

NGINSIGHT - GAS PIPELINE DATA COLLECTION AND VISUALIZATION TOOL



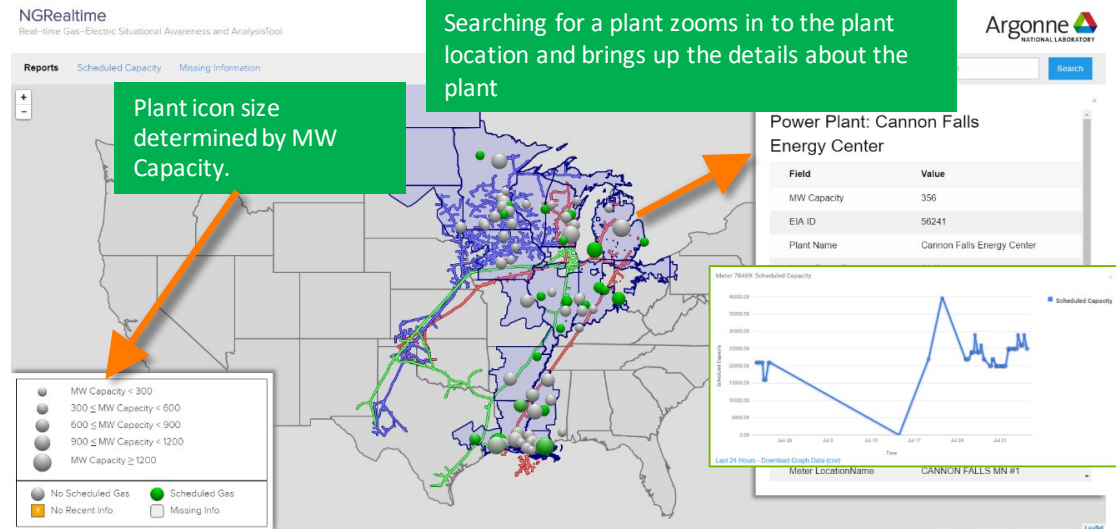
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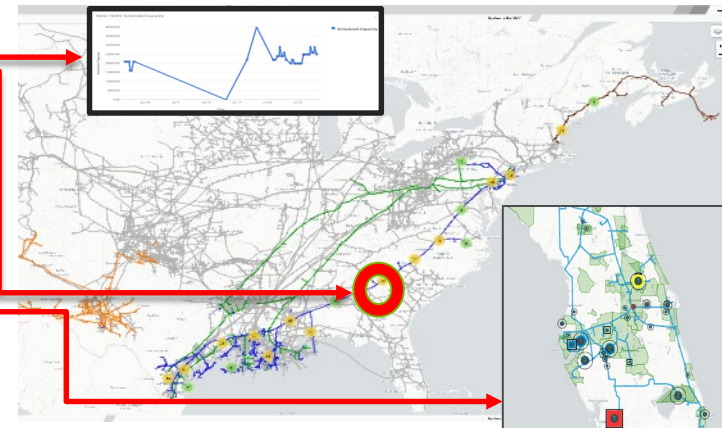
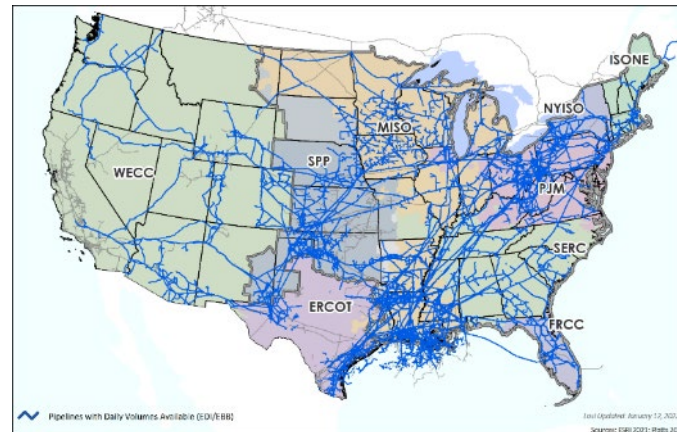
Argonne Asked in 2016 to Provide Visualizing Capability for Near-Real-Time Gas-Electric Information for MISO

- Web-based tool originally developed in 2016 for MISO to provide near-real-time gas-electric situational awareness to MISO's gas-electric coordination group.
- Initially collected data (five times daily) from EBB websites on nominated gas flows from 21 interstate gas pipelines in MISO service territory.
- Website scraping was found to be unreliable due to changes in pipeline ownership, etc.
- It was decided to pursue more reliable data stream via NAESB and individual pipeline companies through EDI.



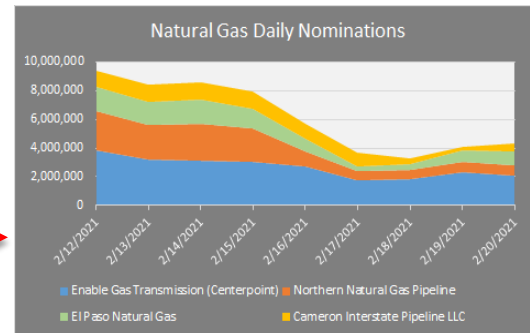
NGINSIGHT TOOL - SITUATIONAL AWARENESS OF NATURAL GAS INFRASTRUCTURE

- *NGinsight* tool provides national-level, near-real-time natural gas situational awareness and enable contingency analysis:
 - Collects electronic bulletin board data using Electronic Data Interchange (EDI).
 - EDI is a computer-to-computer exchange of business documents in a standard electronic format – more reliable than Web scraping.
 - Currently includes >75% of total interstate and offshore pipelines included in the *NGinsight* tool.
- Data collected by the tool:
 - Gas volumes consumed by individual customers (20,000+ points)
 - Unsubscribed capacity available for additional available supply
 - Critical and non-critical notices; planned service outages
 - Currently investigating critical notices using Machine Learning – to determine what pipeline notices should be examined more closely.
- Capability recently added to include background layers:
 - Layers can be static datasets, such as utility service territories, or they can be dynamic data sets displayed in real-time from their source sites, like earthquakes and wildfires.
- Supports interdependency studies with electric power and other critical infrastructure sectors.



Natural Gas Production Data

- EBB data can be used to determine scheduled volumes (not actual flow) of natural gas production as a function of State, county, and pipeline:
 - Can be used to identify future reductions in natural gas supply due to extreme weather, etc.
- Pipeline nomination data provides the type for each receipt point:
 - Helps determine which receipt point is associated with a “Gas Processing Plant” or “Gathering System Interconnect”.
 - Argonne has compiled list of pipelines connected to each processing plant (see example below).
- Comparing scheduled volumes from one cycle to the prior could provide indicator that production is experiencing issues during extreme weather, etc. (will review in demo)



EBB Receipt Point Descriptions	
CITYGATE	R
COMPRESSOR	R
END USER	R
GAS PROCESSING PLANT	R
GATHERING SYSTEM INTERCONNECT	R
INTERSTATE INTERCONNECT	R
INTRASTATE INTERCONNECT	R
LNG TERMINAL	R
MEXICO BORDER	R
PARK AND LOAN	R
POOL POINT	R
STORAGE	R
THROUGHPUT METER	R

EXAMPLES OF NATURAL GAS PROCESSING PLANTS CONNECTED TO MULTIPLE GAS PIPELINES

NAME	STATE	COUNTY	Plant Capacity	Meter Station Name1	Pipeline1	Meter Station Name2	Pipeline2	Meter Station Name3	Pipeline3
MOBILE BAY GAS PLANT (MOBILE BAY PROCESSING)	AL	MOBILE	300.0	16706 - DUKE - MOBILE BAY (R)	Gulf South Pipeline Company, LP	15915 - DEFS Mobile Bay (R)	Gulfstream Natural Gas System, L.L.C.	75008 - MBPP Inlet Primary (X)	Dauphin Island Gathering
WILLIAMS MOBILE BAY GAS PLANT	AL	MOBILE	690.0	16714 - WILLIAMS FLD SERVICE - MOBILE BAY (R)	Gulf South Pipeline Company, LP	15922 - Williams Mobile Bay (R)	Gulfstream Natural Gas System, L.L.C.	24265 - MOBILE BAY PLT WFS MP 123.1 (R)	Transcontinental Gas Pipe Line Company, LLC
YELLOWHAMMER GAS PLANT	AL	MOBILE	200.0	16719 - SHELL-YELLOWHAMMER - MOBILE BAY (R)	Gulf South Pipeline Company, LP	17794 - YELLOWHAMMER M3560 MP 122.859 (R)	Transcontinental Gas Pipe Line Company, LLC	N/A	N/A
BADGER WASH GAS PLANT	CO	MESA	N/A	4890 - BADGER WASH RECEIPT (R)	Northwest Pipeline Corporation	4889 - BADGER WASH DELIVERY (D)	Northwest Pipeline Corporation	N/A	N/A

Ranking of Electronic Bulletin Board (EBB) Notices

- Pipelines communicate with customers through EBB notices based on NAESB standards:
 - Critical updates (outages, restrictions)
 - Non-critical updates (invoices, website updates)
- EBB notice structure:
 - Posted date & time
 - Subject & body (textual)
 - Critical / non-critical flag
- Information contained only in the text:
 - Is the notice reporting an outage? How critical is it?
 - What locations or system components are affected?
 - Is the outage ongoing or resolved?
 - What is the restriction amount?
- Project goal: Extract actionable information from EBB notices using Machine Learning and Natural Language Processing
- Would answer question: How critical is a given notice?
 - Level 1: Informative posting (websites updates, invoices)
 - Level 5: Major unexpected outage, force majeure

The tool currently rank notices 1 through 5, with 5 being the most important requiring the user to contact the pipeline for further information and discussion. The tool uses Machine Learning and Natural Language processing algorithms to support this task. It takes into account terms such as “OFO”, force majeure, etc. provided by individual users.

Due to the ongoing Force Majeure, until further notice, AGT has restricted interruptible, secondary out of path, secondary in path and 100% primary firm nominations sourced upstream of the Weymouth Compressor Station (Weymouth) for delivery downstream of Weymouth. No increases in nominations sourced from points upstream Weymouth for delivery downstream of Weymouth will be accepted.

In order to maintain the operational integrity of the system, Algonquin Gas Transmission, LLC (AGT) is issuing an Operational Flow Order (OFO) pursuant to Section 26 of the General Terms and Conditions of AGT's FERC Gas Tariff effective 9:00 AM CCT, November 7, 2020, to all parties, with the exception of those Operational Balancing Agreements required by FERC regulations, on the AGT system.

What the *NGinsight* Tool Does and Doesn't Do

- **Provides near-real-time gas-electric situational awareness to >75% of U.S. interstate and offshore gas transmission pipelines:**
 - Gas volumes consumed by individual customers (20,000+ points);
 - Unsubscribed capacity available for additional available supply;
 - Nominated gas supply to directly-connected gas-fired electric generators.
- **Current and future gas pipeline conditions:**
 - Critical updates (outages, restrictions);
 - Non-critical updates (invoices, website updates).
- **Machine-learning-based ranking of critical notices to identify those most-significant to individual tool users.**
- **Incorporates outside feeds such as weather alerts, major wildfires, earthquakes, etc.**
- **The *NGinsight* tool does NOT have national coverage:**
 - Does not account for about 25% of gas interstate pipelines;
 - Does not include EBB data from intrastate pipelines (e.g., in California and Texas).
- **Does NOT sectionalize the affected pipelines for a more refined location of at-risk assets.**
- **Does NOT correlate refined locations to the Critical Notice information (e.g., disrupted compressors and impacted downstream pipeline segments).**
- **Does NOT currently provide EBB data for “behind-the-meter” natural gas-fired power plants:**
 - Have researched pipeline meter stations which most-likely serve these power plants but have not implemented this change in *NGinsight*.

NGinsight - DEMO



Potential Future Activities – Partial List (as funding permits)

- Continue preparing and maintaining EBB data feeds.
- Contact and sign new EDI access agreements for remaining gas interstate pipelines.
- Conduct EBB web scraping for pipelines and storage areas without EDI (some pipelines are exempt by FERC).
- Collect nomination and notice data from LDCs such as SoCalGas, PG&E, etc. who provide EBB data via the web.
- Investigate EBB data availability for intrastate pipelines (in Texas, etc.).
- More refined location of assets so we would be sectionalizing the pipeline assets (e.g., market regions).
- Correlate refined locations to the Critical Notice information (e.g., disrupted compressors and impacted downstream pipeline segments).
- Enhance machine learning (ML) models for ranking NG EBB notices using recent data and key words from BES outreach.
- Help support future appropriate / controlled tool users with their work through appropriate restricted secure protocols.
- Develop need and security access levels for different tool user requirements.

What possible tool enhancements are missing from this list?

We welcome your suggestions!

Possible Ways to Provide Greater Insights on Gas Production to Regional Organizations

- Argonne could set up the *NGinsight* tool to evaluate each cycle's scheduled nominations with the prior cycles and “red flag” those with set threshold reduction as a general indicator of potential issue.
- This information could be conveyed to all RTOs and other stakeholders, and could highlight their own pre-selected points of interest (e.g., natural gas processing plants within their service territory, etc.).
- It should be recognized that natural gas producers, in general, have the ability to pull from diverse set of resources so caution should be used in how to assess “red flags” on specific gas production assets:
 - Could lead to misinterpretations of cuts when market is responding to keep end-use deliveries intact.
 - The tool cannot specify how gas production drops would impact end-user/specific generators.

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INTERSTATE PIPELINES NOT CURRENTLY COLLECTED

Company Name / Owner	Pipeline Name	Previously Webscraping?	Company Name / Owner	Pipeline Name	Previously Webscraping?
Alliance Pipeline L.P.	Alliance Pipeline L.P.	Yes	Hartree Natural Gas Storage Co.	SG Resources Mississippi, L.L.C.	Yes
Black Bear Transmission LLC	Ozark Gas Transmission	EDI	Kinder Morgan, Inc.	Stagecoach Pipeline & Storage (sold by Crestwood)	Yes
Black Bear Transmission LLC	AlaTenn		Kinder Morgan, Inc.	Arlington Storage (sold by Crestwood)	Yes
Black Bear Transmission LLC	Midla		Kinetica Partners LLC	Kinetica Deep Water Express, LLC	Yes
Black Bear Transmission LLC	Trans-Union		Kinetica Partners LLC	Kinetica Partners LLC	Yes
Bluewater Gas Storage, LLC	Bluewater Gas Storage, LLC	Yes	Markwest Energy Patners, L.P.	Arkoma Connector Gas Pipeline - MarkWest Pioneer, L.L.C.	Yes
Cheniere Energy, Inc.	Cheniere Corpus Christi Pipeline, L.P.	Yes	Markwest Energy Patners, L.P.	Rendezvous Pipeline Company, LLC	
Cheniere Energy, Inc.	Cheniere Creole Trail Pipeline, L.P.	Yes	MV Pipelines, LLC	KPC Pipeline	Yes
Cheniere Energy, Inc.	Midship Pipeline Company, LLC		NJR Midstream	Leaf River Energy Center	Yes
Crestwood Equity Partners LP	Tres Palacios Gas Storage	Yes	Sempre	Cameron Interstate Pipeline LLC	EDI
DCP Midstream, LLC	Cimarron River Pipeline, LLC		Sempre	LA Storage LLC	EDI
DCP Midstream, LLC	Dauphin Island Gathering Partners		Spire Energy	MoGas Pipeline LLC	Yes
Eastern Shore Natural Gas	Eastern Shore Natural Gas		Spire Energy	Spire Storage West LLC	Yes
Energy Transfer	Gulf Run Transmission, LLC		Southwest Gas Corporation	Great Basin Gas Transmission (Paiute Pipeline)	
Energy Transfer	Stingray Pipeline Company, L.L.C.		Tallgrass Energy	East Cheyenne Gas Storage	Yes
Energy Transfer	Southwest Gas Storage Company		TC Energy	ANR Storage	Yes
Energy West Development Inc	Black Hills Shoshone Pipeline, LLC		TC Energy	Bluelake Storage Company	Yes
EnLink Midstream Company	Sabine Pipe Line LLC	Yes	Third Coast Infrastructure, LLC	Chandeleur Pipe Line, LLC	
ENSTOR GAS, LLC	BayGas Storage	Yes	Third Coast Infrastructure, LLC	Destin Pipeline Company, LLC	
ENSTOR GAS, LLC	Freebird Gas Storage LLC	Yes	Third Coast Infrastructure, LLC	High Point Gas Transmission	
ENSTOR GAS, LLC	Caledonia Energy Partners	Yes	UGI Storage	UGI Storage	Yes
ENSTOR GAS, LLC	Mississippi Hub LLC	Yes	UGI Storage	UGI LNG Storage	Yes
ENSTOR GAS, LLC	Katy Storage and Transportation, L.P.		UGI Storage	UGI Sunbury, LLC	
ENSTOR GAS, LLC	Gramma Ridge Storage and Transportation		Unitil Gas Transmission	Granite State Gas Transmission, Inc.	Yes
Golden Pass	Golden Pass Pipeline LLC	Yes	USG Corporation	B-R Pipeline Company	
Golden Triangle Storage, Inc.	Golden Triangle Storage, Inc.	Yes	USG Corporation	USG Pipeline Company, LLC	
Hartree Natural Gas Storage Co.	Cadeville Gas Storage LLC	Yes	Venture Global LNG, Inc.	TransCameron Pipeline, LLC	
Hartree Natural Gas Storage Co.	Monroe Gas Storage Company, LLC	Yes	White River Hub, LLC	White River Hub, LLC	
Hartree Natural Gas Storage Co.	Perryville Gas Storage LLC	Yes	WhiteWater Midstream	Gateway Pipeline LLC	
Hartree Natural Gas Storage Co.	Pine Prairie Energy Center, LLC	Yes	Xcel Energy Inc.	WestGas InterState, Inc.	

PREPARING AND MAINTAINING EBB DATA FEEDS

- Coordinate formal documentation required by NAESB standards and pipeline companies.
- Collect technical attributes needed for EDI exchange.
- Run data exchange tests for
 - Network connectivity.
 - Encryption protocols.
 - NAESB and X12 standard compliance.
 - Data availability.
 - Data format.
- Repeat process for the production site.
- Establish schedule for data requests, running multiple trials (each of these activities incurs a cost to the pipeline).
- Control interaction timing with each pipeline (so as not to crash the pipeline's EDI system).
- Monitor complex dynamic system of entities with different technical/structural characteristics that can change on a daily basis.

It takes much time (potentially months) to complete the setup process with each pipeline – which can be a huge cost to the pipeline.

- Provide production site maintenance (24/7), including
 - Performing daily inspections of received data.
 - Investigating and resolving exchange interruptions.
 - Updating server operating system software.
 - Proactively avoiding errors that can disrupt the pipeline company's system (costing them money).
 - Weekly archiving of data files.
 - Updating supporting software library and maintaining annual licenses.
- Maintain pipeline and storage facility database.
- Match data to pipeline system assets.
- Conduct EBB web scraping for pipelines and storage areas without EDI (some pipelines are exempt by FERC).