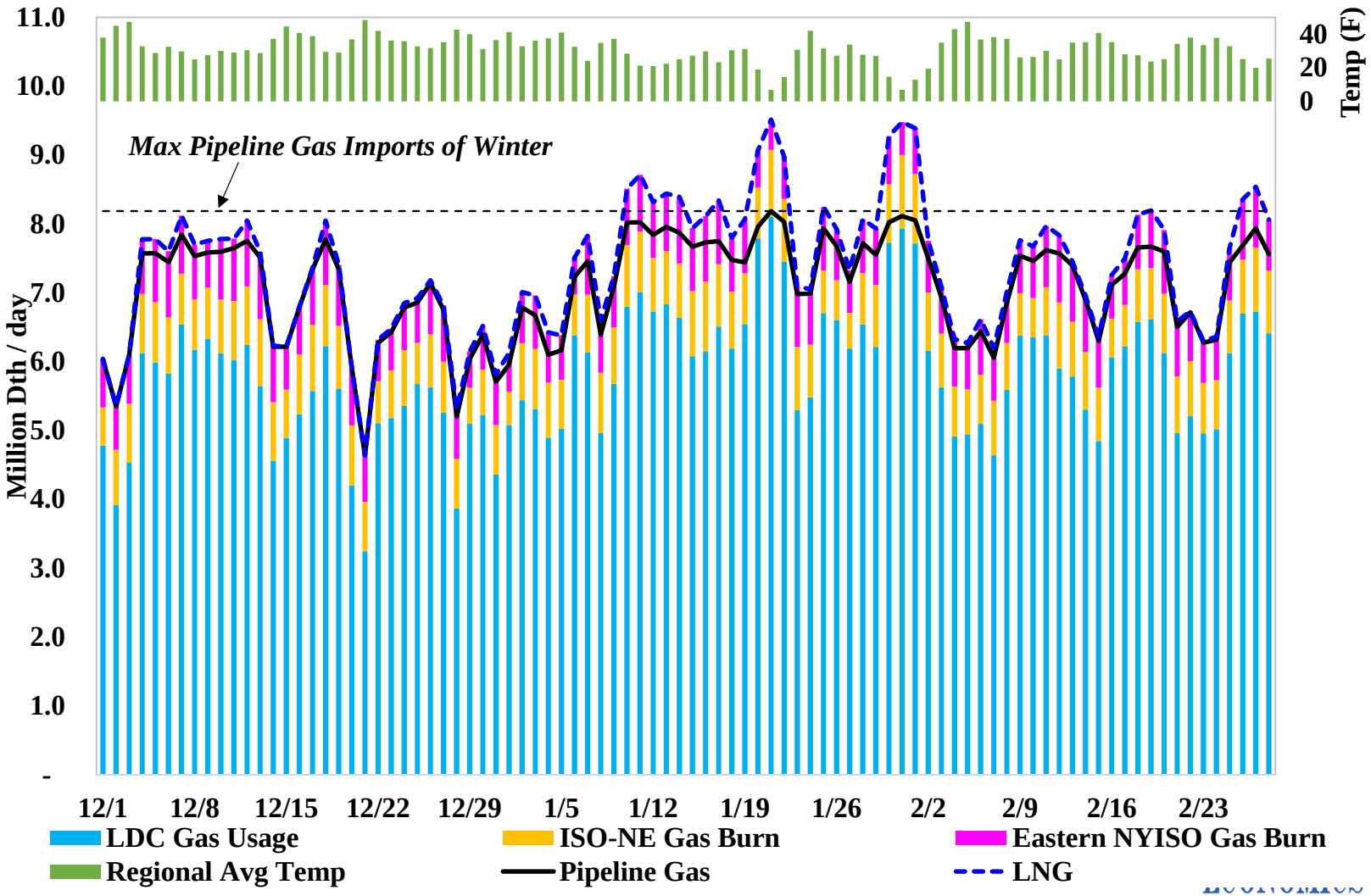
See notes on Slide 38

Regional Pipeline Gas and LNG
Winter 2017-2018



See notes on Slide 38

Regional Pipeline Gas and LNG
Winter 2018-2019



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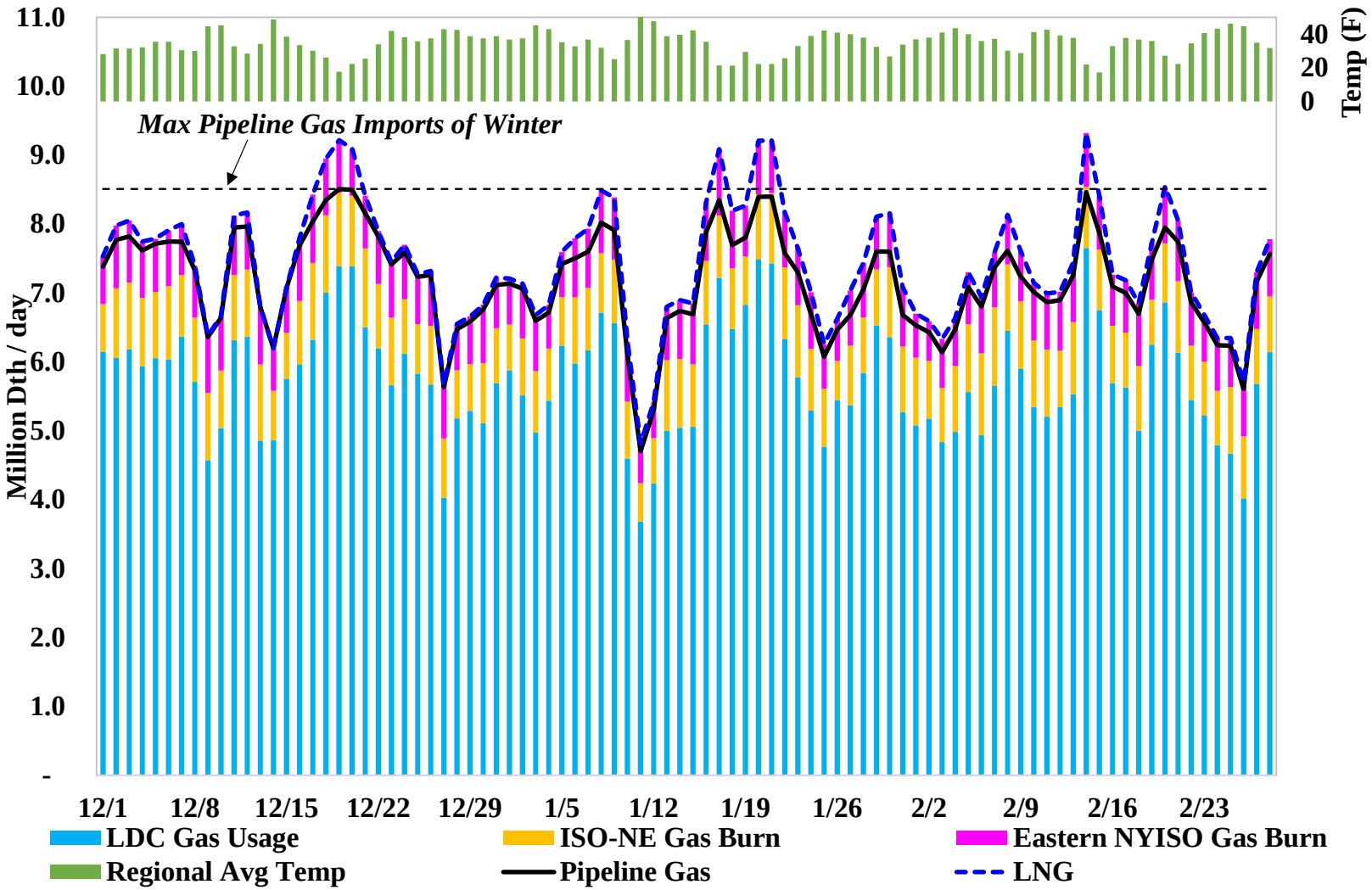
Regional Pipeline Gas and LNG
Winter 2019-2020



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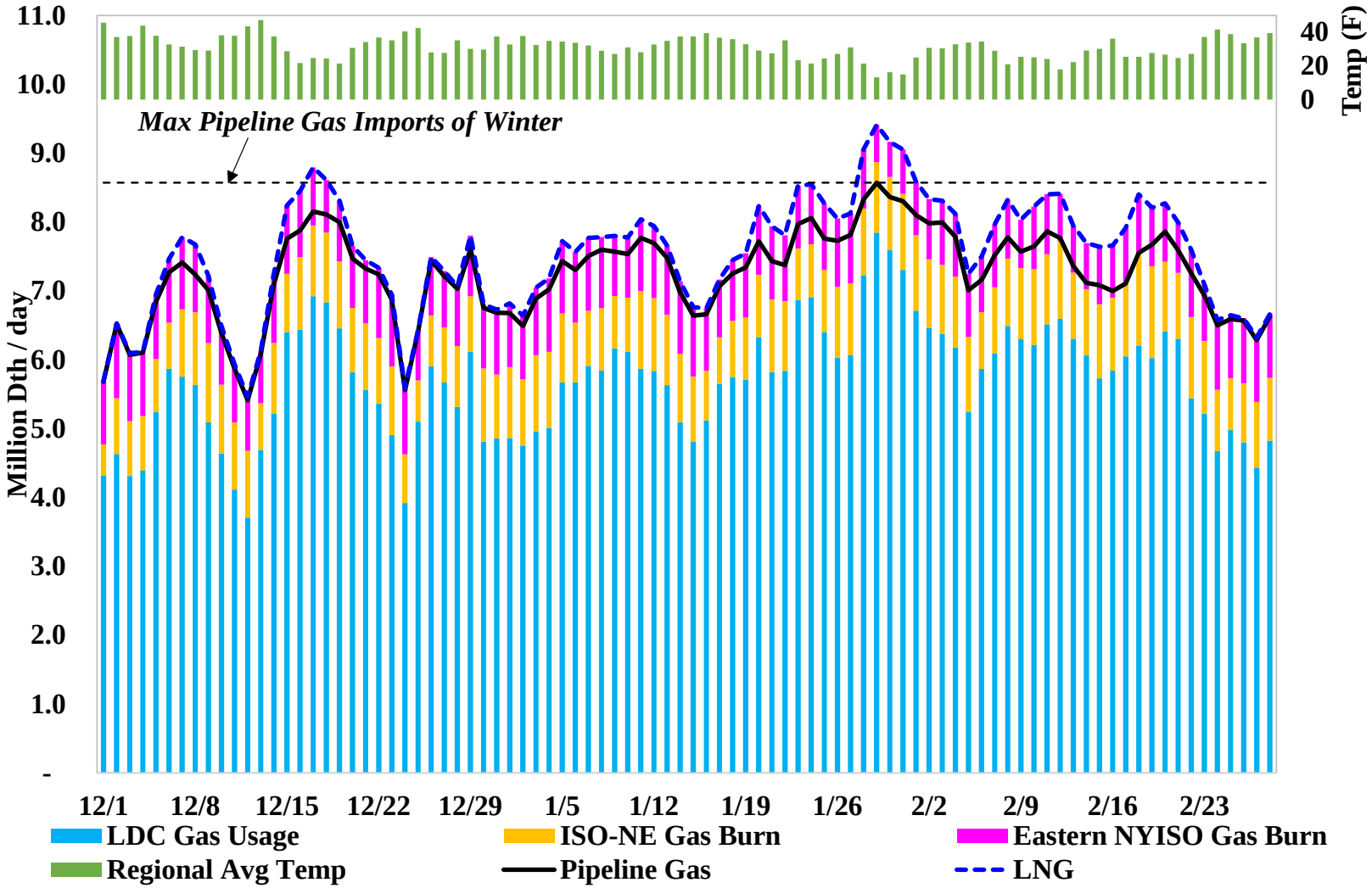
Regional Pipeline Gas and LNG
Winter 2020-2021



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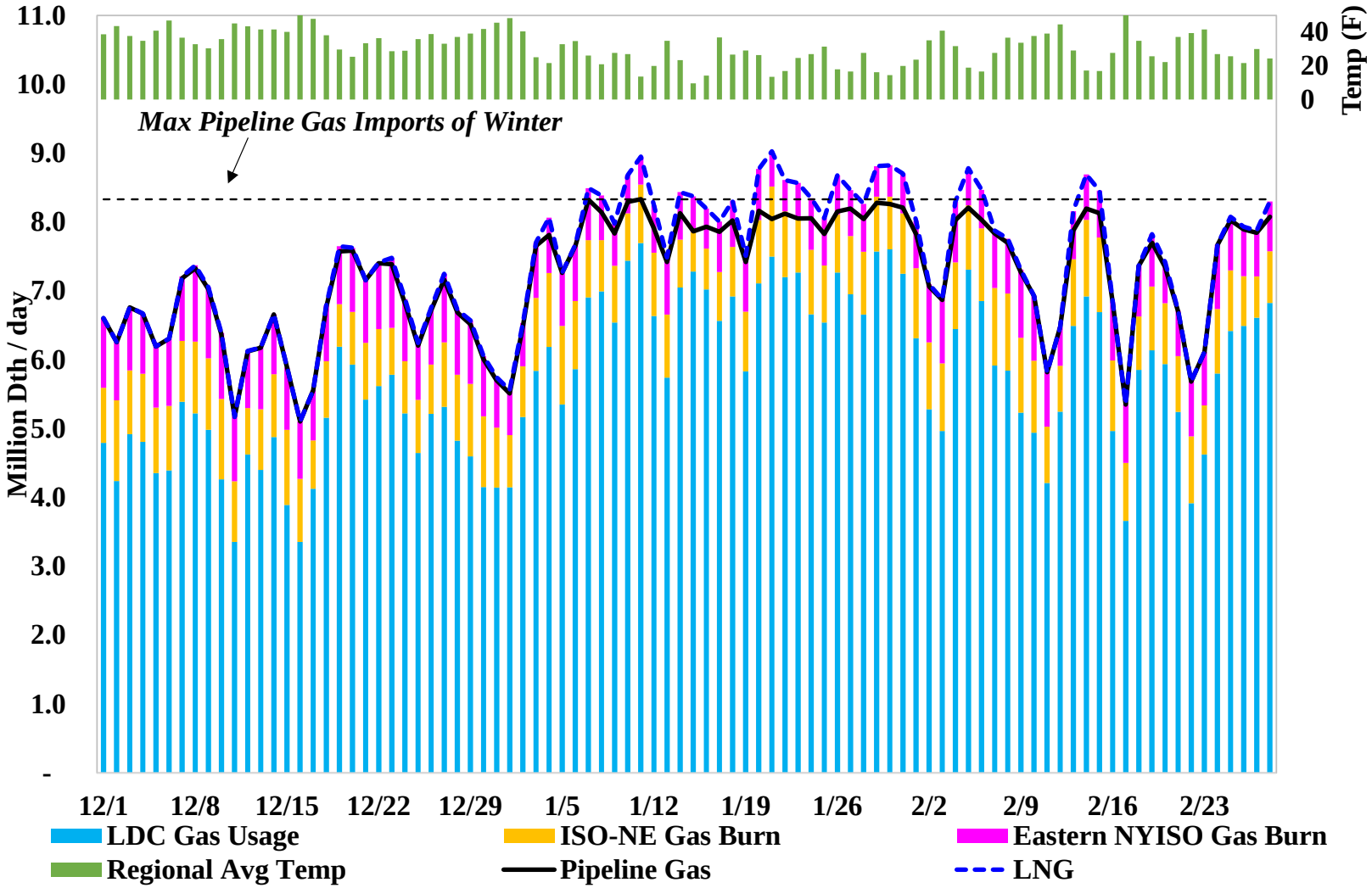
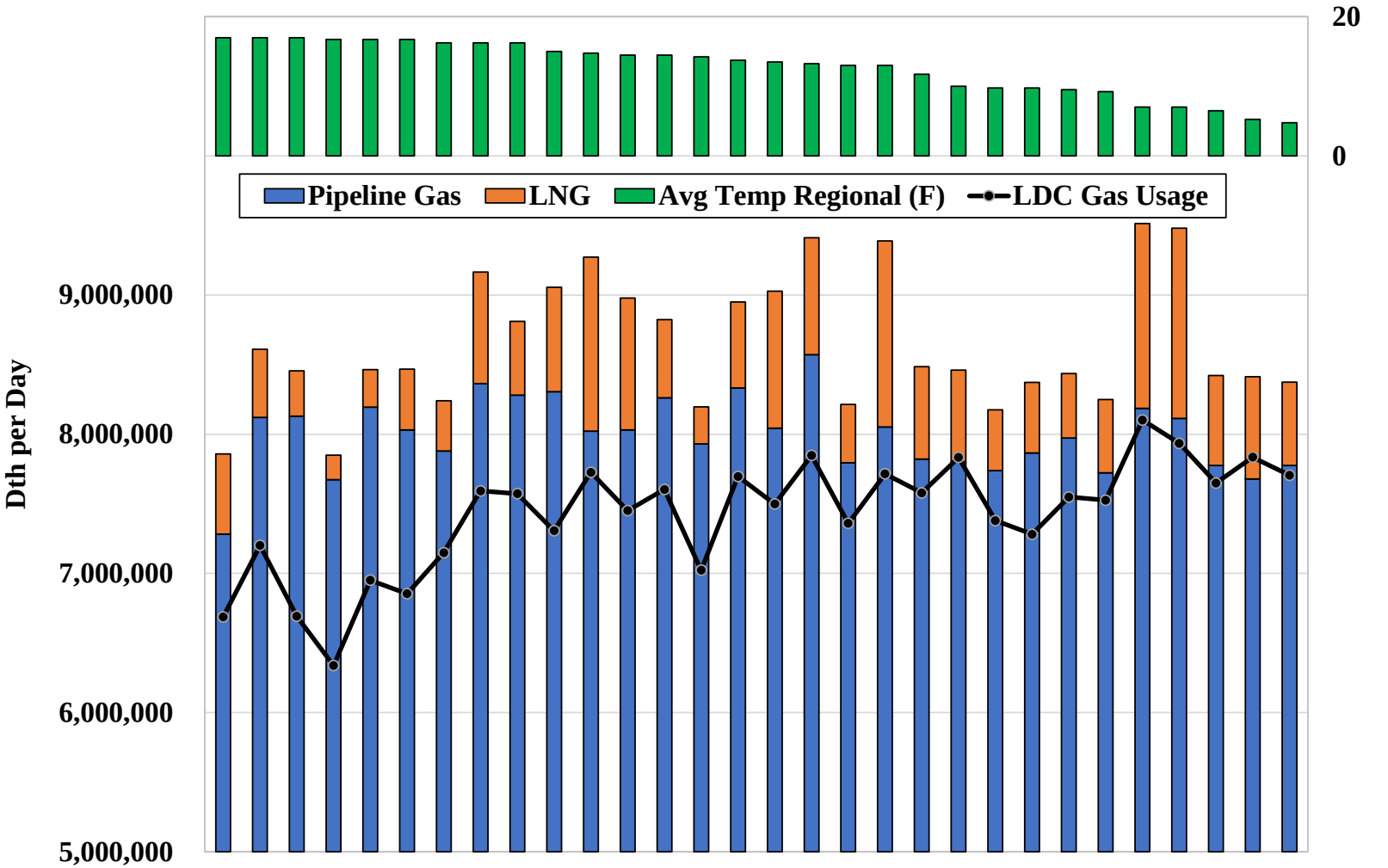
Regional Pipeline Gas and LNG
Winter 2021-2022



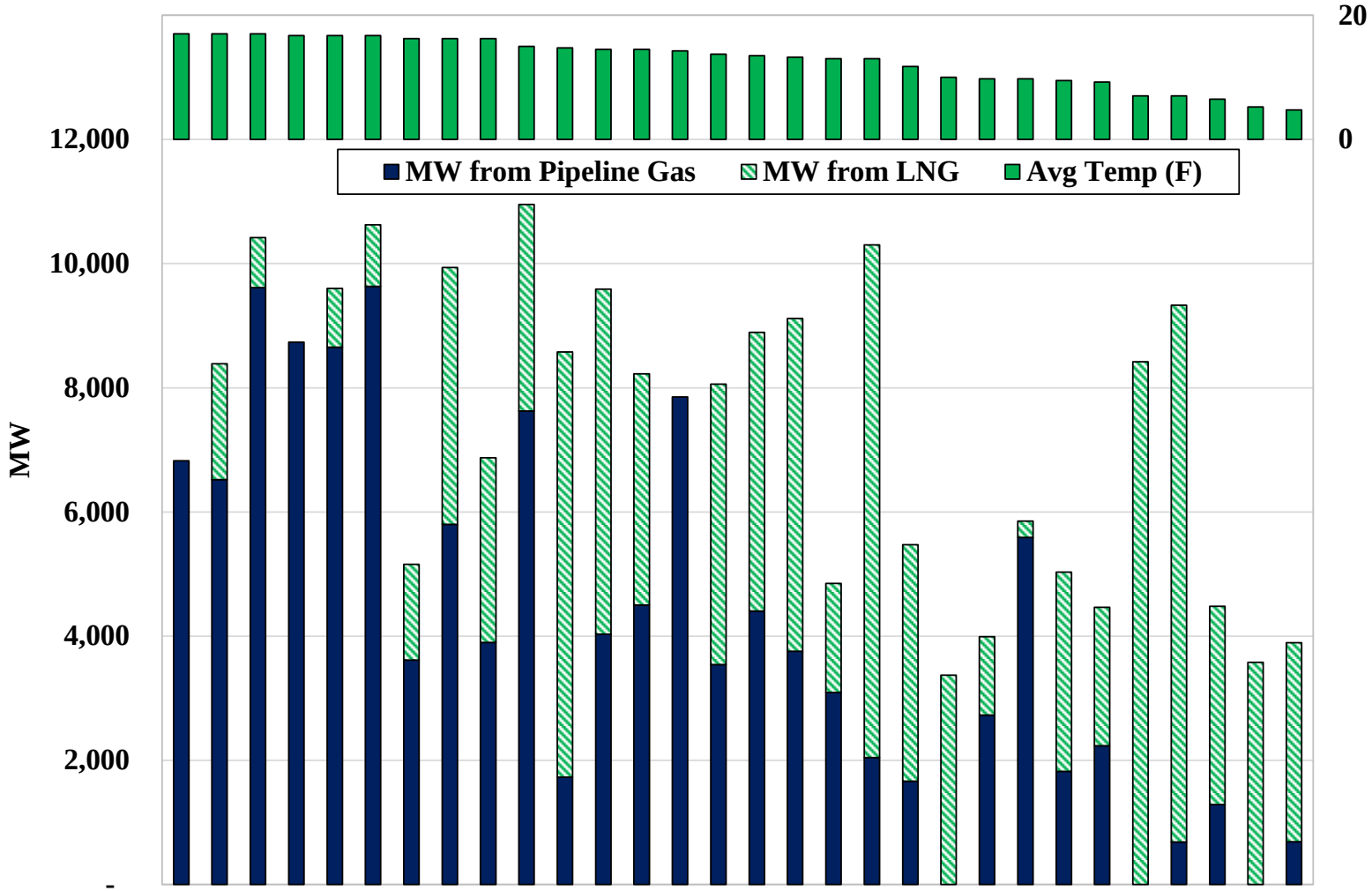
Importance of LNG in Non-Firm Gas Supply

- The following slides show how LNG imports are pivotal to the gas supply available for non-firm generators
  - ✓ Slide 29 illustrates that on the coldest days in recent winters, estimated LDC demand is close to (or can exceed) total pipeline imports
  - ✓ Slide 30 estimates the portion of region-wide non-firm gas generation made possible by LNG on the coldest days in recent winters
  - ✓ Slide 31 shows the variability of regional LNG imports in recent winters

Regional Gas Supply and LDC Usage
30 Coldest Days, Winter 2017/18 - 2022/23

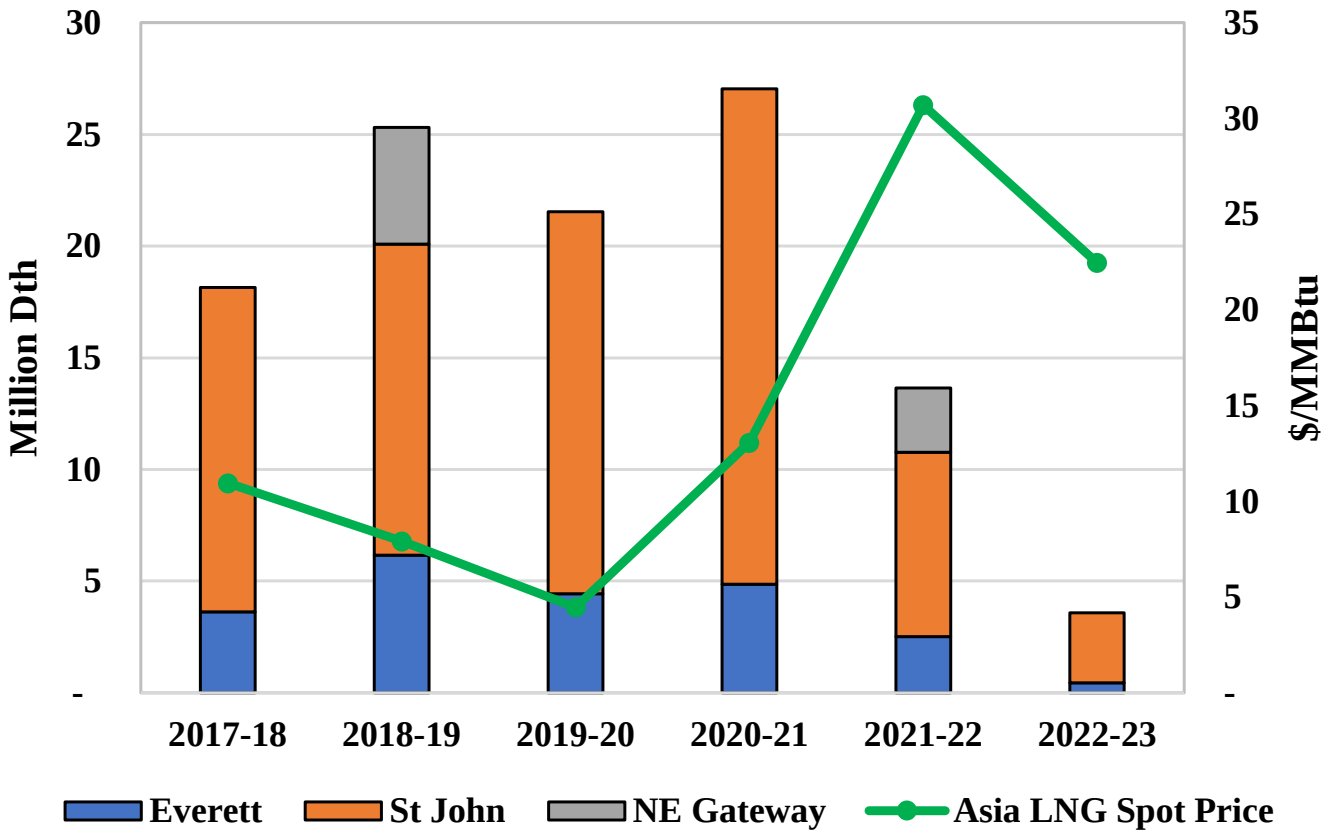


Non-Firm Gas Generation
30 Coldest Days, Winter 2017/18 - 2022/23



Winter LNG Imports and Prices

Excludes LNG to Mystic 8 & 9



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Importance of LNG in Non-Firm Gas Supply

- Modeling gas availability based on historical data will be very sensitive to how historical LNG is treated.
- Gas LDCs make excess LNG available, but this may not occur when conditions approach their 'design day' planning targets in a severe or lengthy cold snap.
  - ✓ **Just as historic average electricity imports exceed imports during Bin 1 and Bin 2 events, historic gas usage exceeds available gas supply during design day conditions.**
- More LNG likely available on cold days in a mild winter, which may skew historical scatter plot of gas generation vs. load.
- High global prices have lowered LNG supply relative to the past.
- When probabilistically modeling gas availability, an adjustment for potentially lower LNG injections than historically observed is needed.

See notes on Slide 39

Analysis of Gas Generator Availability

- The following slide compares daily regional gas-fired generation to NYCA peak load in winter 2017-18 through winter 2021-22.
- Includes all gas-fired generation in region, excluding certain units with dedicated fuel supplies (e.g. Mystic 8 & 9 in NE).
- Includes only pipeline gas generation
  - ✓ Regional LNG imports are netted out from generators' gas burn if pipeline inflows are at limit.
  - ✓ Excludes effect of generation made available by LNG for which generators lack contracts.

See notes on Slide 39

Regional Pipeline Gas Generation
Net of LNG on Constrained Days

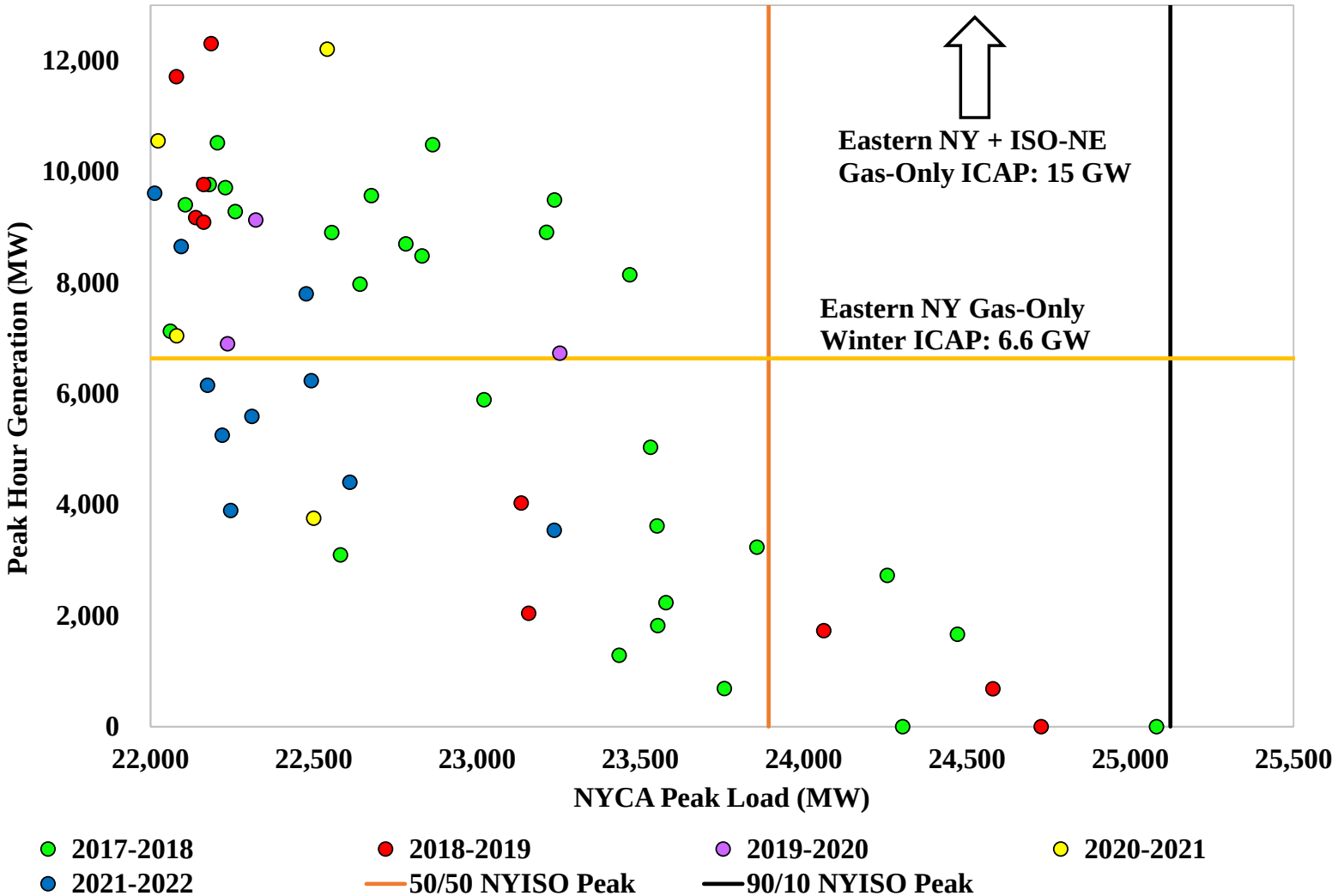
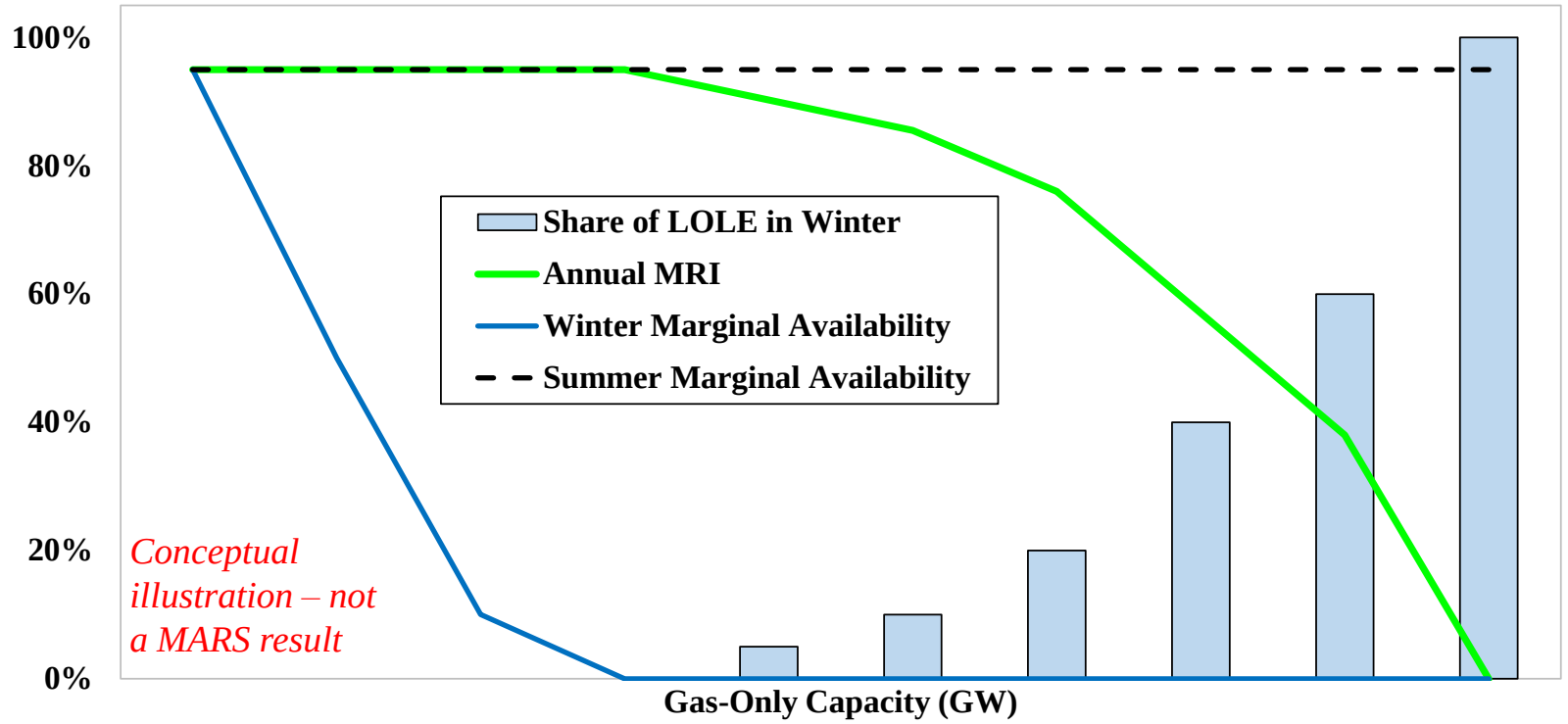


Illustration of Accreditation Impact



- Impact of gas limitations on accreditation outcomes depends on timing of reliability risk after considering seasonal supply.
- Summer peak load is much higher, so risk is concentrated in summer unless large amounts of supply are unavailable in winter.

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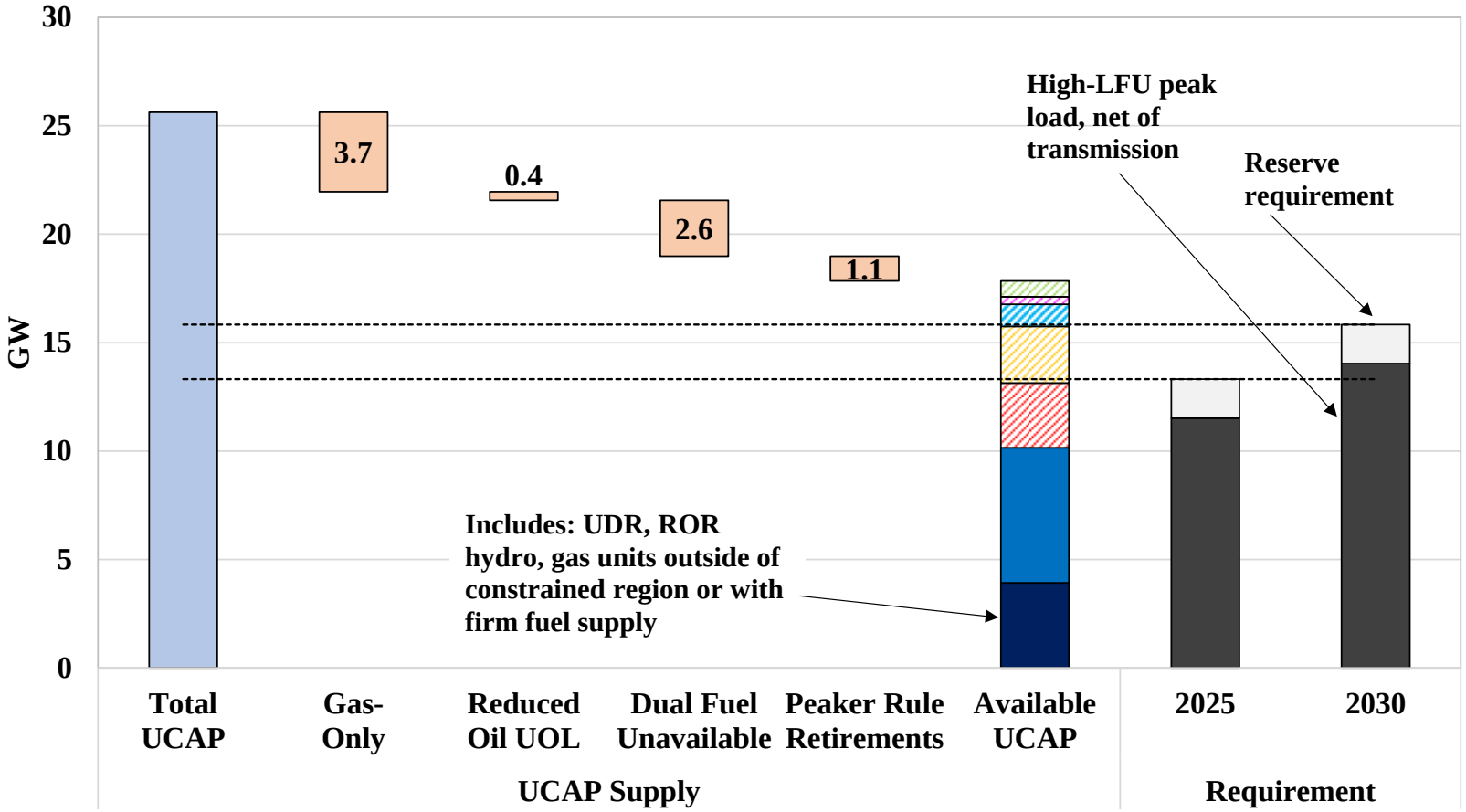
See notes on Slide 40

Winter Peak Supply vs. Demand
Eastern NY

Reserve margins in Eastern NY highly dependent on oil units with limited tanks.



Conclusions

- Peak winter demand for gas exceeds pipeline capacity to Eastern New York and New England.
  - ✓ Gas LDCs reserve/procure vast majority of this capacity.
- On very cold days, gas will be available to generators only if:
  - ✓ Generator has firm transport contract, or
  - ✓ Imported LNG creates a surplus above LDCs' needs.
- NYISO's RA model should discount non-firm gas-only generators and external assistance from New England in winter
- Impact on capacity value depends on degree of winter reliability risk after appropriately discounting resources
  - ✓ Will also need to consider availability of oil-fired units with limited fuel storage and refueling capacity.

Appendix: Notes on Figures

- Notes on Slide 23-27 (Regional Pipeline Generation and LNG)
  - ✓ Generation totals include gas-fired generation by gas-only and dual fuel units in the Eastern NY + New England region (see county map on Slide 6), excluding Mystic 8 & 9
  - ✓ LNG imports include Everett and Northeast Gateway facilities plus imports via Maritimes & Northeast pipeline (sourced from Saint John LNG). Excludes LNG imports directly to Mystic 8 & 9.
  - ✓ Pipeline Gas includes interstate pipeline flows at delivery points/segments entering Eastern NY + New England region, listed on Slide 7 (excluding flows from Maritimes & Northeast pipeline considered to be LNG imports)
  - ✓ Daily LDC Gas Usage estimated as residual of Pipeline Gas + LNG minus gas-fired generation Eastern NY and New England.
  - ✓ Temperature shown is average of NYC and Boston areas.

Appendix: Notes on Figures

- Notes on Slide 34 (Regional Pipeline Gas Generation Scatter Plot)
  - ✓ 50/50 and 90/10 NYCA peak load forecasts derived from 2022 Gold Book
  - ✓ 'Gas-Only' ICAP includes:
    - Capacity of gas-fired units with no dual fuel equipment,
    - Capacity of dual fuel units that can only run on gas due to equipment maintenance or permitting issues, and
    - Incremental capacity of dual fuel units that have higher upper operating limits when running on gas than alternative fuel.
  - ✓ Data points reflect peak hour gas-fired generation by gas-only and dual fuel units in the Eastern NY + New England region (see county map on Slide 6), excluding selected units with unique fuel supply arrangements
  - ✓ Gas-fired generation data is adjusted to exclude supply made available by LNG by prorating generation using the following ratio (values in daily Dth):

Max(0, Regional LNG Imports – (Max Pipeline Import Capability – Pipeline Gas Imports)) / Daily Total Generator Gas Consumption

Appendix: Notes on Figures

- Notes on Slide 36 (Eastern NY Winter Peak Supply vs Demand)
  - ✓ Total UCAP reflects generator, UDR and SCR capacity sold in Winter 2021/22 Spot Auctions
  - ✓ 'Requirements' for F-K region are estimated as:
    - 2022 Gold Book coincident peak load forecast for zones F-K multiplied by one plus average Bin 1&2 load forecast uncertainty multiplier from MARS 2023 IRM model
    - *minus* CE Group emergency import limit reflecting AC Transmission projects,
    - *plus* 1800 MW SENY reserve requirement.
  - ✓ Capacity categories:
    - *Gas-Only*: Capacity of gas-fired units with no dual fuel equipment,
    - *Reduced Oil UOL*: Capacity of dual fuel units that can only run on gas due to equipment maintenance or permitting issues, and
    - *Dual Fuel Unavailable*: Incremental capacity of dual fuel units that have higher upper operating limits when running on gas than alternative fuel.
    - *Peaker Rule Retirements*: units indicating retirement by 2025 to comply with DEC Peaker Rule regulations in 2022 Gold Book
  - ✓ Dual fuel oil inventories classified based on NYISO winter fuel survey data