ELECTRIC TRANSMISSION 301:

Grid Resilience, Gas-Electric Coordination, New Business Models

June 10, 2014

FACULTY:

- *Charles Berardesco, Senior Vice President and General Counsel, North American Electric Reliability Corp.*
- *Harry Vidas, Vice President, ICF International Energy Advisory & Solutions*
- *Anne George, Vice President of External Affairs, ISO-New England; former Connecticut DPUC Commissioner*
- *Steven Burtch, Senior Vice President of Business Development, AltaLink*
- *Cary Kottler, General Counsel, Clean Line Energy Partners*
- *Jim Hoecker, Husch Blackwell LLP, Counsel to WIRES and former FERC Chairman (Moderator)*

Presented by WIRES - a national coalition of organizations dedicated to investment in a strong, well-planned and environmentally beneficial electricity high voltage transmission system in the US.

Meeting New Challenges To Grid Reliability

- “The Power Grid: Our Achilles Heal” –Wall Street Journal
- “Power Grid Preparedness Falls Short, Report Says” –New York Times
- “Hackers Seek to Disrupt Electric Grid Through‘Smart Devices’ ”
  –San Francisco Chronicle
- “U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather.” –U.S. Department Of Energy
- “[N]ewer technologies and construction standards…allow new projects to offer greater storm resilience than the existing lines.” –Brattle/WIRES

ELECTRIC TRANSMISSION 301: NERC and Infrastructure Security

Charles A. Berardesco

Senior Vice President and General Counsel

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda

- NERC Overview
- Standards
- Compliance Monitoring and Enforcement Program
- Critical Infrastructure Protection
- Reliability Assessment and Performance Analysis
- Reliability in Canada
- NERC Resource and Contact Information

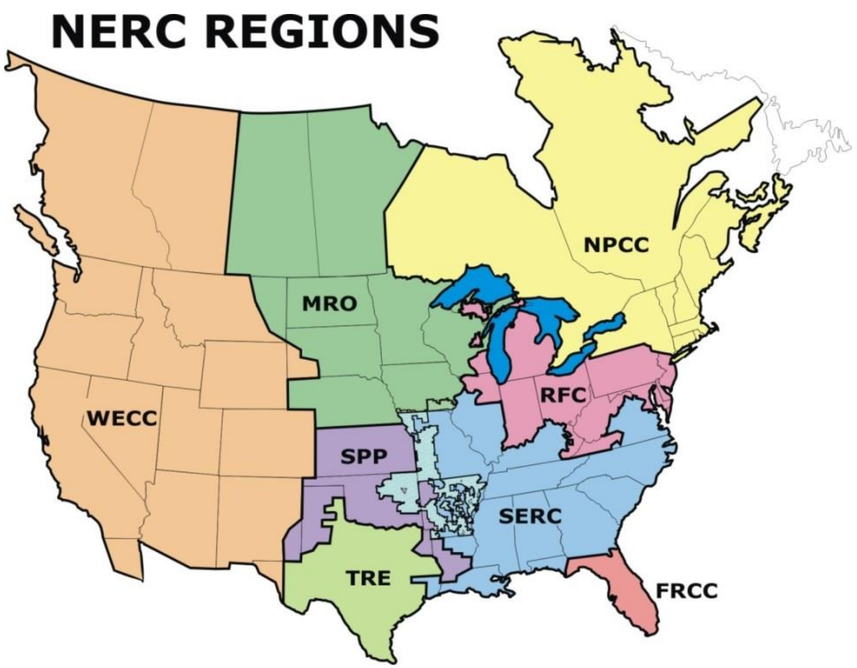
NERC Overview

History of NERC

- Evolution from voluntary, industry-sponsored organization to certified Electric Reliability Organization (ERO)
- Certified as ERO pursuant to section 215 of the Federal Power Act
- Subject to oversight by FERC and Canadian federal and provincial authorities
- Delegation agreements with Regional Entities (REs)
- Reliability Standards became mandatory and enforceable on June 18, 2007

Role of the Regions

- NERC works with eight (8) REs
- Authority delegated pursuant to Section 215(e)(4) of the Act (separate delegation in U.S. and Canada)
- REs enforce Reliability Standards within their geographic boundaries
- May develop Regional Reliability Standards and Regional Variances
- Must comply with the applicable provisions of NERC's Rules of Procedure and Reliability Standards



NERC's Statutory Program Areas

- Reliability Standards
- Compliance Monitoring and Enforcement Program
- Organization registration and certification
- Reliability Assessment and Performance Analysis
- Training, Education and Certification
- Situation Awareness
- Infrastructure Security

NERC Perspective on Key Potential Risks

- Changing Resource Mix
  - Coal to natural gas
  - Effect of renewables
  - Effect of distributed generation
- Extreme Physical Events
  - GMD
  - Storms
- Cold Weather Preparedness
- Cyber and Physical Security
  - Responding to nation-state threats

Standards

Stakeholder Accountability

- Standard development process depends on active participation of stakeholders
- Stakeholder technical expertise is essential to standard development process
- Standards must be approved by FERC
  - Order 672: Commission must give "due weight to technical expertise of ERO"

Standards Committee

- Prioritizing standards development activities
- Reviews actions to ensure the standards development process is followed
- Reviews and authorizes Standard Authorization Requests (SARs)
- Manages progress of SARs and standards development efforts
- Reviews and authorizes drafting new or revised standards and their supporting documents
- Makes appointments to drafting teams

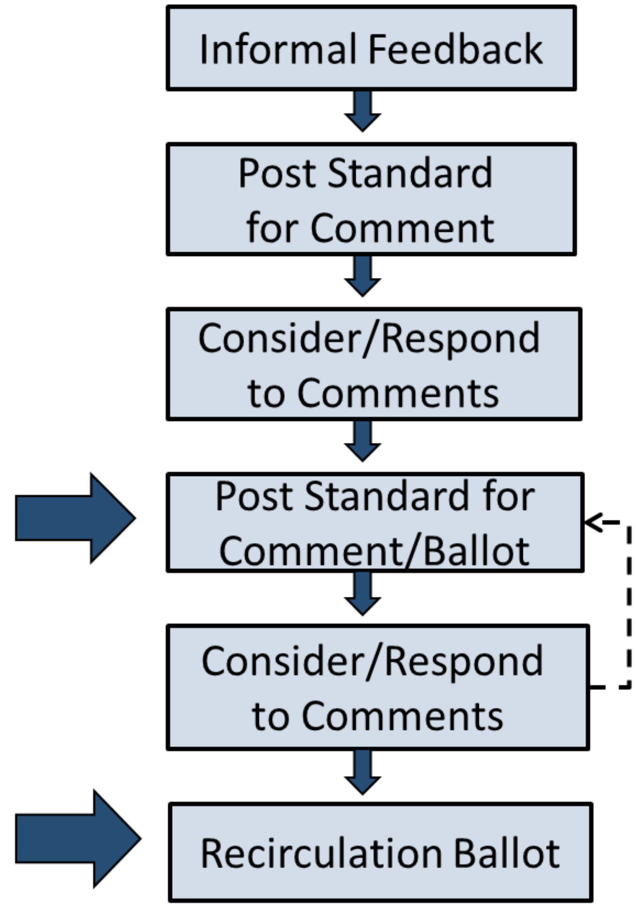
Stakeholder Consensus Process

New/Successive Ballot:

At this step, the standard is either "new" or significantly changed from the last version posted for comment/ ballot. The ballot record starts with no votes and no comments.

Recirculation Ballot:

At this step, there have been no significant changes to the standard from the last ballot. The ballot record starts with all votes and comments from the previous ballot.



Major New Standards

- Physical Security
  - Filed with FERC, awaiting approval
  - Requires applicable entities to assess major risk and develop protection plans
- CIP Version 5 Standards
  - Only national and enforceable cyber-security standards
  - Working actively with industry to transition to new standards
  - Response to FERC directives contained in order approving Version 5

Compliance Monitoring and Enforcement Program (CMEP)

CMEP Overview

- Focus on improving bulk power system reliability
  - Prompt reporting
- Protects confidentiality of involved parties
- Regional implementation
  - REs perform compliance monitoring of users, owners and operators on behalf of NERC
- NERC oversight role
  - Active oversight
  - Review of regional implementation

CMEP Overview (Cont'd)

- NERC monitors, assesses and enforces compliance
- CMEP identifies eight (8) monitoring methods:
  - Self-Report
  - Self-Certification
  - Periodic Data Submittal
  - Exception Reporting
  - Complaints
  - Compliance Investigations
  - Compliance Audits
  - Spot Checks
- Over 1,900 entities are subject to over 100 Standards

Reliability Assurance Initiative

- Development and enhancement of risk-based compliance and enforcement approaches
- Activities include:
  - The completion of an ERO-wide Compliance Auditor Manual and Handbook
  - ERO-wide consistent methodologies for risk assessment and evaluation of management controls
  - Improvements to self-reporting and streamlined enforcement process, known as Find, Fix, Track and Report
  - Pilots to streamline enforcement and focus resources on those areas that pose a greater risk to reliability and security of the bulk power system

Aggregation Program

***Purpose*:**

Allows applicable registered entities to self-assess issues, identify risk, and mitigate issues posing a minimal risk to reliability

- Participants will maintain a record of instances of noncompliance with specified Standards
- Minimal risk issues only
- Tracking format by spreadsheet
- Spreadsheet provided to Regional Entities after six months

Enforcement Discretion

Purpose:

to identify minimal risk issues which would be recorded and mitigated without triggering an enforcement action

- NERC and the Regional Entities will monitor and log issues tracked for enforcement discretion treatment to refine discretion criteria (including issues regarding risk) and monitor trends
- Only minimal risk issues at this time

End-State RAI Processes

Maturity Continuum

Mature controls / Risk assessment

- Eligible for adjustment in scope, monitoring and related testing
- May be eligible for aggregation/logging
- Presumption of discretion

Controls not provided

- May require increased scope, monitoring or testing
- Not eligible for aggregation/logging
- No presumption of discretion

NERC Critical Infrastructure Protection Department Priorities

CIP Department Priorities

- Critical Infrastructure Protection (CIP) Standards
  - CIP v3 to v Transitioning
- Electricity Sector Information Sharing and Analysis Center (ES-ISAC)
  - ES-ISAC Capability Enhancements
  - Cyber Risk Preparedness Assessments
  - White House Electricity Subsector Cybersecurity Capability Maturity Model
- Coordination of efforts with reorganized Electric Sub-Sector Coordinating Council
- Outreach and Awareness Activities
  - Grid Security Conference
  - Grid Security Exercise

Reliability Assessment and Performance Analysis

Reliability Assessment and Performance Analysis (RAPA)

- Assess, measure, and investigate historic trends and future projections to ensure BPS reliability.
  - Identify the trends
  - Analyze and benchmark the trends
  - Identify solutions and assess needs for BPS reliability improvement
  - Develop solutions to those problems and needs

Reliability and Adequacy Assessments

- Three annual independent reliability assessments prepared, pursuant to authority in FPA 215(g), whereby NERC is required to conduct periodic assessments of the reliability and adequacy of the bulk-power system in North America
  - Long-Term Reliability Assessment
    - 10-year outlook
  - Winter Reliability Assessment
    - Issued in the late fall, which reports on the reliability outlook for the coming winter season
  - Summer Reliability Assessment
    - Issued in the spring, which reports on the reliability outlook for the coming summer season

NERC Reliability Assessments

- Peak demand forecasts
- Resource adequacy
- Transmission adequacy
- Key issues and emerging trends impacting reliability
  - Technical challenges
  - Evolving market practices
  - Potential legislation/regulation
- Regional self-assessment
- Ad-hoc special assessments

Periodic Special Reliability Assessments

- Accommodating High-Levels of Variable Generation
- Impacts of Environmental Regulations
- Smart Grid Reliability Considerations
- Reliability Impacts of Climate Change Initiatives
- Effects of Geomagnetic Disturbances on the BPS
- Natural Gas and Electric Power Dependencies

Performance Analysis of BPS

- Identify and track key reliability indicators as a means of benchmarking reliability performance and measuring reliability improvements
- Include assessing available metrics, developing guidelines for acceptable metrics
- Maintaining reliability performance indicators
- Developing appropriate reliability performance benchmarks

Reliability Risk Analysis and Control

- Works with Events Analysis, Reliability Assessments, and Performance Analysis to identify key reliability risks
- Supports the Reliability Issues Steering Committee (RISC)
- Administers RISC processes for cataloging, analyzing, and controlling reliability risk

Reliability in Canada

Electric Reliability in Canada

- Constitutional authorities
  - Ensures no one dominant/authority perspective
- History of the industry
- Structure and characteristics
- A long history of reliability
- Commitment to, and expectations of, an international ERO
- Ongoing cross-border support and assistance in times of need

A Reliability Assurance Mosaic

- Nine (9) jurisdictions with reliability authority
  - Each has its own regime
  - All committed to working with the ERO
- Some "mature" but all evolving
  - Changes in policies, structures and practices with implications for how reliability is managed
- Compliance oversight and enforcement coming to the fore

Interactions in Canada

- Canadian participation is formally integrated in NERC's foundation documents
  - But limited Canadian membership/registration in ERO
- Strong, positive engagement with Canadian jurisdictions and stakeholders
  - Federal/Provincial/Territorial (FPT) reliability working group
  - CAMPUT (Canadian Association of Members of Public Utility Tribunals)
  - Key federal departments and agencies (including the Security & Intelligence community)
  - Canadian Electricity Association

Coordinating Electric and Natural Gas Systems

ELECTRIC TRANSMISSION 301:

Coordinating Natural Gas/Electric Operations and Long-Term Resource Planning and Investment

Harry Vidas

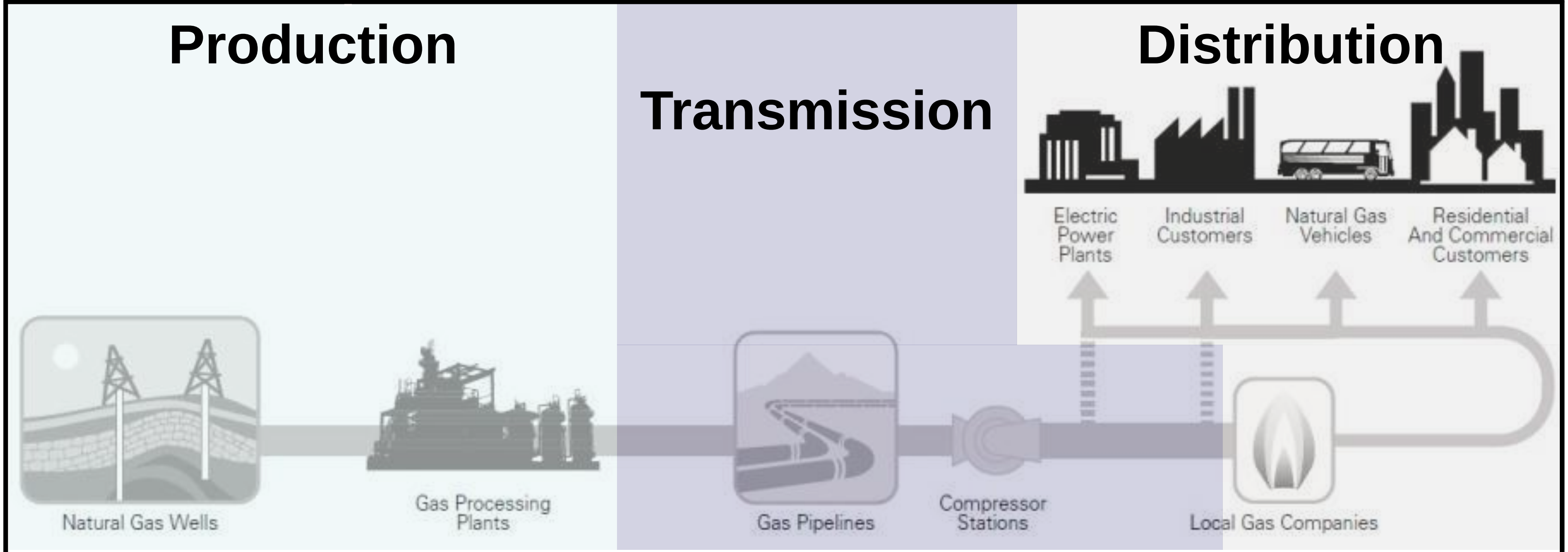
Vice President

Overview

- Why is natural gas different from other fuels used for electricity generation?
- Why is interest in gas/electric integration and coordination growing?
- What are the relevant analytic and policy questions?
- How do we find the answers?

Overview: Understanding Natural Gas Value Chain Key to Power-Gas Integration

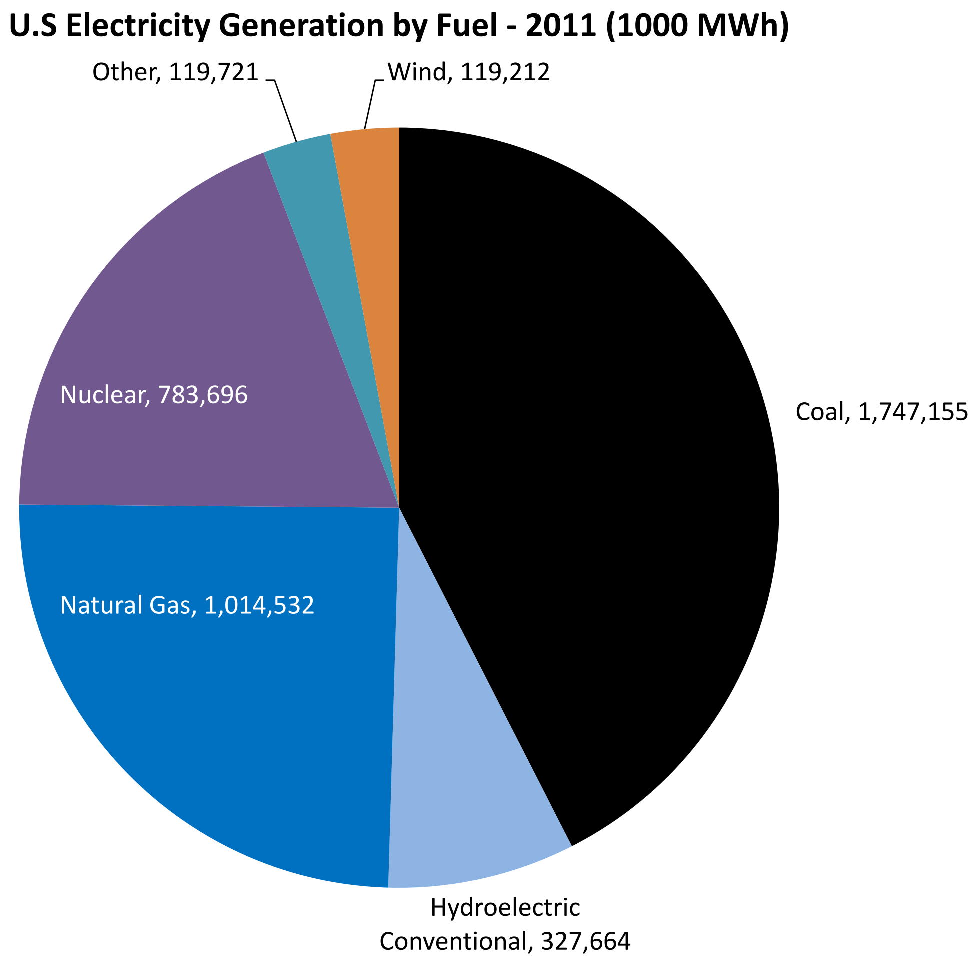
Simplified Illustration of Natural Gas Flow



Source: Natural Gas Council

Of the Major Electricity Generating Energy Sources, Only Natural Gas:

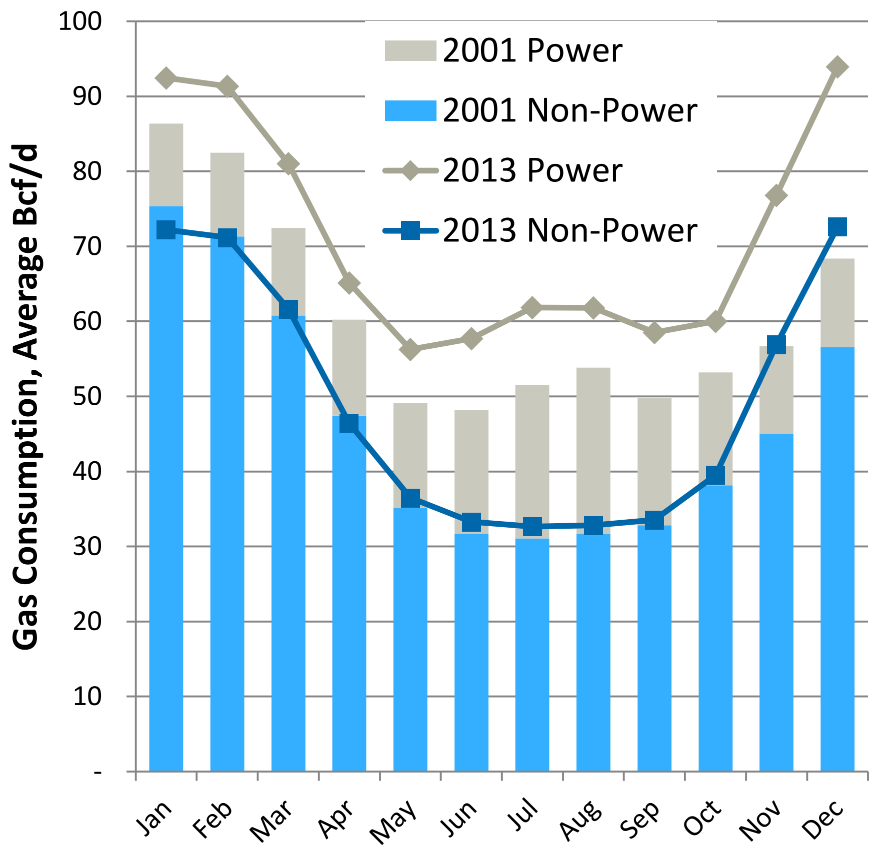
- Is not easily stored onsite – therefore, real-time delivery is critical to support generators.
- Procurement cycle is several times per day – not synchronized with electricity markets.
- Is also widely used outside the power sector – therefore the concurrent demand from other sectors critically affects supply for the power sector.
- Is delivered by a regulated pipeline under standard tariff services that cannot be modified for individual generators.



Gas-Electric Integration – Why has it Become Such a Big Issue?

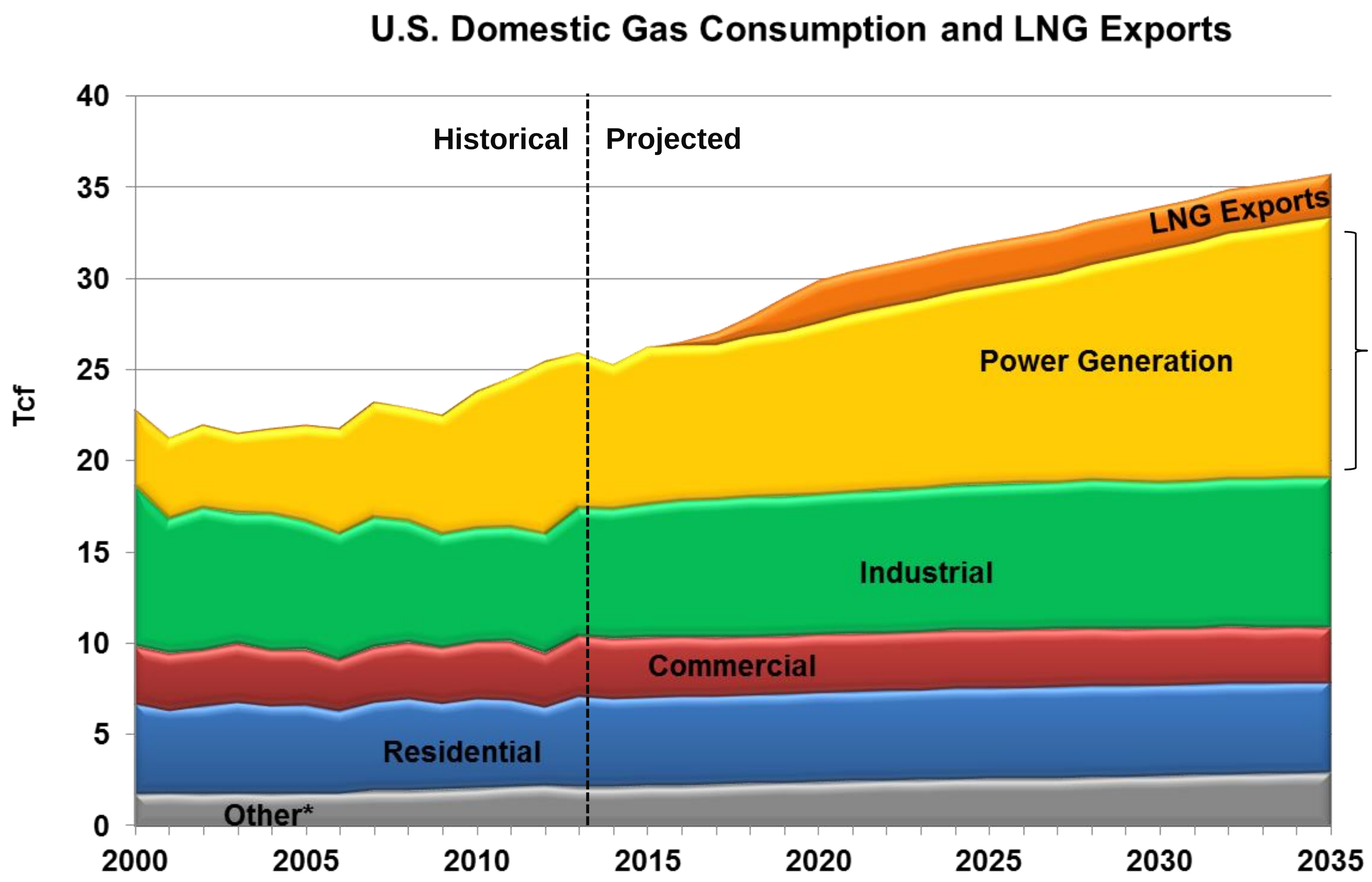
- Over the past 15 years, growth in gas-fired capacity has been robust.
  - Gas accounted for over 40% of installed capacity and nearly 30% of total generation in 2013.
  - Increased use of gas to meet base load generation results in higher winter peak demand when a number of regional markets can be constrained.
  - Expectation for continued growth in gas-fired generation, much like the growth exhibited in ICF's base case.
- Natural gas is seen as playing a growing role in "firming" variable generation.
- There have been events in which gas supply/delivery limitations have affected electricity delivery – there is concern that there will be more.
- There is long-term, continuing concern over the operational and contractual differences between gas and electricity systems.

J.S. Monthly Gas Demand, 2001 versus 2013



Source: EIA Natural Gas Consumption by End Use

Power Sector Will Become Bigger Share of Gas Market

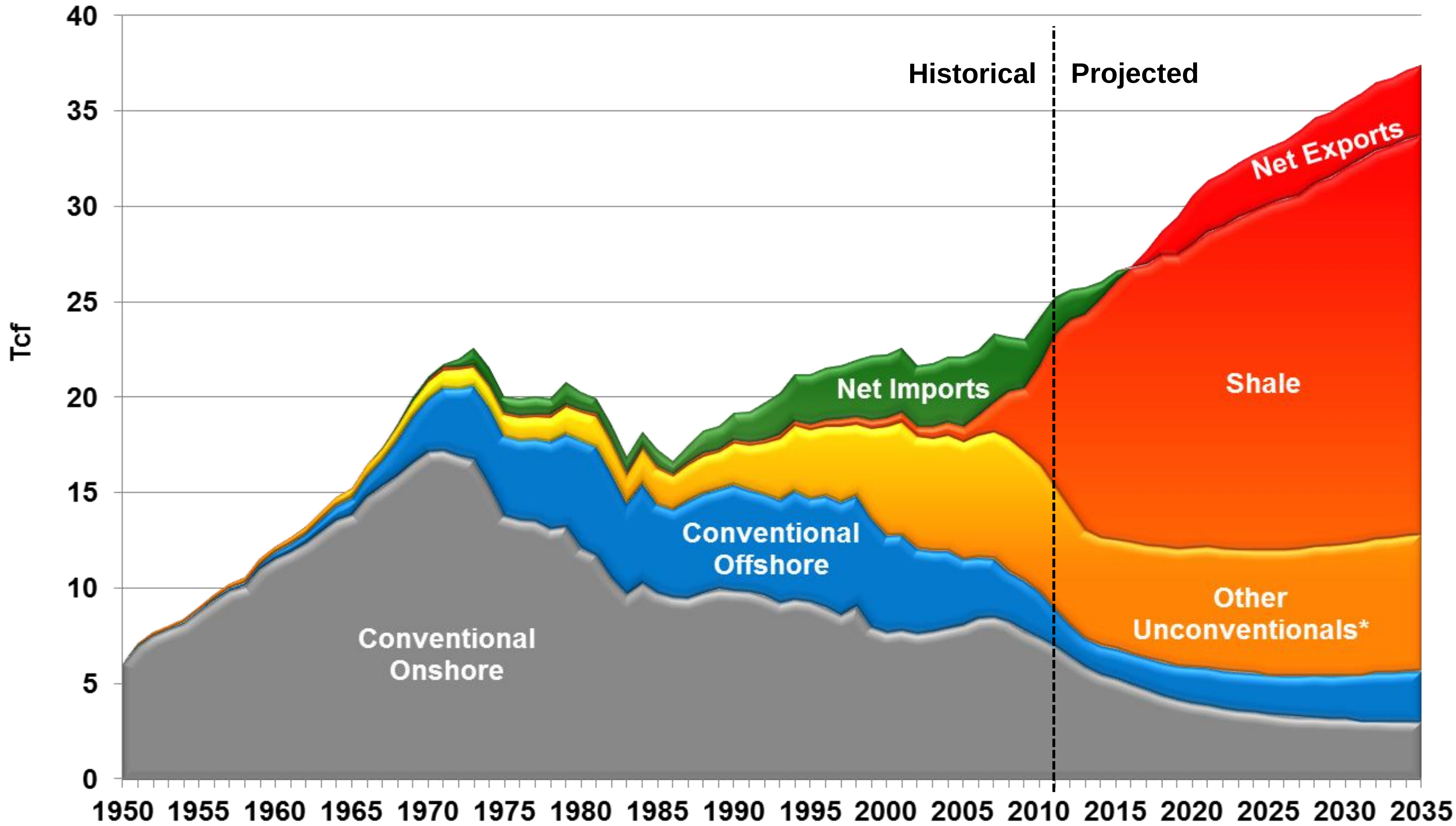


Power sector gas use is expected to comprise over 60% of incremental U.S. gas use growth between 2012 and 2035.

** Includes pipeline fuel and lease & plant*
Source: ICF GMM Q1 2014

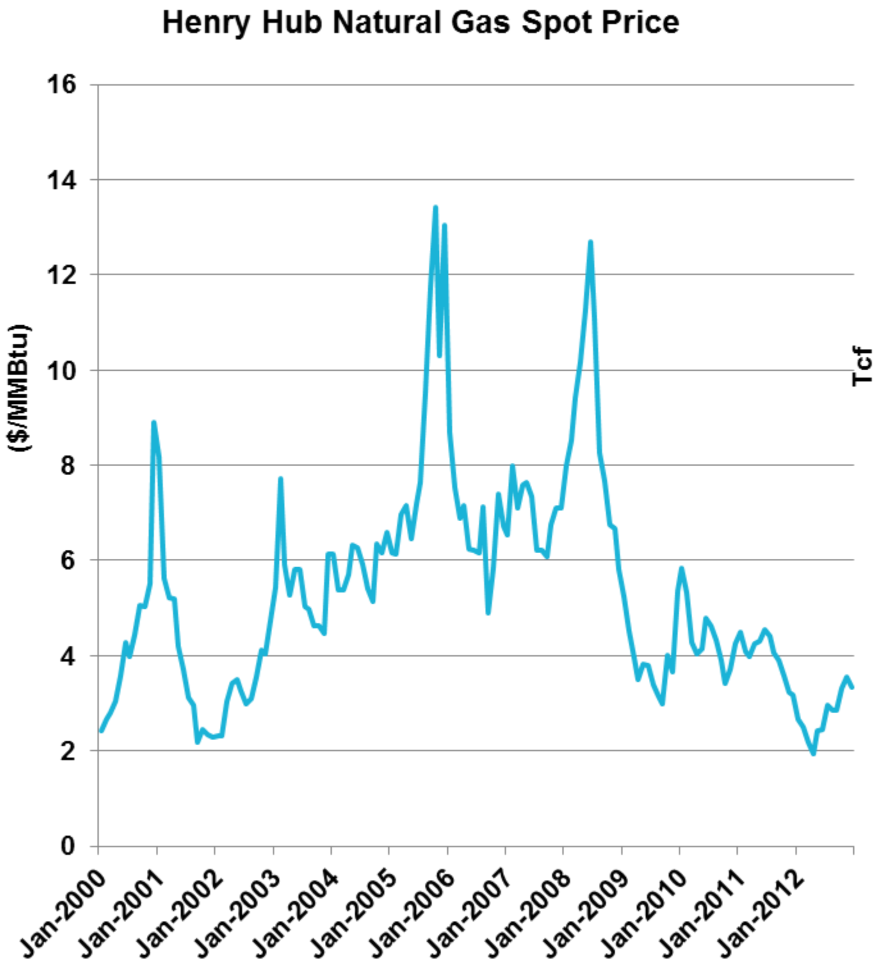
Market Expansion Supported by Growing Shale Gas Production

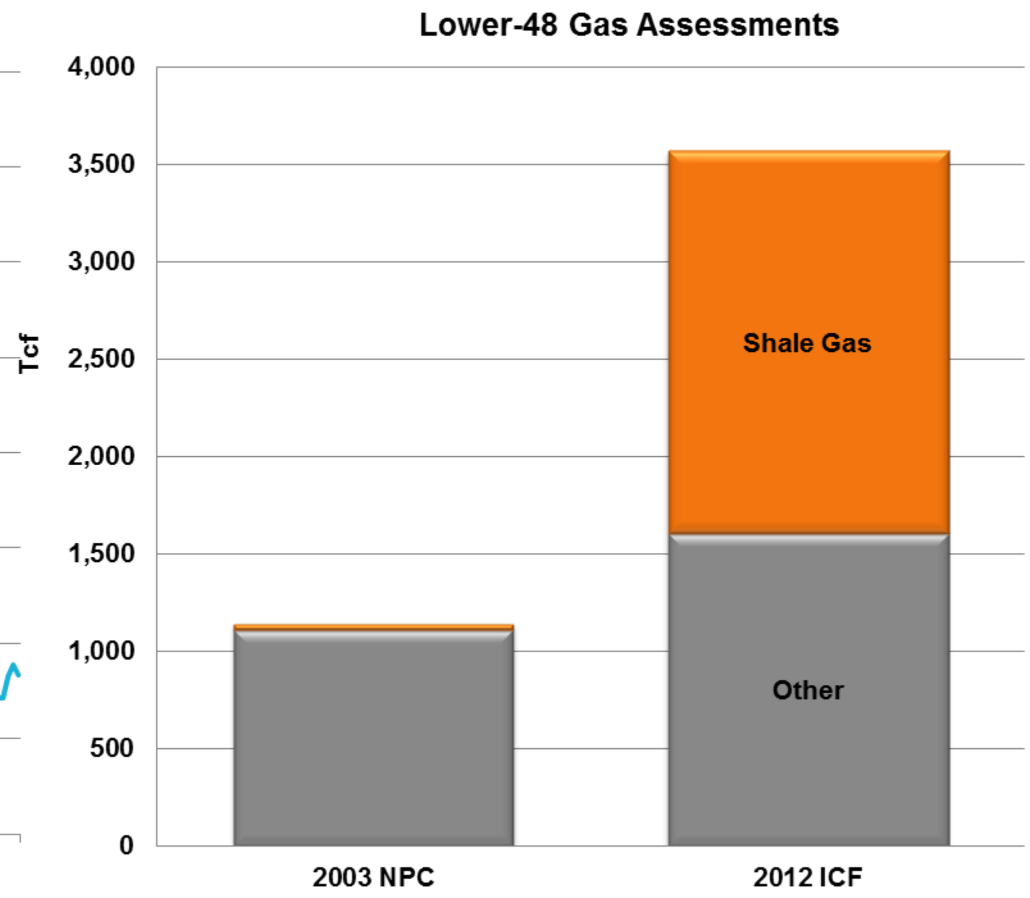
U.S. Natural Gas Production and Net Trade



Sources: EIA and ICF estimates (1950-1999), ICF Gas Market Model (GMM)® Q1 2014 (2000-2025)
** Includes tight gas, associated gas from tight oil, and coalbed methane*

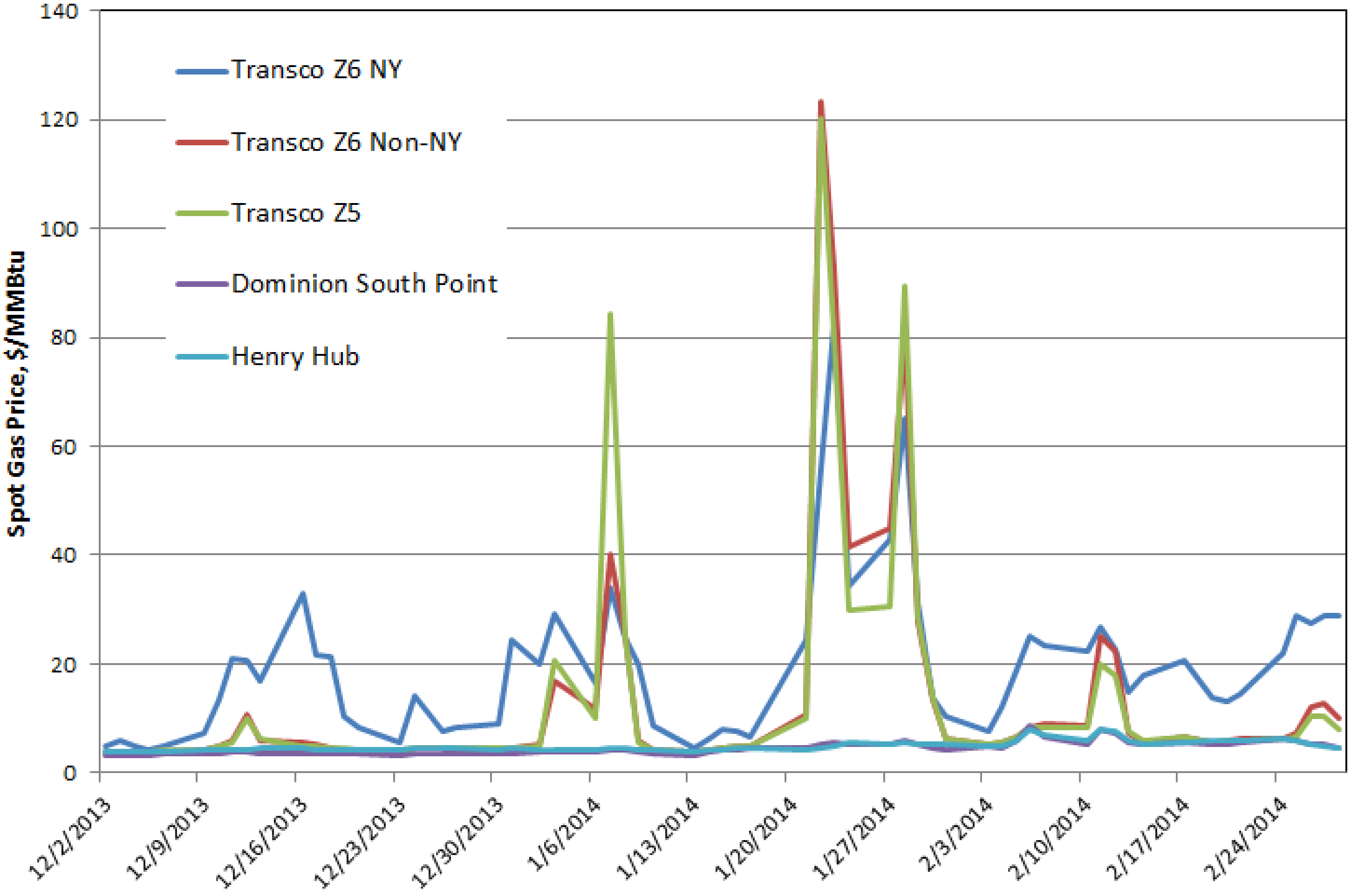
Increasing Shale Gas is Holding Down Prices





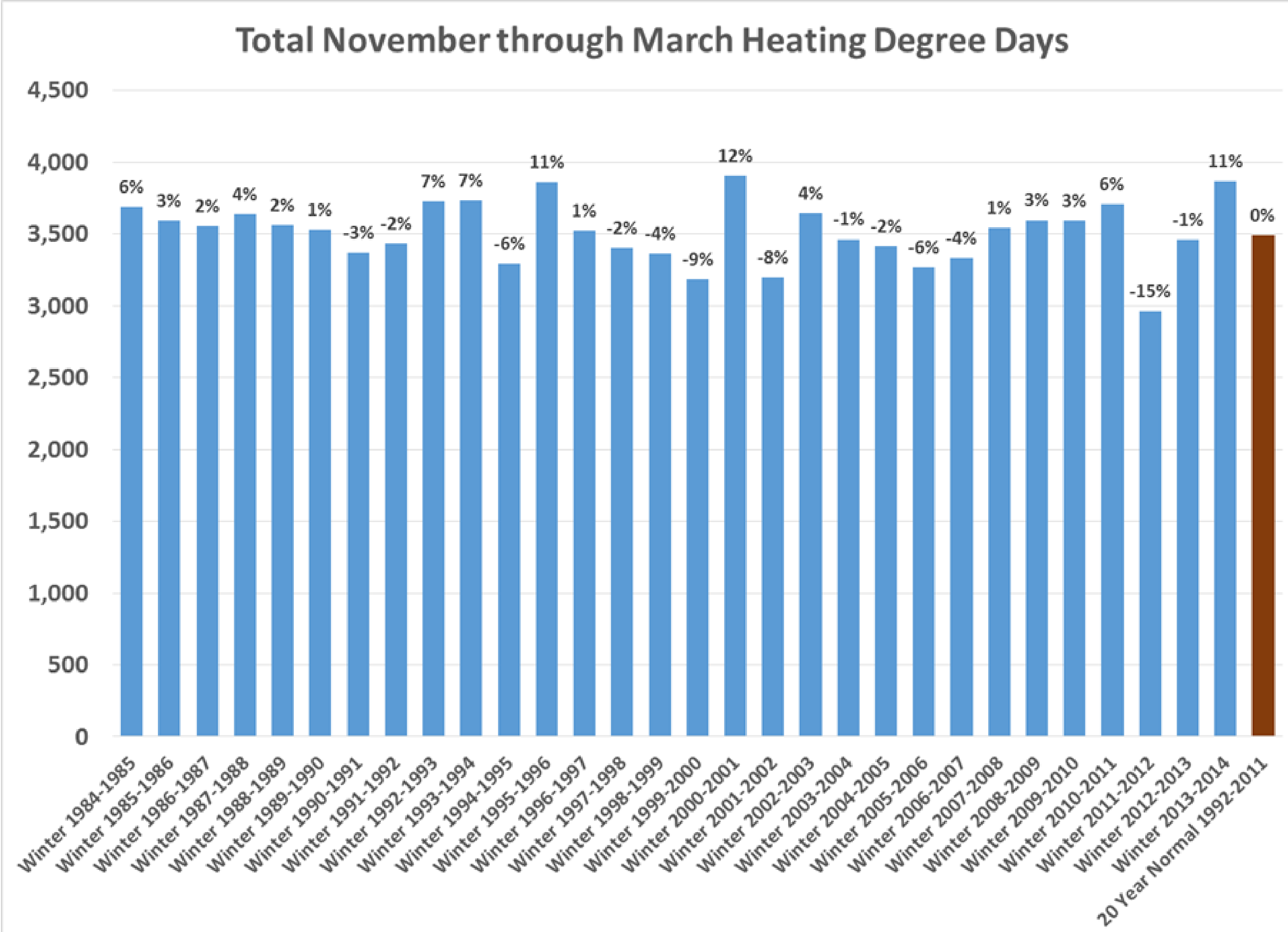
Source: http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm

Although Wellhead Supplies are Plentiful, Past Winter Illustrates Effects of Inadequate Delivery Capacity



Bottom Line: A number of Northeastern markets were constrained over many days throughout this past winter.

U.S. Heating Degree Days



With about 3,900 heating degree days for the U.S., this winter was the 3rd coldest winter out of the past 30 winters.

Several Electricity Markets Lost Generating Capacity Due to Inadequate Natural Gas Supplies

- While there were no major disruptions to gas or electric systems this winter, we "skated very close to the edge."
  - ICF's power market experts estimate that PJM was within a few hundred MW of rolling blackouts.
  - During the polar vortex, gas prices spiked and fuel costs exceeded the electric wholesale price cap.
- PJM was not alone in gas supply constraints:
  - 2.2 GW lost in NYISO, mostly downstate.
  - 6.7 GW lost in MISO
  - 2.4 GW lost in SPP

January 6 & 7 2014
Electric Loads and Outages (MW)

ISO	Peak Load	Total Lost Generation (Forced Outages and Derates)	*Generation Lost Due to Fuel Supply Issues*
PJM	141,312	41,336	***9,718***
NYISO	25,738	4,135	***2,235***
MISO	107,770	32,813	***6,666***
SPP	36,602	3,185	***2,412***

Source: FERC Winter 2013-14 Operations and Market Performance Presentation, based on data provided by ISOs

Firm Pipeline Capacity

- Gas pipelines must show firm transportation contracts for their capacity to receive FERC certification for construction.
- Holders of firm pipeline capacity have first call but can release unused capacity at times of low demand, but only during pipeline nomination windows.
- Electric generators may use this capacity on an interruptible basis without paying for firm capacity.
- However, at peak gas demand periods, unused capacity may not be available so generators may not be able to receive fuel.
- In organized electricity markets, generators cannot recover firm pipeline charges through market payments and therefore rely on interruptible or released capacity, even when bidding “firm” electricity.

Operational Differences

- Gas load for electricity can change frequently and unpredictably during one day. Gas is usually nominated (bid) only four times per day.
- Electricity is delivered essentially instantaneously but actual gas delivery moves at only tens of miles per hour, so pipelines must plan well ahead for delivery.
- Gas generators may take gas that they have not contracted for in order to meet electricity demand.
- While these gas volumes are ultimately replaced through balancing provisions, the timing of the replacement does not prevent pressure transients that threaten delivery pressures along the pipeline.

Reliability Assessment

- Electric assets are often either ”on” or “off,” while gas assets usually maintain substantial capacity after component failures
- Critical electric assets, when inoperable singularly or in small groups, can lead to rapid, widespread service outage. Cascading failures are unlikely in a gas system.
- Electric system resiliency is most usefully analyzed using N-1 or N-2 analyses. These are also useful for gas systems, but weather variability and its effects on interruptible capacity are the more practical concern
- Redundancy and interconnects make both electricity and gas systems more reliable.

Key Questions to Address

- Is there sufficient gas supply (i.e., overall gas resources) from producers to satisfy peak demand in a given market? Will this outlook be affected by more stringent upstream environmental rules?
- Is there sufficient physical delivery capability to deliver gas to power plants at a time of peak demand?
- Do power plants have contractual call on supply and delivery capacity at a time of peak demand, and can the power plants be considered firm if they don't have firm gas supply? If not, what is the probability that interruptible gas service will be available?

Key Questions to Address (cont.)

- How can utilities, transmission organizations, and gas pipelines better coordinate the different scheduling and contracting practices to ensure reliable and efficient operation of the gas and electric systems?
- How and why might gas supply be limited under certain circumstances (e.g., well freeze offs and LNG disruption), and how would this impact gas and electric system reliability?
- How and why might delivery capacity be limited under certain circumstances (e.g., compressor or pipeline failure), and how would this impact gas and electric system reliability?
- What are the costs and feasibility of on-site storage (e.g., LNG storage) and dual fuel capability as solutions to these problems?

ICF's Role in Integration Studies

- ICF has been at the forefront in helping to understand and resolve these issues
- In 2012 to 2014, ICF completed studies for ISO-NE on regional gas supplies and their availability to electric generators.
- ICF wrote report to NERC on integrating natural gas reliability, availability and adequacy into long-term electric resource adequacy assessments
- ICF was chosen by NARUC and the Eastern Interconnect States' Planning Council (EISPC) to conduct a study on the long-term electric and natural gas infrastructure requirements throughout the Eastern Interconnection

Regional Integration Studies

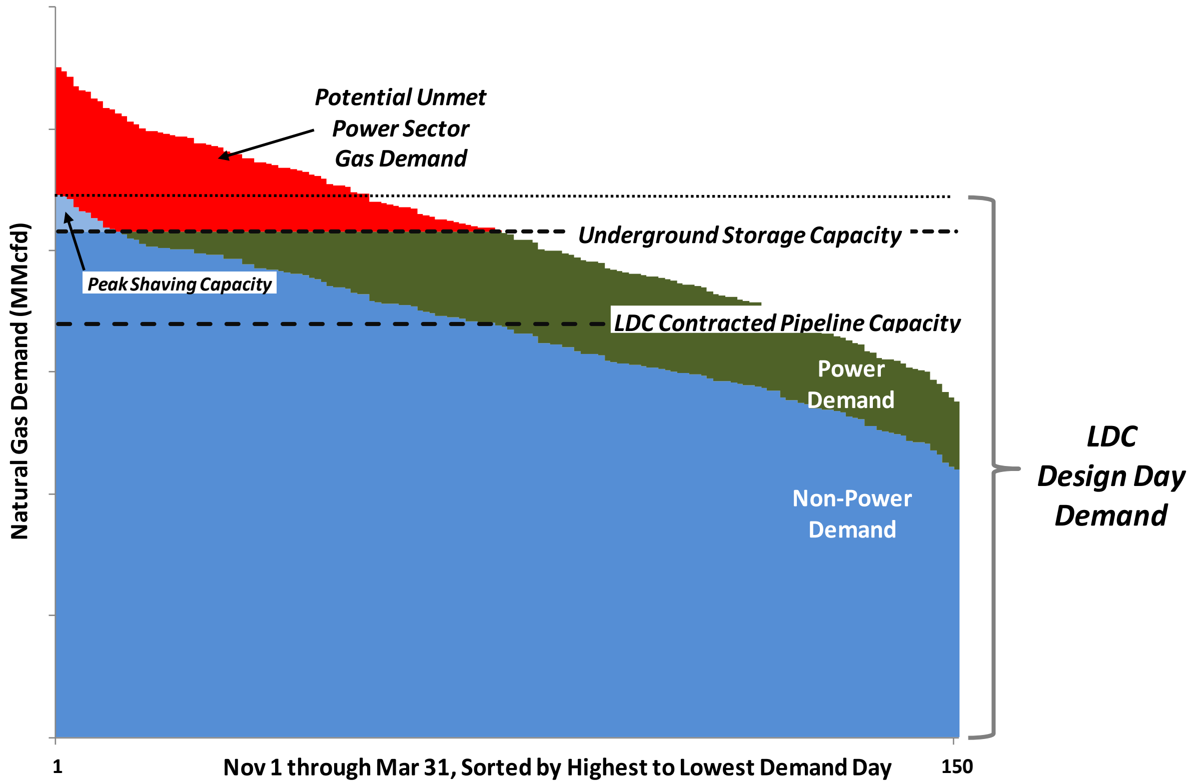
- ICF’s analysis for **EISPC** focuses on projecting the potential for unmet fuel requirements and then assessing multiple options for meeting load:
- The Eastern Interconnect Planning Collaborative (**EIPC**), representing six ISO/RTO planning authorities is conducting another analysis focusing on the next 10 years.
- Western Interstate Energy Board (**WIEB**) is completing a study of the adequacey Western Interconnect gas infrastructure, with emphasis on serving power generation
- Electric Reliability Council of Texas **(ERCOT**) commissioned studies in the wake of the 2011 incident

FERC Initiatives

- To date, FERC initiatives have focused on coordinating gas-electric system operations, not on longer-term planning.
- FERC Order 787 allows interstate natural gas pipelines and electric transmission system operators to share non-public operational information with each other to make gas and power service more reliable.
- The March NOPR aims to shift the gas day scheduling to better align with electric daily scheduling, and add two more intraday nomination cycles to allow more flexibility scheduling of pipeline nominations.
- LDCs and Western pipelines have expressed concerns about changing gas day scheduling; additional costs and potential unintended consequences (would a new gas day schedule just shift the problem west?)
- Additional FERC orders address ISO/RTO system scheduling and how pipelines post information on released capacity.

Analytics of Adequacy of NG Infrastrcuture

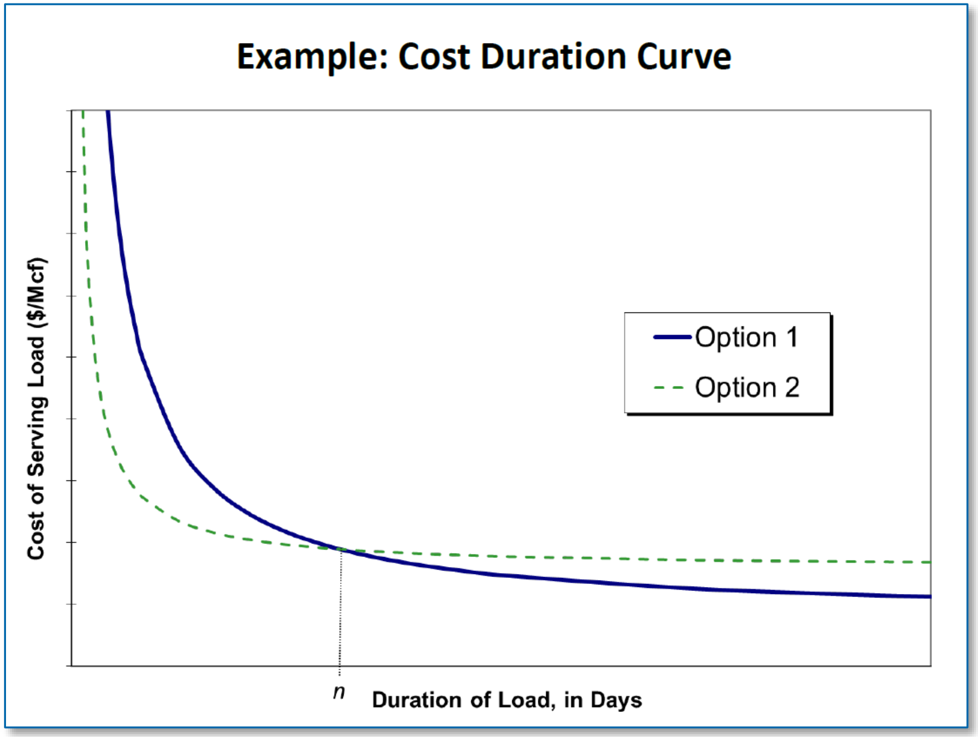
- Where LDCs hold nearly all pipeline capacity, power generator access depends on time of year and weather.
- Analysis of resource adequacy requires the ability to project available gas capacity as a function of economic/load growth and weather for non-power sectors.
- Must also be able to assess the interactions with regions upstream and downstream of the target region.



Example Natural Gas Daily Load Duration Curve

Selection of Optimum Mix of Fuel Sources

- Fuel Sources for gas or gas/oil power plants
  - Gas pipeline
  - Underground storage
  - High deliverability underground storage
  - Peakshaving plant
  - Above-ground compressed gas storage
  - Fuel switching



- Cost components include: capital, fixed O&M, non-fuel variable O&M, and fuel

Optimal mix will vary among regions

Principles and Objectives for Costs Recovery and Allocation

- Allocate infrastructure costs to customers who create the demand.
- Do not distort market prices.
- Enhance market liquidity and price transparency.
- Balance resource adequacy against willingness to pay.
- Make cost recovery system as transparent, simple, reasonable and consistent as possible in the eyes of ratepayers.

Conclusions

- The gas/electric integration issues have received the attention of many industry participants, stakeholders and regulators
- Focus is both on operational coordination (e.g. FERC regional conferences) and long-term resource adequacy (e.g. NERC studies).
- Major regional studies have been undertaken by EISPC, WIEB, EPIC and others.
- Expected events and trends:
  - Improvements in scheduling and coordination
  - Confirmation by regional studies of growing long-term reliance on gas and specific needs for additional natural gas infrastructure
  - Efforts to address generators ability to pay for firm gas pipeline capacity thru changes in electricity market design and other mechanisms
  - More delineation of rights and costs for non-rateable pipeline takes to accommodate intra-day gas load swings
  - More focus on planned maintenance schedules

EESI

WIRES

ELECTRIC TRANSMISSION 301:
Gas/Electric Coordination in New England

Anne George

Vice President, External Affairs & Corporate Communications

ISO new england

Presentation Outline

Current Trends And Challenges

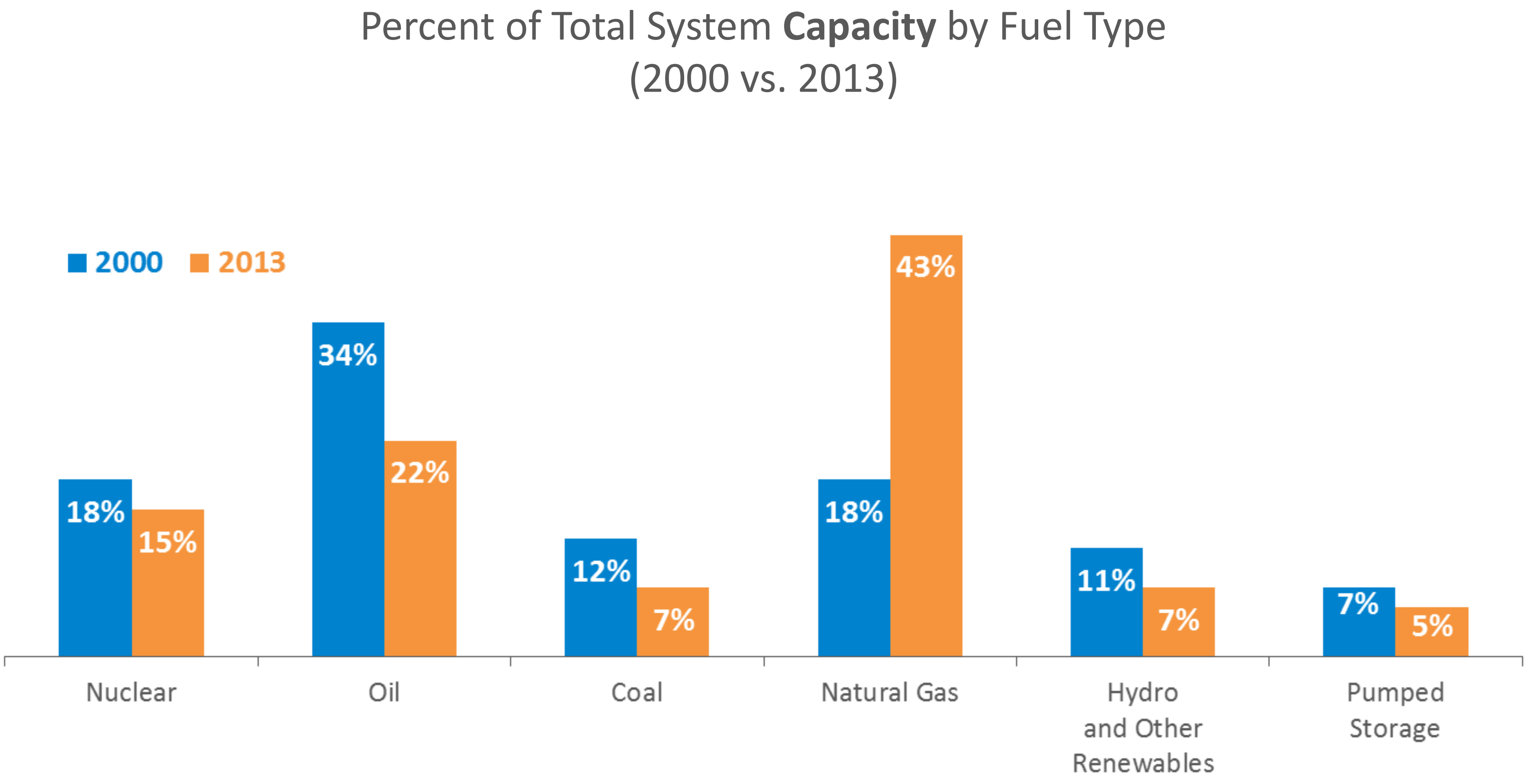
- Fleet in transition
- Significant amount of natural gas generation added and more proposed
- Price volatility associated with dependence on natural gas
- Unavailability of natural gas creates reliability risks
- Transmission and natural gas pipeline infrastructure needed

Addressing Challenges

- Market rule improvements
- Federal policies seeking to better align natural gas day with electricity day
- Regional cooperation aimed at developing infrastructure

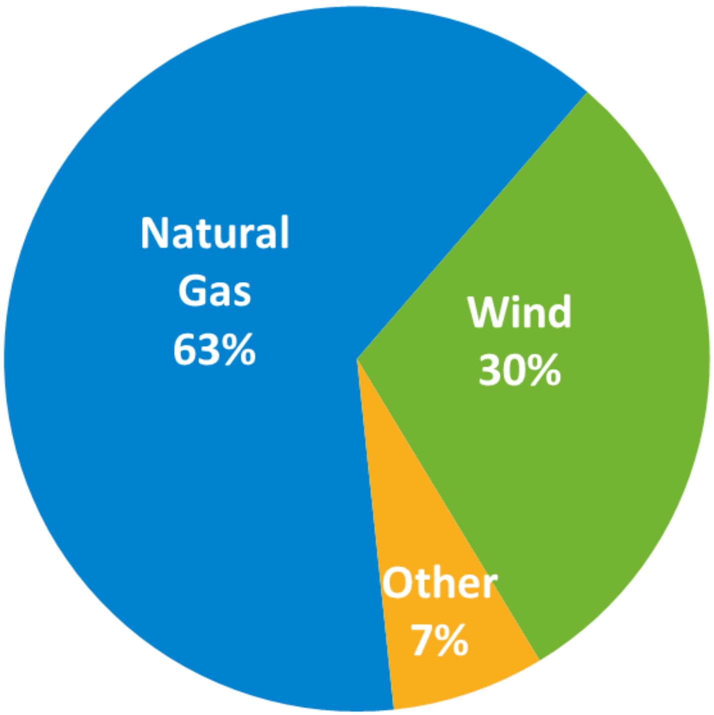
Dramatic Changes in Power System Resources

The resources making up the region's installed generating capacity have shifted from nuclear, oil and coal to natural gas



Significant Amounts of Natural Gas Proposed

Proposed Generation

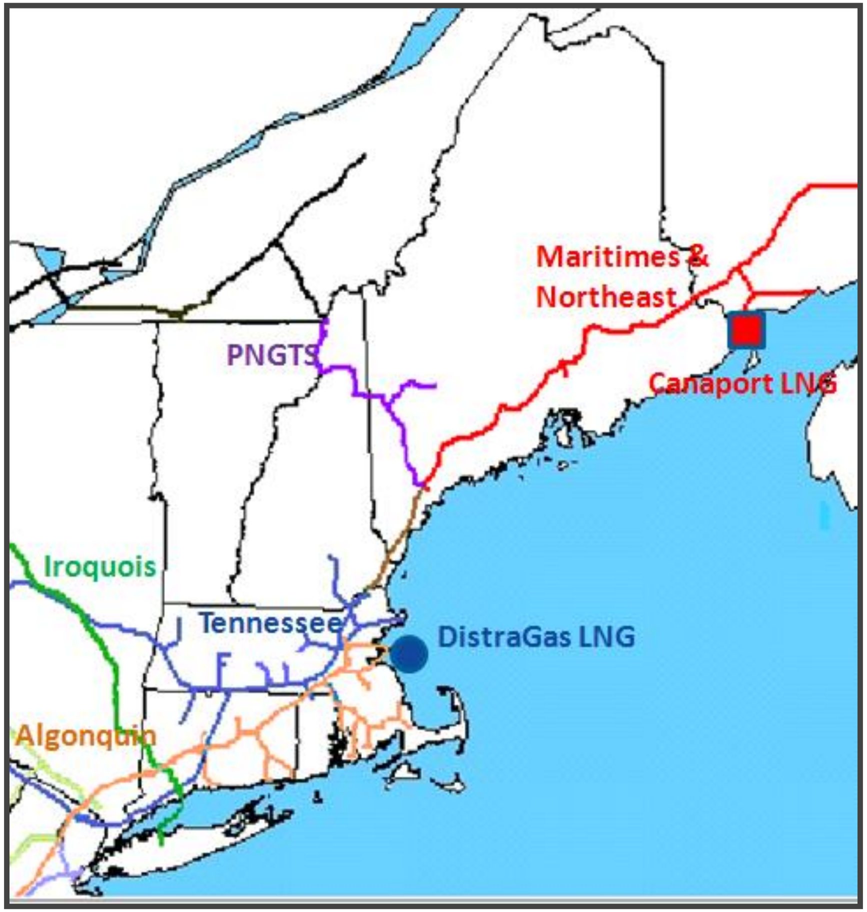


- Over 4 GW of natural gas proposed to be developed in the region over the next half dozen years
- The addition of more gas can exacerbate region’s dependence and challenges associated with price volatility and reliability

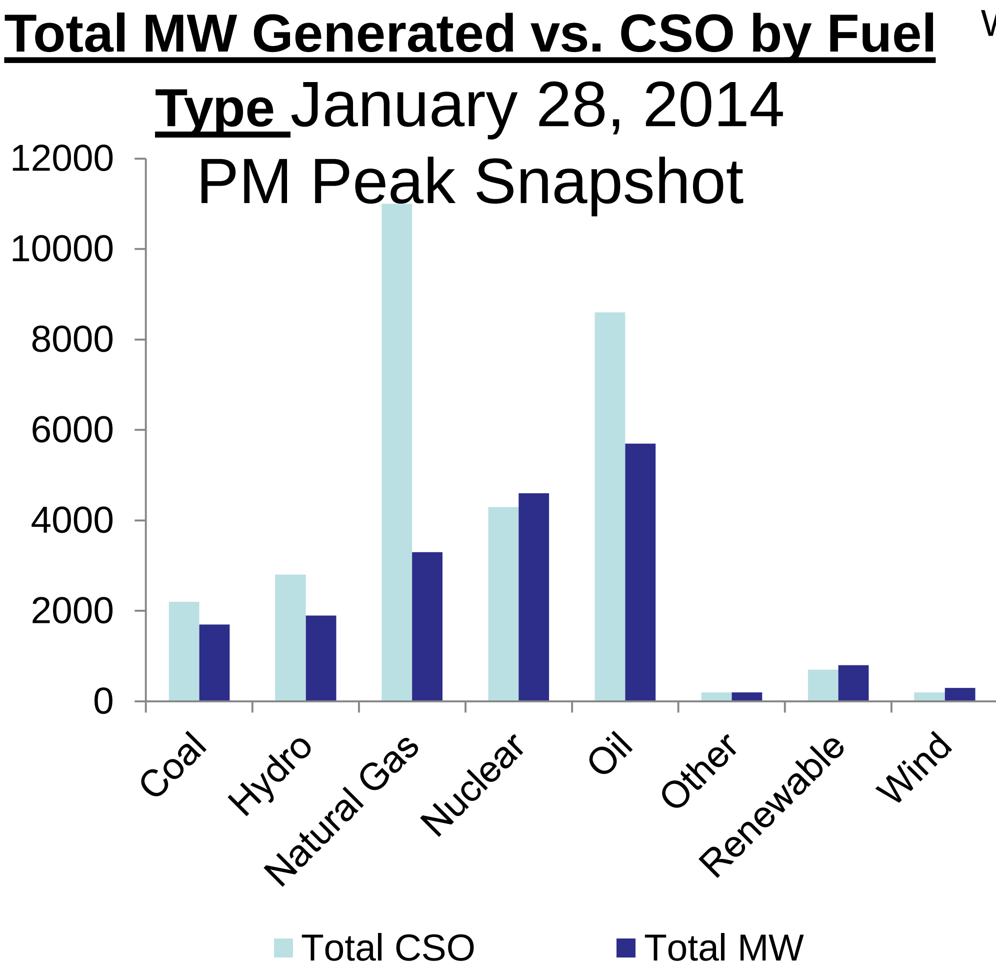
New England's Natural Gas Transmission System

Region has limited natural gas storage potential and additional infrastructure can help region better access natural gas supply in neighboring regions

- 5 gas pipelines
- 2 LNG storage facilities
  - Distrigas 3.4 Bcf
  - Canaport 9.9 Bcf
- Amount of gas-fired generation on each facility
  - Algonquin: 8,859 MW
  - Distrigas: 1,694 MW
  - Iroquois: 1,472 MW
  - M&N: 2,200 MW
  - PNGTS: 436 MW
  - Tennessee: 3,851 MW



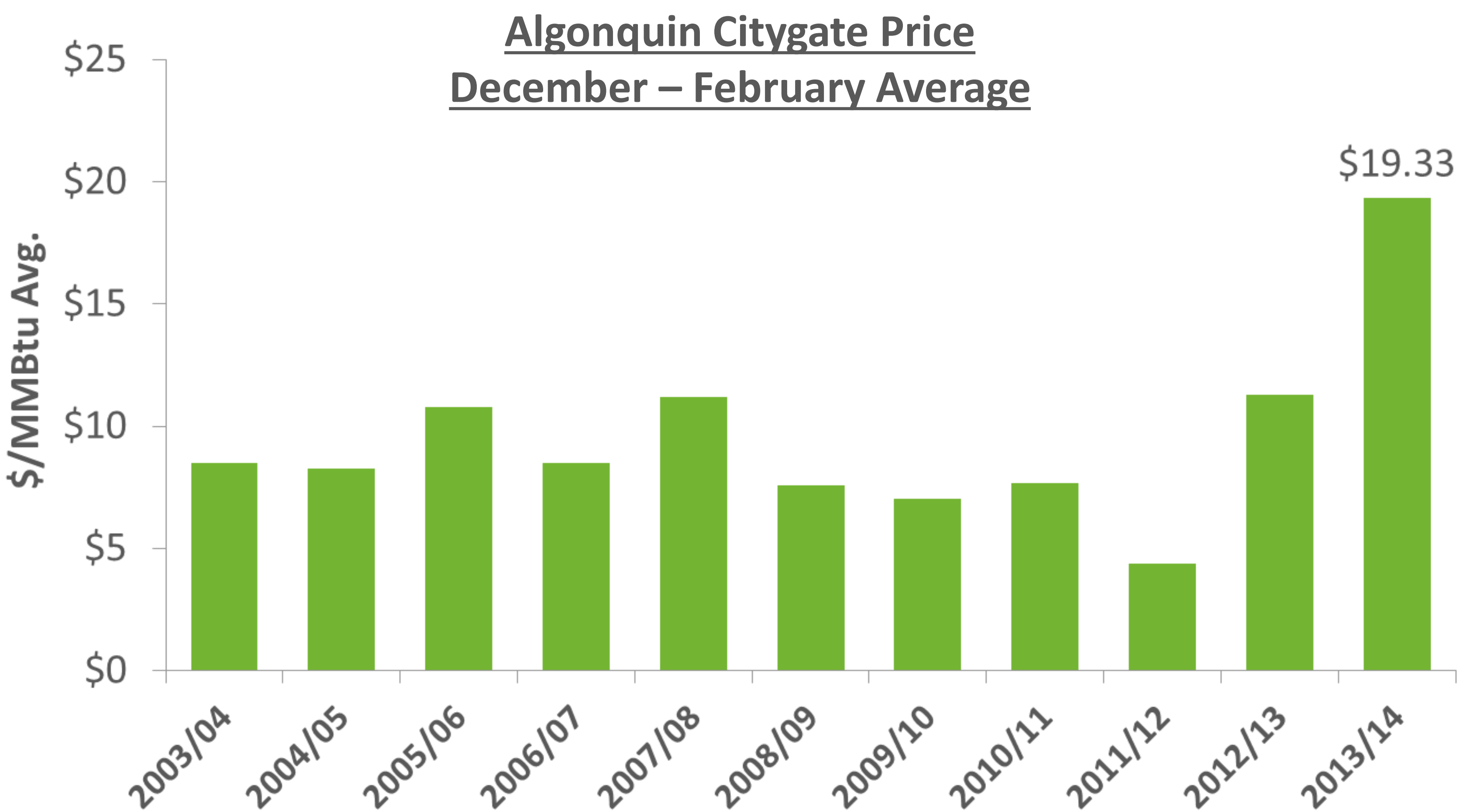
Limited Gas in Winter Impacts Generator Availability



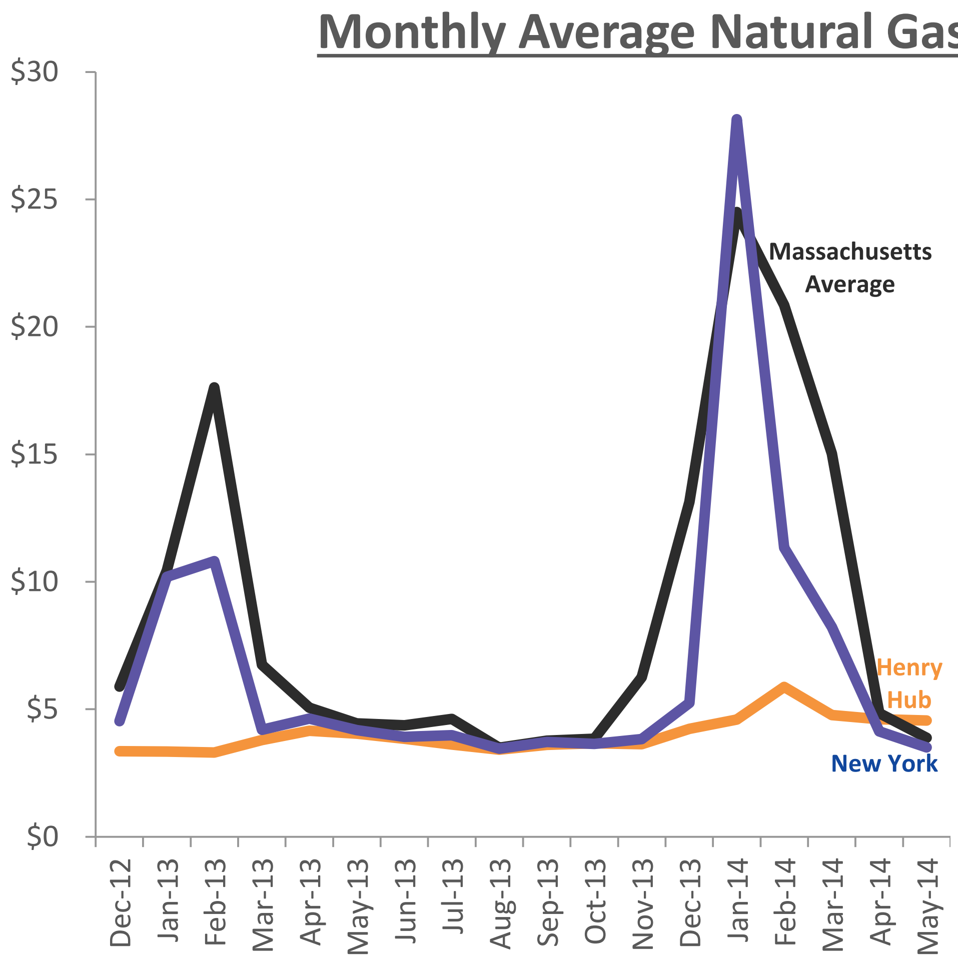
While oil provided more energy than in recent years, and other non-gas generators neared their capacity limits, gas produced far less than capacity

For example, on January 28, 2014, of the more than 11,000 MW of gas-fired generation with a capacity supply obligation, about 3,000 MW were generating during the peak hour

Winter Gas Prices Nearly Doubled in a Year



Natural Gas Prices High Relative to Other Regions

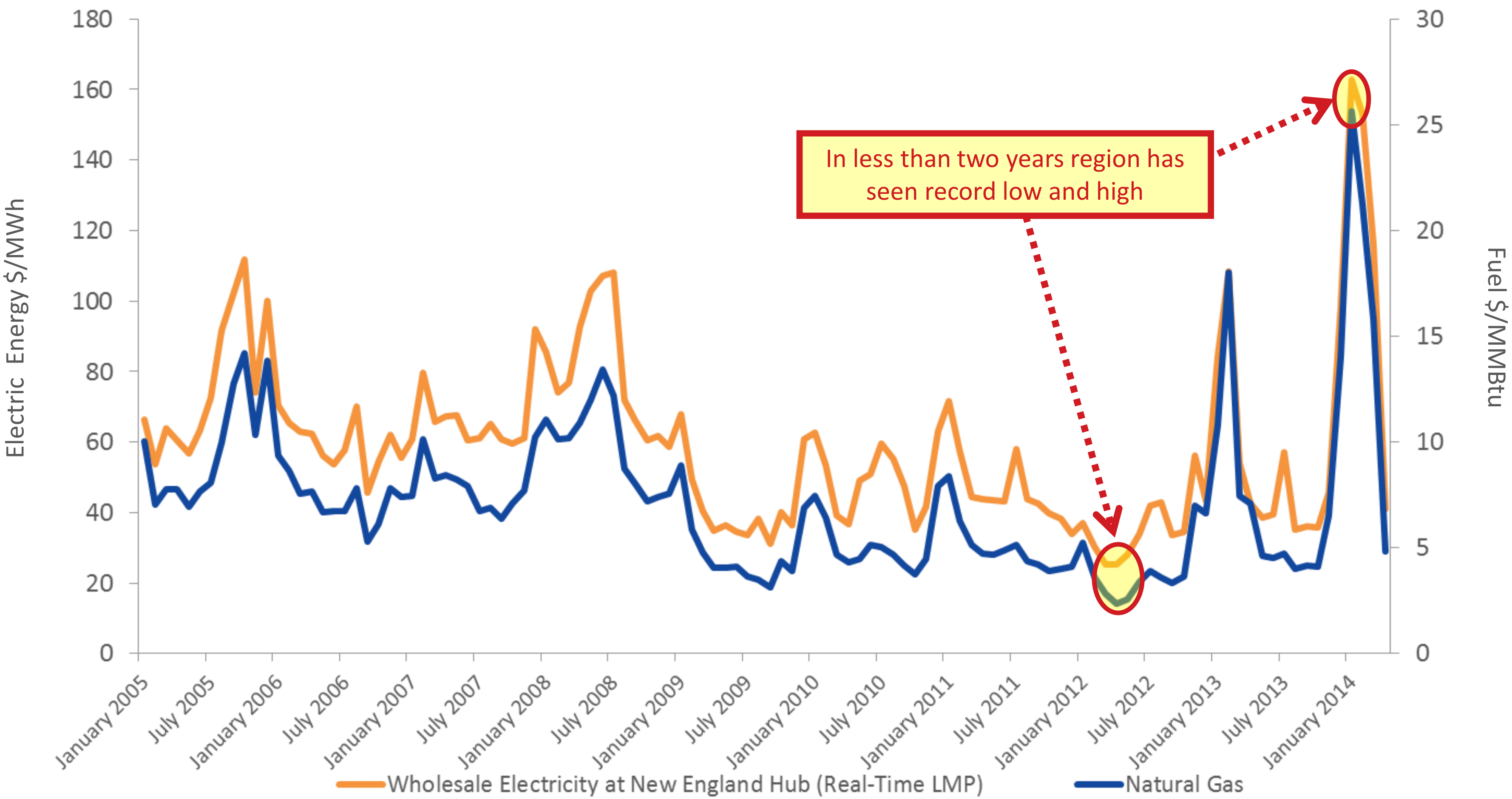


Winter Monthly Gas Differentials

Winter natural gas prices in New England generally higher than New York and much higher than Henry Hub

Month	Henry Hub	MASS Avg.	New York	NY vs. MA Avg.	Henry Hub vs. MA Avgl
Dec-12	$3.35	$5.89	$4.54	($1.35)	($2.54)
Jan-13	$3.34	$10.45	$10.20	($0.25)	($7.11)
Feb-13	$3.30	$17.63	$10.81	($6.82)	($14.33)
Dec-13	$4.23	$13.13	$5.25	($7.88)	($8.90)
Jan-14	$4.60	$24.50	$28.15	$3.65	($19.90)
Feb-14	$5.88	$20.85	$11.34	($9.51)	($14.97)

Gas Volatility Impacts Wholesale Electricity Prices

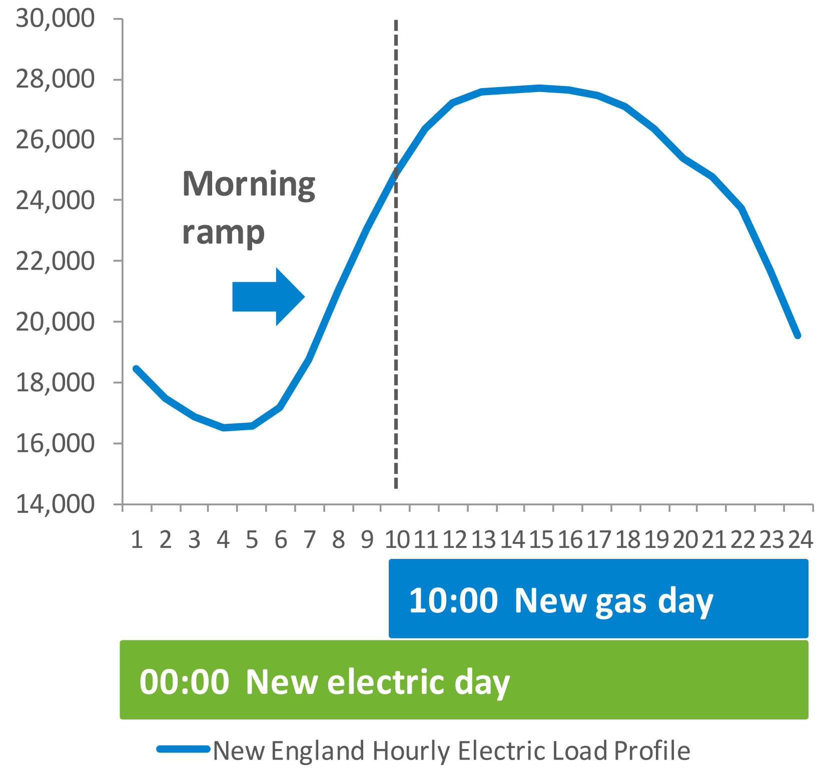


Many Units Have Announced They Will Retire and More At-Risk in Coming Years

- A few years ago ISO identified 28 units at-risk of retiring
  - Representing 8,300 MW of older oil and coal resources that will be over 40 years old in 2020
- Over 3,000 MW of generation have recently informed ISO they plan to retire
  - Salem Harbor (2014)
  - Norwalk Harbor (2017)
  - Brayton Point (2017)
- Vermont Yankee Nuclear power plant also announced retirement (2014)

Gas and Electric Markets are Not Aligned

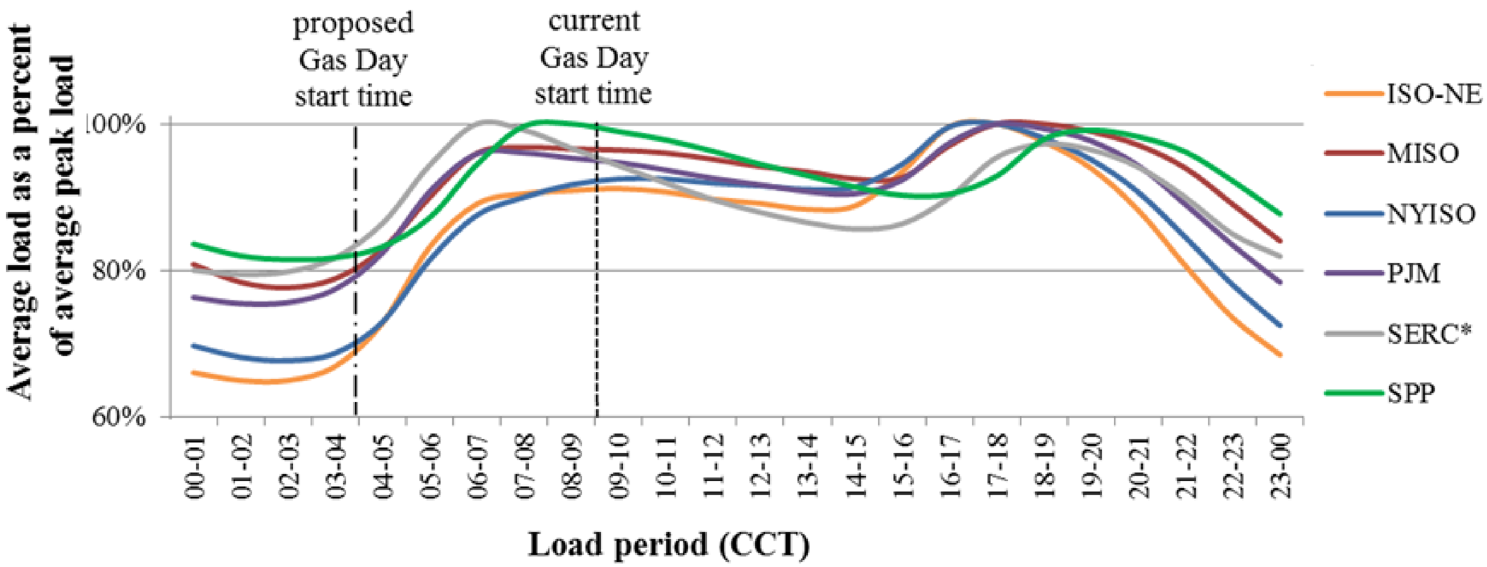
- Different operating days make it difficult for gas-fired generators to satisfy scheduling in both markets
- Some gas units needed for the electric system's morning ramp can't get gas until the new gas day starts (at 10 AM)



- New England moved day-ahead timing to give natural gas generators time to secures fuel and the ISO more time to secure resource adequacy

National & Regional Efforts Can Improve Reliability

NAESB Gas-Day Change Being Considered



- Market rule enhancements effective this December will provide greater flexibility generators to structure and modify their supply offers in the day-ahead and real-time markets

Regional Changes Forthcoming

Three Major Capacity Market Enhancements

1. **Pay for Performance**
2. **Sloped demand curve**
3. **Improved zonal modeling**

- Problems with capacity market resolved by Pay for Performance
  - Capacity payments are poorly linked to resource performance
  - Consequences for non-performance are negligible
  - Lack of incentive for resource owners to make investments to ensure they can provide energy and reserves when needed
  - Lack of investment poses serious threats to system reliability

Pay for Performance

- Provides capacity resources with strong, economically-sound, market-based incentives to perform at times of need

- Market participants have ***flexibility*** to select best, least-cost way to ensure performance
  - Firm-fuel arrangements
    - Short-notice and/or non-interruptible fuel supply arrangements
  - Dual-fuel capability
  - Fuel storage
  - New technologies and innovation

New England Governors Seeking Infrastructure

- This winter, the region's Governors, through the New England States Committee on Electricity (NESCOE), requested ISO technical support and tariff filings at FERC to support their objectives to expand energy infrastructure
- **New Electric Transmission Infrastructure**
  - Enable delivery of 1,200 MW to 3,600 MW of clean energy into New England from no and/or low carbon emissions resources
- **Increased Natural Gas Capacity**
  - Increase firm pipeline capacity into New England by 1000 mmcf/day above 2013 levels, or 600 mmcf/day beyond announced projects
  - Targeted to be in-service by winter 2017/18

Conclusions

- New England has a growing reliability problem due to gas pipeline constraints and poor performance by some resources and a need to balance an increasing amount of intermittent renewable energy
- New England states are driving additional investments in behind-the-meter resources (EE, DR, and DG) in combination with grid-connected, intermittent resources (wind and solar energy)
- Capacity market incentives are necessary, but may not be sufficient, to drive pipeline investments
  - Dual fuel is currently a more economic choice for generators than firm-gas transportation
- ISO working with states relative to infrastructure development

Competitive Development and New Business Models

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ELECTRIC TRANSMISSION 301:

New Models for Transmission Development Competitive Procurement

Steven Burtch

Senior Vice President of Business Development

ALTALINK

Different Jurisdictions Have Used Different Methods To Build Needed Transmission

- The Classic Approach in U.S./Canada:
  - Direct assignment of projects according to utility service territory (e.g., AltaLink in Southern Alberta)
  - Business model: recover cost of service plus allowed equity return under a deemed capital structure
- Merchant Projects:
  - Undertaken by a developer who has a vision of a specific opportunity (e.g., Cross-Sound Cable)
- Competitive Processes:
  - Well established in parts of Latin America
  - A more recent approach in U.K. and U.S./Canada
  - Run by system operators (ISOs) and regulators (utility commissions), to achieve specific objectives

Examples of Competitive Procurements Latin America Leads the Way

- Brazil (successful long-term model)
  - Competitive procurement implemented in late 1990s by Federal Government
    - Why? Response to power shortages that affected major cities
    - Process run by federal regulator (ANEEL)
  - Experience:
    - 29 auctions have awarded >190 projects to Brazilian and international companies (e.g., Spanish, Colombian, Chinese), valued at over 53 billion Reals or US$25 billion
  - Business model:
    - Winner determined based on lowest bid for annual revenue amount, which is indexed to inflation for a 30-year concession

Examples of Competitive Procurements Latin America Leads the Way

- Chile (successful model)
  - Current competitive procurement running since 2005
    - Why? Chilean government wants competition in Chile's energy sector as it has all been privatized since 1980, and to enhance its underdeveloped grid
    - Process run by CDEC (system operator) for each region
  - Experience:
    - 8 auctions have awarded 14 projects to Chilean and international companies (e.g., Spanish engineering, procurement and construction firms), valued at US$1.5 billion
  - Business Model:
    - Winner determined based on lowest bid for an annual revenue amount, which is indexed to both the US dollar and inflation for a 20-year concession

Examples of Competitive Procurements U.K., U.S. and Canada are Experimenting

- U.K. (OFTO1, OFTO 2)
  - Competitive procurement implemented in 2009 for offshore wind projects in North and Irish Seas
    - Why? Implemented to competitively bid the subsea transmission required for offshore wind development
    - Process run by OFGEM (Office of Gas and Electricity Markets)
  - Experience:
    - 13 projects awarded through single auction mainly to small U.K. companies and financiers as of January 2014
  - Business Model:
    - 4 stage process; compliance check, non-financial deliverability, financial deliverability, revenue and assumptions
      - Winning bidder selected based on revenue streams bid (60%) and quality of assumptions (40%)

Examples of Competitive Procurements U.K., U.S. and Canada are Experimenting

- U.S. (experience differs market by market):
  - TX PUC ran CREZ (Competitive renewable Energy Zones), in 2008 as an assignment process (not competitive procurement):
    - Most qualified participants were awarded project(s)
  - More recently, FERC Order 1000 encouraged RTOs and ISOs to define competitive procurement processes
  - Competitive procurement “test driven” in 2013 in some RTOs:
    - CA ISO for Gates-Gregg and Sycamore-Penasquitos Winners: PG&E, SDG&E
    - PJM for 1) Artificial Island NJ constraints and 2) PJM-wide optimization
    - Business model: traditional cost-of-service regulatory treatment
  - New competitive processes expected in MISO and SPP in 2015

Examples of Competitive Procurements U.K., U.S. and Canada are Experimenting

- Canada (a few "islands" of new competitive experience in two leading provinces):
  - Ontario - competitive procurement for East-West Tie project situated north of Lake Superior (400 km, double circuit, 240 kV):
    - Why? test incumbent on cost/schedule, introduce "new blood" into only transmission market
    - Business Model: winner becomes a cost-of-service regulated TFO under the jurisdiction of the Ontario Energy Board (OEB)
    - Process developed/run by regulator, OEB
      - Required qualified transmitters to pre-qualify and register >12 months in advance
      - Provided ~6 months for bid development
      - Winner (Upper Canada Transmission) announced in 8/2013

Examples of Competitive Procurements U.K., U.S. and Canada are Experimenting

- Canada (a few “islands” of new competitive experience in two leading provinces):
  - Alberta – starting competitive procurement with Fort McMurray West (500 km, single circuit, 500 kV); Fort McMurray East to follow:
    - Why? Seek to improve on incumbent cost/schedule performance, drive cost down
    - Business Model: based on P3 model, 35-year fixed-price contract with adjustors, pre-Permit & License risk poses unique challenges atypical of most P3 projects (e.g., highways)
    - Process developed/run by Alberta Electric System Operator (AESO), approved by Alberta Utility Commission (AUC):
      - RFQ process (July through January 2014), selected five consortia to develop proposals
      - RFP process (January through year-end 2014) to develop, submit and select winning proposal

Conclusions

- Competitive procurement is new to U.S. and Canada, but a "way of life" in other jurisdictions (e.g., Brazil)
- Approach in U.S. and Canada highly fragmented:
  - By RTO, ISO or regulator; by project or new routine process
  - Alberta Canada using a competitive procurement model more like Latin America (i.e., fixed price bids versus cost-of-service)
  - Implications: every opportunity can differ greatly, demands careful attention by companies wishing to compete
- Upcoming competitive procurement processes in U.S. (e.g., MISO, SPP), offer possibility for further refinement of approach as RTO and company experience/comfort-level with competition grows

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ELECTRIC TRANSMISSION 301: New Business Models

Cary J. Kottler

General Counsel

CLEAN LINE
ENERGY PARTNERS

What's Driving Transmission Investment?

Aging Infrastructure

Growing Demand for Renewable Energy

New FERC Policies

Other Regulatory Drivers

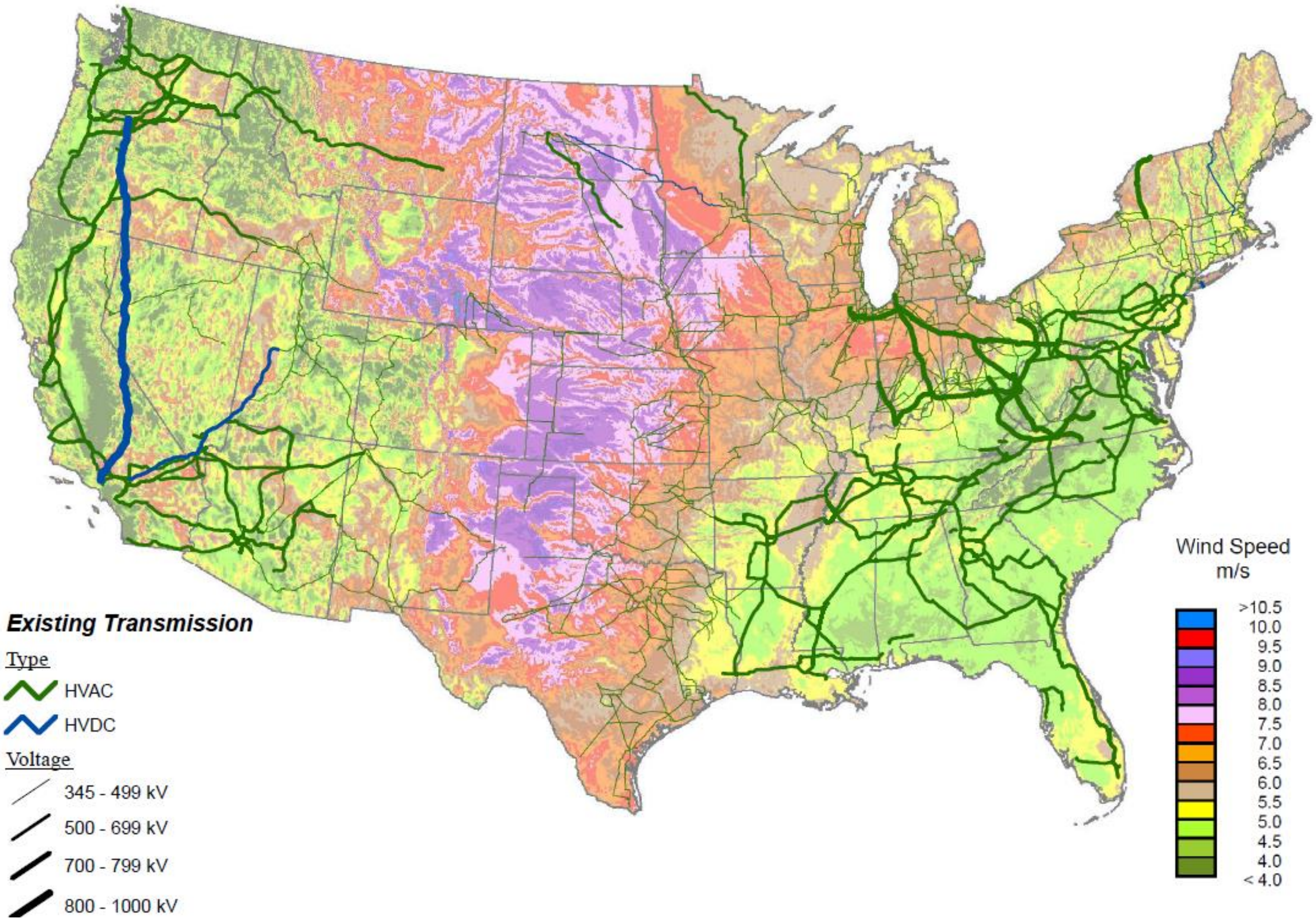
U.S. transmission investments by FERC-jurisdictional providers increased from $2 billion/year in the 1990's to $10-13 billion/year in the last several years*

Projected $120-160 billion of investments over the next decade (for reliability, integration of new resources, upgrading/replacement of facilities built in 1950-70's)*

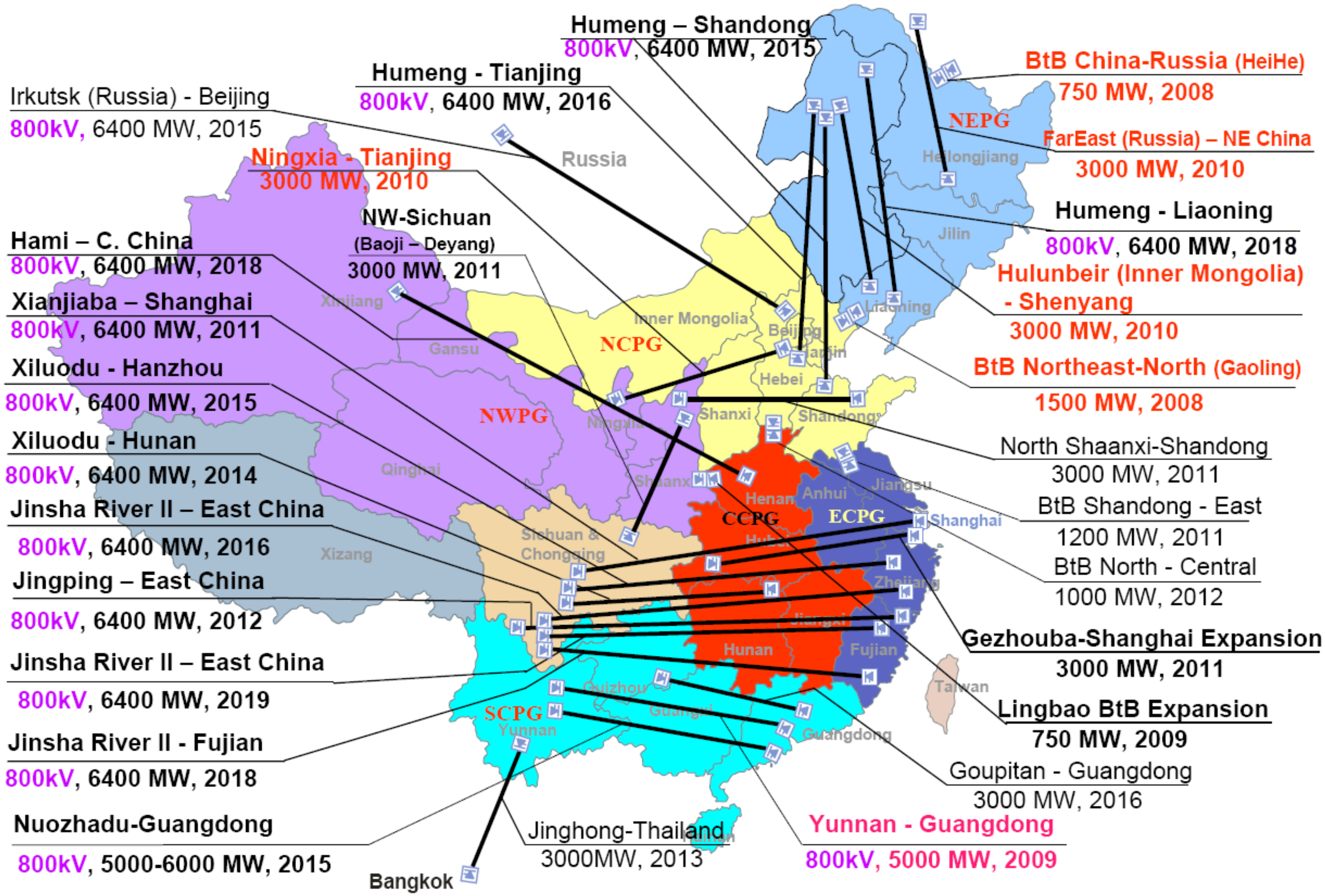
New Business Models

- Transmission Subsidiaries (Transcos)
- Joint Ventures
- Public-Private Partnerships
- Independent Transmission Companies
- Merchant Transmission
- Passive/Financial Investment

Clean Line's projects connect the best wind resources to load centers



HVDC in China



HVDC transmission lines bring economic, environmental and electric reliability benefits

Greater Efficiency	Lower line losses
Reduced Cost	Requires less infrastructure, results in lower costs and lower prices for delivered renewable energy
Improved reliability	Control of power flow enhances system stability and lowers cost of integrating wind
Smaller footprint	Use narrower right-of-way than equivalent alternating current (AC)

3000-4000 MW Capacity

AC

Three 500 kV lines

DC

One ± 500kV bipole

Key Issues in effectively siting multi-state transmission lines

- Varying Legal Requirements by State
- Environmental Permitting
- Federal, State, & Tribal Land Issues
- Coordinating Interconnection, Regulatory, & Financial Timelines

Closing

Jim Hoecker

Questions?

Contact us at:

jim.hoecker@huschblackwell.com

202-378-2316

www.wiresgroup.com

Contact Our Faculty

- *Charles A. Berardesco, NERC*
  - *Charles.Berardesco@nerc.net*
- *Harry Vidas, ICF International*
  - *Harry.Vidas@icfi.com*
- *Anne George, ISO-New England*
  - *AGeorge@iso-ne.com*
- *Steven Burtch, AltaLink*
  - *Steven.Burtch@AltaLink.ca*
- *Cary Kottler, Clean Line Energy Partners*
  - *CKottler@cleanlineenergy.com*
- ***Jim Hoecker**, Counsel to WIRES and former FERC Chairman*
  - *James.Hoecker@huschblackwell.com*