Iroquois Gas Transmission System, LP

Natural Gas Transmission – Wellhead to City Gate or

"Everything you wanted to know about building a pipeline to get gas to market, but were afraid to ask..."

> Robert Perless, Project Development Manager Christopher Stutz, Sr. System Controller

> > **2020 NGA's Operations School**

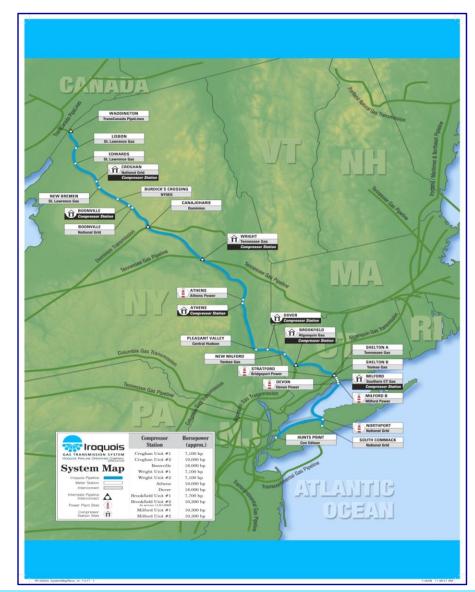
Bryant University, RI June 2 – 5, 2020



Iroquois Gas Transmission System

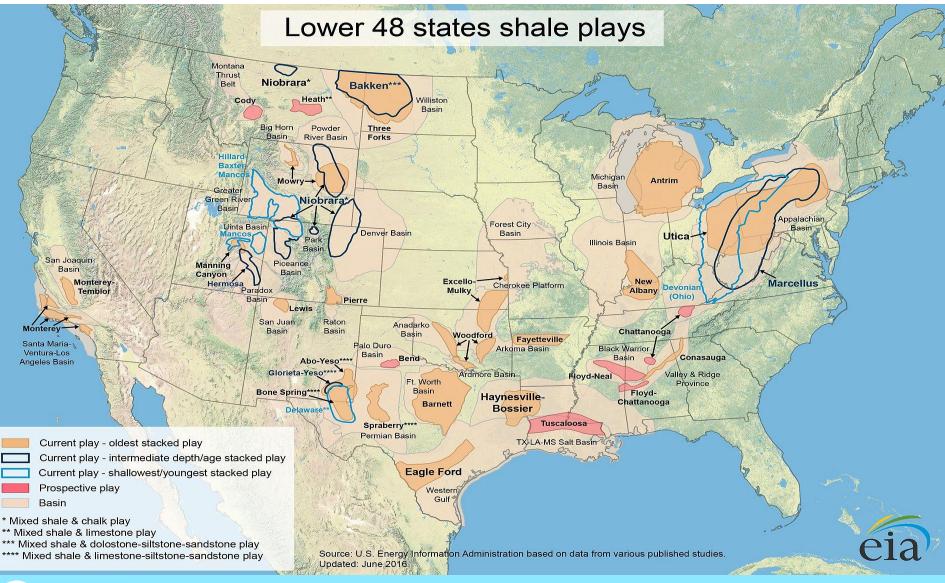
Commenced Operations in 1991

- Headquarters in Shelton, CT
- 83 employees (20 field operating personnel)
- 24/7 Gas Control monitoring
 - Remote operated valve sites, meters and compressor stations
- Comprehensive integrity programs
 - Extensive aerial, ground , and "in-line" inspection programs
- Primary Markets
 - Connecticut
 - Long Island
 - New York City
- 1.6 Bcf/d Physical Receipt Capability:
 - TransCanada = 1.2 Bcf/d
 - Algonquin = 0.4 Bcf/d
 - XNG = 0.02 Bcf/d
- Piping
 - 416-mile of 30" and 24" pipeline
 - MAOP = 1440 psig
- Pipeline Interconnects:
 - TransCanada
 - Dominion
 - Tennessee (200 and 300 lines)
 - Algonquin
- 7 Compressor Stations 115,900 HP





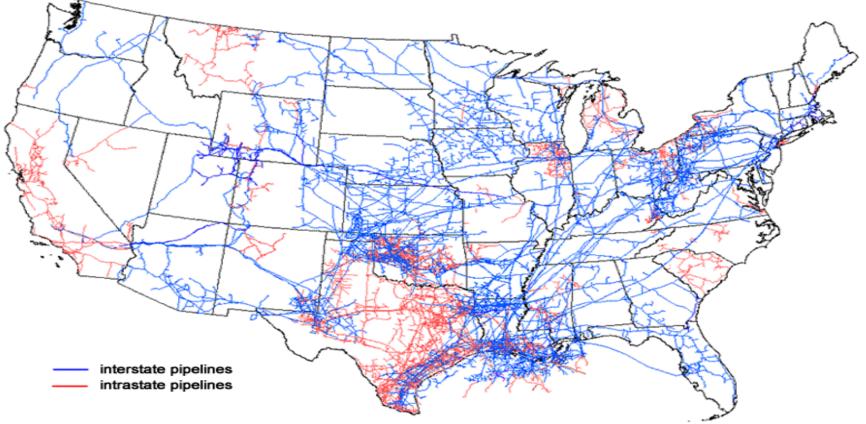
Where does natural gas come from?



😽 Iroquois

How does natural gas get transported?

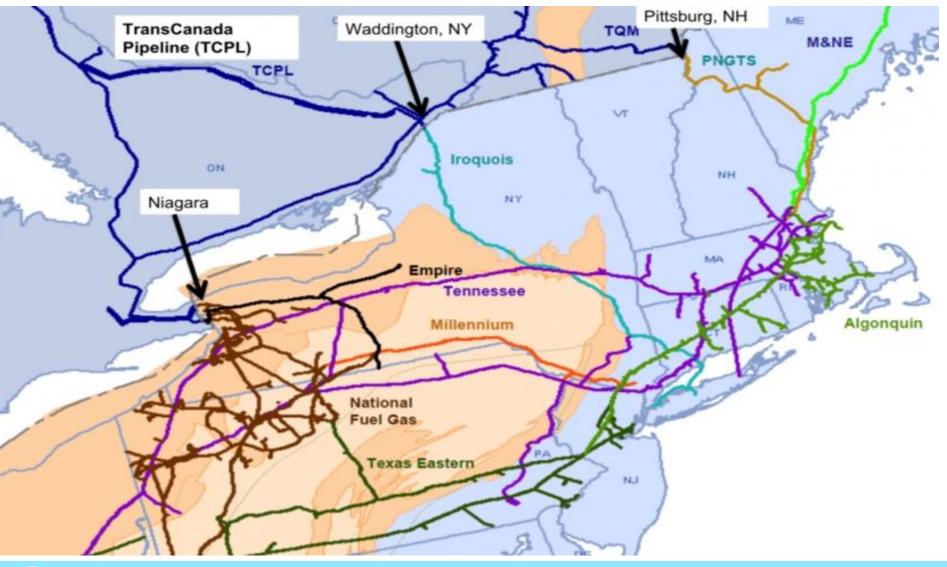
Map of U.S. interstate and intrastate natural gas pipelines



Source: U.S. Energy Information Administration, About U.S. Natural Gas Pipelines



Northeast Interstate Natural Gas Pipelines

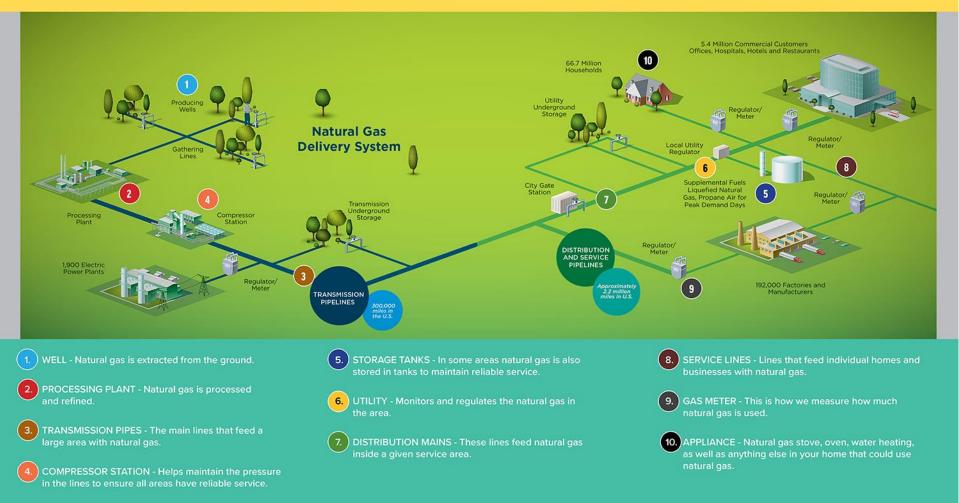




Lesson 1 – How gas gets to Market

How Natural Gas is Delivered to Your Home

lroquois

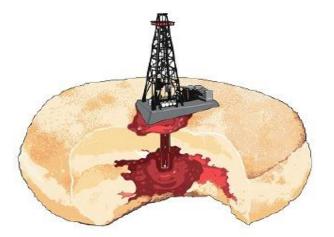


Lesson 1 – How gas gets to Market

Old Way of Drilling

Jelly Donut

Conventional Drilling Basic Vertical Penetration Limited Formation Contact



New Way of Drilling

Tiramisu

Unconventional Drilling More Sophisticated Horizontal Penetration Extensive Formation Contact

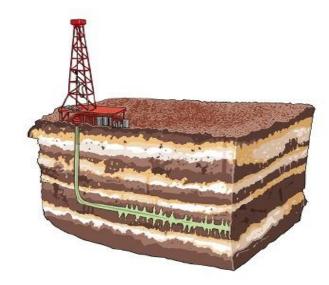


Illustration © James Scherrer 2014

Illustration © James Scherrer 2014



Typical Natural Gas Well pad





Typical Natural Gas Compressor station





Lesson 2 – Genesis of Pipeline Projects

- Supply Push
 - Marcellus Shale production looking for a home (e.g. Constitution Pipeline)
- Demand Pull
 - Power plant development
 - LDC Expansion
- Project Types
 - Looping
 - Compression
 - Cooling



Lesson 2 – Timeline of Pipeline Projects

- Starts with an idea...
- Open Season sell your idea to your shippers
- Precedent Agreement (PA) it all becomes legal
 - Who does what and when with dates "precedent"
 - How do we unwind this if it all goes "south" and who is left holding the tab?
- Stakeholder engagement from the top down approach
 - Politicians (Federal, State, and local)
 - Advocacy and Community Groups
 - Landowners
 - Compressor Station buy the land or use existing sites
 - Pipeline Easement with the landowner
 - Eminent Domain
 - Compensation



Lesson 2 – Timeline of Pipeline Projects

- Permitting an interstate pipeline
 - Federal
 - FERC 7c Pre-filing process and Open houses
 - Army Corp of Engineers
 - US Fish and Wildlife
 - State
 - Department of Environmental Protection
 - State Office of Historic Preservation
 - Siting Council
 - Coastal Consistency, Department of State
 - Local
 - Inland Wetlands
 - Planning & Zoning
 - Building Permits



Lesson 3 – Constructing a Pipeline Projects





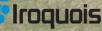
Iroquois Capital Project MarketAccess Timeline

- Open Season April 2005
- Sign PA with Con Edison November 2005
- FERC Pre-filing November 2005
- FERC Scoping / IGTS Open Houses Jan/Mar 2006
- FERC 7c Application March 2006
- FERC Certificate December 2006
- Engineering/Procurement 2007
- Construction 2008
- In-Service November 2008



DOVER COMPRESSOR STATION PROPOSED GAS COOLING

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GAS TRANSMISSION SYSTEM IROQUOIS PIPELINE OPERATING COMPANY, OPERATOR

ARTISTIC RENDERING BASED ON CONCEPTUAL DESIGN





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MarketAccess – Dover Gas Cooling

 In-Service – early October 2008 and ahead of schedule.

No major delays or unexpected "issues".



Iroquois Capital Project 08/09 Expansion Timeline

- Open Season October 2006
- Sign PA with Keyspan February 2007
- FERC Pre-filing March 2007
- FERC Scoping / IGTS Open Houses April/June 2007
- FERC 7c Application September 2007
- Engineering/Procurement 2007/2008
- FERC Certificate March 2008
- 401/404 Water Quality for Looping July 2008
- Construction 2008/2009
- In-Service November 2008/2009





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2 - Bits

ETTS





Iroquois Capital Projects

- 08/09 EXPANSION
 - Keyspan / National Grid
 - 200,000 Dth/day
 - Millennium→Algonquin→IROQUOIS→Hunts Point
 - Alternative to Islander East Project
 - Facilities
 - 1.6 Miles of Looping in Newtown (In-service Nov. 2008)
 - New Transfer Compressor (10,300 HP) with gas cooling at existing Brookfield Compressor Station (In-service Jan. 2009)
 - New In-line Compression (20,600 HP) at existing Milford Compressor Station (In-service Nov. 2009)























10/02/2008

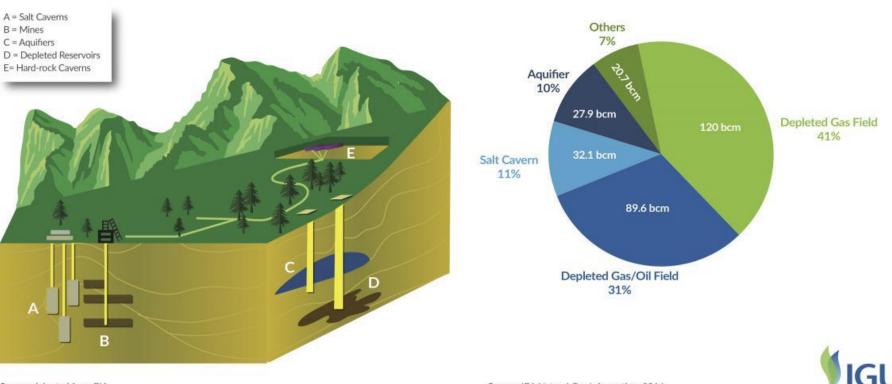




Lesson 3 – Pipeline Storage

Natural Gas Storage

Types of Storage



Global Gas Storage Capacity (in bcm)

Source: Adapted from EIA

Source: IEA Natural Gas Information, 2016





Lesson 3a – LDC Storage, Propane Air Systems





Lesson 3a – LDC Storage, LNG



PORTABLE PIPELINES

Experience You Can Count On

LNG TRANSPORTATION







Lesson 3 – LDC Storage, Virtual Pipeline





Lesson 4 – Pipeline Operations, Gas Control

- What is Gas Control-
 - Gas Control is a centralized control room staffed around the clock that monitors pipeline conditions and remotely operates the pipeline
 - Gas Control has many responsibilities including maintaining safe and efficient operations based on conditions and nominations.
 - Gas Controllers typically use a Supervisory Control and Data Acquisition System also known as SCADA to operate the pipeline remotely.





Lesson 4 – Pipeline Operations, Gas Control and Field Technicians

- Communication One of the most important roles of a Gas Controller is to keep open communications with field staff.
- Communication is key in keeping both Field Technicians and the public safe.
- Field work projects are typically planned with Gas Control staff to determine the best time to complete field work with minimal impact on operations. Gas Control staff analyzes trends and nominations to determine the best times to complete work.



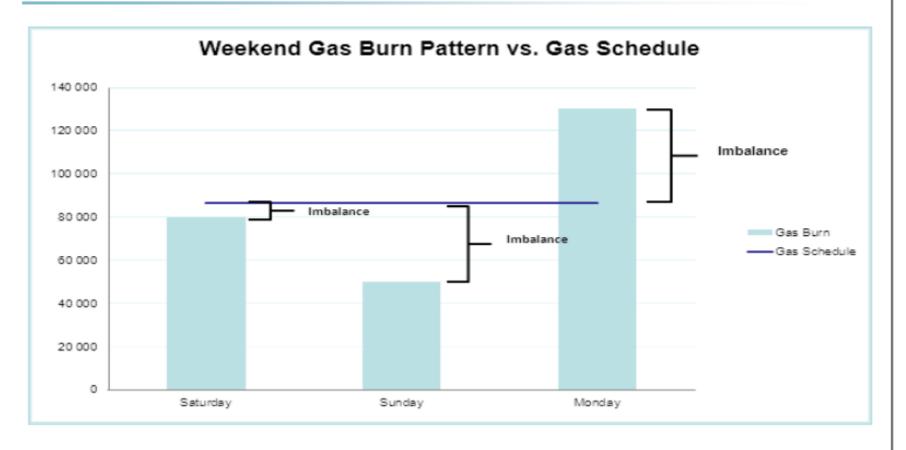
- Every Dekatherm of gas must be accounted for, this is done through nominations.
- Nominations reflect a customer's receipt point, transportation path, and delivery point.



<u>Cycle</u>	Cycle Time	<u>Process</u>	
Timely	10:00	Nominations Due	Pre day - 2:00 PM
		Confirmations	2:30 PM - 5:30 PM
		Scheduled Quantity	5:31 PM - 6:00 PM
Evening	10:00	Nominations Due	2:01 PM - 7:00 PM
		Confirmations	7:30 PM - 9:30 PM
		Scheduled Quantity	9:31 PM - 10:00 PM
IntraDay1	15:00	Nominations Due	7:01 PM - 11:00 AM
		Confirmations	11:30 AM - 1:30 PM
		Scheduled Quantity	1:31 PM - 2:00 PM
IntraDay2	19:00	Nominations Due	11:01 AM - 3:30 PM
		Confirmations	4:00 PM - 6:00 PM
		Scheduled Quantity	6:01 PM - 6:30 PM
IntraDay3	23:00	Nominations Due	3:31 PM - 8: PM
		Confirmations	8:30 PM - 10:30 PM
		Scheduled Quantity	10:31 PM - 11:00 PM



Weekend Gas Burn Pattern





Gas Pipeline Operation Fundamentals

- What is Line Pack The ability of a natural gas pipeline to effectively "store" small quantities of gas on a short-term basis by increasing the operating pressure of the pipe. Most pipelines use line pack as a resource to help manage the load fluctuations on their systems, building up line pack during periods of decreased demand and drawing it down during periods of increased demand.
 - If the pipeline pressure gets too low it may collapse
 - If the pipeline pressure gets too high it may cause leaks or ruptures





Gas Pipeline Operation Fundamentals – Cont.

- Gas pipelines must operate with a line pack within a certain range, similar to a voltage range for a transmission line
 - "Receipts" (input) of gas need to match "Deliveries" (burn) to keep line pack in balance
 - When "Deliveries" exceed "Receipts" line pack goes down
 - When "Receipts" exceed "Deliveries" line pack goes up
- To incent correct behavior pipelines impose penalties when shippers don't balance "Receipts" and "Deliveries"





Analogy: Imbalance Gas

Natural Gas

- Most pipelines have gas storage attached to the system
 - Transporter must contract for firm storage
 service or rely on interruptible storage
- Some pipelines offer a park and loan (pack or draft) service at an extra cost
 - Subject to availability, interruptible





Analogy: Imbalance Gas – Cont.

- Natural Gas
 - A shipper on the pipeline may leave some gas on the pipe as line pack (pack the pipe)
 - Most pipelines discourage this practice & will penalize excessive behavior
 - All major pipelines can provide extra gas beyond what is actually scheduled by a shipper by taking gas out of line pack (draft the pipe)
 - As above, excessive behavior will incur penalties, possible interruption.





Thank You For Your Kind Attention





