



**WEATHER RESILIENCE IN THE NATURAL GAS
INDUSTRY:
THE 2017-18 TEST AND RESULTS**

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EXECUTIVE SUMMARY

INTRODUCTION—Proof of Resilience

In July 2017, the Natural Gas Council (NGC) released “Natural Gas Systems: Reliable and Resilient” (NGC Report), a report detailing the characteristics of the U.S. natural gas industry that contribute to its reliability and resilience to weather-related interruption of service, including the ability to compensate for any operational issue and to recover rapidly. Most notable from the July 2017 NGC Report was the finding that the gas pipeline industry exhibited a 99.79 percent reliability in fulfilling its firm contract obligations over the ten years leading to and including 2016. Beginning one month after the release of the NGC Report, a series of significant weather events—two hurricanes and the combination of the Northeast freeze and the Bomb Cyclone—tested the natural gas industry. The industry’s performance through the stress test of those three widely varied and tumultuous events fully reinforced the conclusions of the 2017 NGC Report. The natural gas system performed extremely well during times of high stress and demand demonstrating its reliability and resilience in the most challenging of weather conditions.

The NGC commissioned a second report to study in detail the natural gas industry’s performance through the three aforementioned weather events. This study, “Weather Resilience in the Natural Gas Industry: The 2017-18 Test and Results,” (the NGC Resilience Study) was conducted by RBN Energy, LLC and was compiled from a review of press accounts, regional transmission operators’ reports, government reports, and detailed interviews with 25 affected companies. The following Executive Summary details key elements and conclusions of the NGC Resilience Study.

REVIEW OF THE 2017-2018 WEATHER EVENTS

The 2017-2018 storms spanned the full range of potential weather impacts on the natural gas industry.

Gulf Storms and Flooding: Hurricane Harvey represented a traditional Gulf of Mexico hurricane affecting offshore production and is remembered for flooding and immobilizing the fourth largest U.S. city and the headquarters of much of the natural gas pipeline industry.

Extreme Wind and Flooding in Populated Areas: Hurricane Irma was a fierce South Atlantic and Gulf storm moving the length of the heavily populated state of Florida, which relies on natural gas for power generation more than any other state in the U.S., with some extended impact north into Georgia and the Southeast.

Deep Freeze and Extreme Winter Conditions: The Bomb Cyclone is shorthand for a historic Northeast deep freeze, exacerbated by a snow and ice hurricane affecting Northeast production areas and the most densely populated region in the U.S., the East coast.

DEFINING RESILIENCE

To assess resilience of the natural gas industry, this study created a hybrid definition based upon terminology used by the U.S. Department of Energy and dictionary definitions. The study measures the resilience of the natural gas industry based on its ability to:

- » Prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions, and
- » Withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.

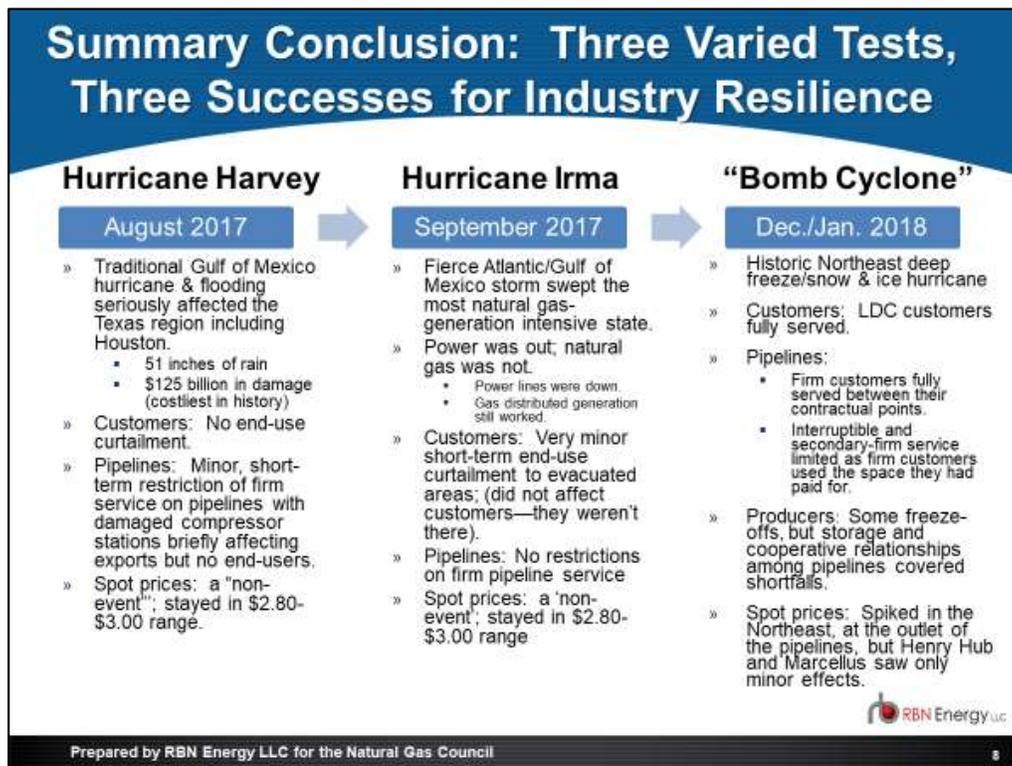
Ultimately, the greatest test of resilience is whether commitments to customers can be met regardless of the degree of stress that is caused by a weather event. As this study demonstrates, the natural gas industry passes this test with flying colors.

OVERALL CONCLUSION

This study of the 2017-2018 experience confirms the natural gas industry’s remarkable resilience to wide variety of severe weather.

Figure 1 is a table summarizing the weather events and related industry performance.

Figure 1: Characteristics and Impact of the Three Weather Events



OPERATIONAL RESILIENCE

The natural gas industry’s reliability and resilience may be attributed to four key characteristics:

- » **Underground Facilities:** The extensive underground location of facilities protects them from weather impacts;
- » **Line Pack:** Transmission pipelines incidentally store gas at pressure (called “Line Pack”) which provides a buffer that can mitigate the effects of abnormal operating conditions;
- » **Network Reliability:** The network configuration of the pipeline industry means that, in the event of an outage, there is usually a “work-around” that allows continued service to LDCs and directly-connected consumers; and
- » **Confined Impact:** Physical configuration limits impact of a disruption; not susceptible to ‘cascading events’ such as those on electric transmission systems.

PLANNING & PREPARATION

The natural gas system resilience can be attributable to several factors: primarily planning and preparation, which in combination with physical properties of natural gas resulted in few operational issues that threatened supply or capacity. In cases where there was potential for impaired firm pipeline service, the industry was able to “work around” the issues through rerouting of gas, turning to underground natural gas storage, and/or coordinating among interconnected pipelines to circumvent impacts to firm customers’ service.

In the two major hurricanes, the real news about the natural gas industry was that there *was* no news. The industry performed normally throughout both storms. In the face of large electric-transmission-driven power outages in Florida, steady gas industry performance enabled backup generation, distributed generation and combined heat and power (CHP) installations to continue to operate, thus protecting high-priority electricity needs, despite the statewide loss of the grid.

TIMELY RESPONSE & RECOVERY

Firm service customers, including local distribution companies (LDCs), experienced no impactful curtailment in any of the three storms. There were limited curtailments caused by facility damage, but repairs were completed by the time evacuations were lifted and consumers returned and required service.

NO SHORTFALL OF SUPPLY OR CAPACITY

During the Bomb Cyclone, customers with firm service agreements in the Northeast received their supplies as contracted. The exhaustion of committed firm capacity in New York and New England resulted in spot-price-driven economic impacts in power markets but did not result in a loss of natural gas reliability. Fuel switching by power generators during this time were due to economic decisions and not supply decisions. In the Mid-Atlantic market, the PJM Interconnection (PJM) indicated that any gas-fired generation outages were NOT a result of a failure of firm transportation. Rather, a temporary differential in fuel prices caused some generators to switch from gas-fired generation to coal-fired generation. Unfortunately, a decision by PJM to operate some coal facilities briefly in lieu of gas-fired generation was misinterpreted by the Department of Energy’s National Energy Technology Laboratory (NETL) as a failure of gas-fired generation. PJM directly corrected the NETL assertion, clarifying that the decision was strictly economic, as coal became briefly less expensive than natural gas—gas supply to generators remained fully available.

TYPES OF SERVICE – A CUSTOMER CHOICE

Firm Pipeline Service

The customer pays a fixed monthly charge to reserve capacity between specific points on the pipeline, essentially leasing space whether gas flows or not. This is the highest-priority service, provides underpinning for pipelines to invest capital.

Interruptible Pipeline Service

The customer pays a rate per unit actually transported, only as gas actually flows. If no gas flows, there is no charge to the customer. Interruptible service is a lower priority service than firm, subject to availability of pipeline capacity with no guarantee of service.

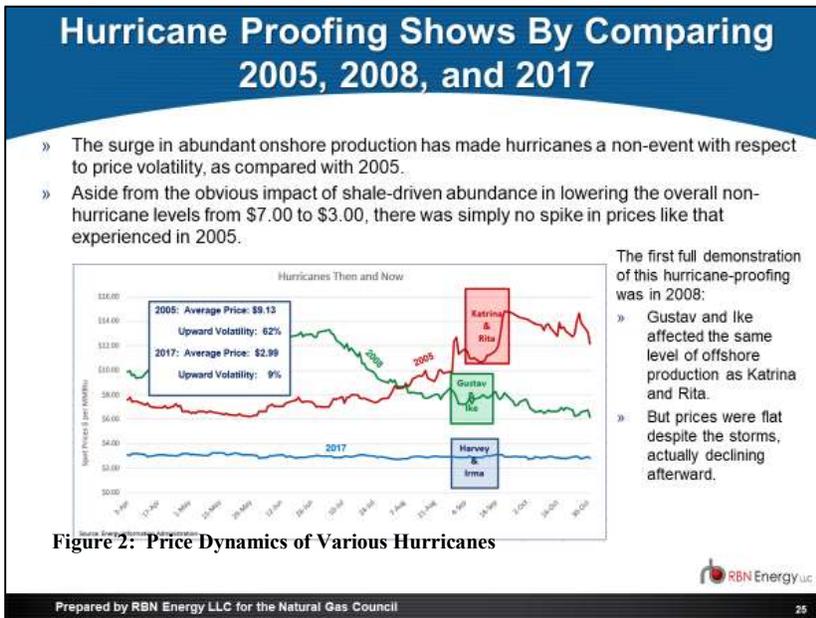
On high-demand days, if customer has only interruptible transportation and is seeking natural gas in the day-ahead market, the customer’s supply options may be limited to local spot markets that are higher-priced than the prices available to firm customers.

Marketer Transportation Options

Marketers and marketers acting as “asset managers” may offer contract options such as rebundled packages of capacity and the gas commodity, able to provide flexible service on the pipeline throughout 24-hour gas day or finding other ways to tailor service to the individual customer’s requirements.

The NGC Report emphasized that any examination of reliability of the natural gas system for individual customers must start from an understanding of which contract choices those customers opted for.

HURRICANE “PROOFING” DUE TO THE SHALE REVOLUTION



A major difference in the impact of Gulf of Mexico hurricanes in past years as compared to today is the lack of sensitivity of the natural gas industry to hurricane-driven supply disruption. Historically, hurricanes in the Gulf of Mexico had a serious impact on supply availability from offshore. While service remained resilient, there were significant economic consequences in the form of higher natural gas prices caused by the supply-demand balance and pipeline bottlenecks moving gas from Texas.

Harvey & Irma

In the recent two major hurricanes, the real news about the natural gas industry was that there was no news. The industry performed as expected throughout both storms. In the face of large electric-transmission-driven power outages in Florida, steady gas industry performance enabled backup generation, distributed generation and combined heat and power installations to continue to operate, thus protecting high-priority electricity needs, despite the statewide loss of the grid.

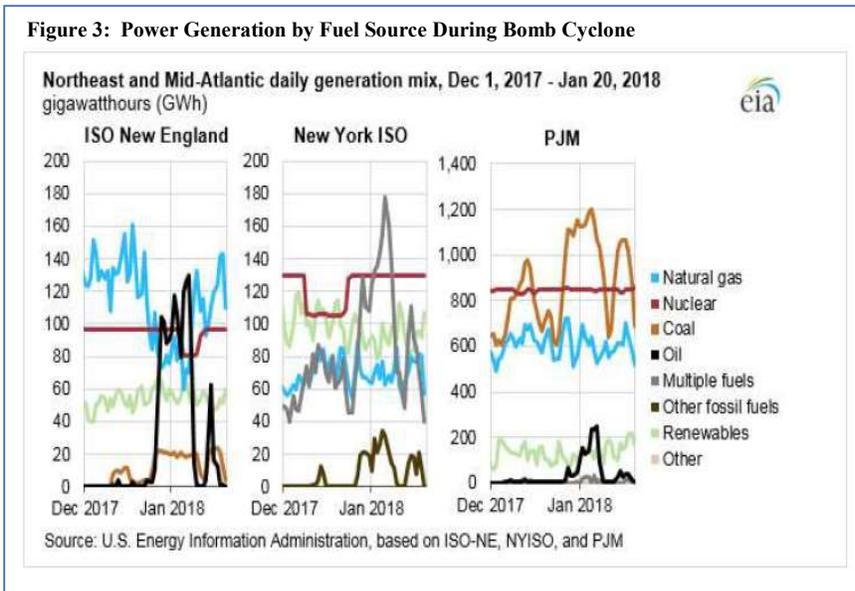
Due to the shift from largely Gulf of Mexico supplies to regionally diverse onshore shale production, this phenomenon has vanished. Shale gas has “hurricane-proofed” the industry for over a decade. Figure 2 is a comparison of price dynamics as between the pre-shale storms of 2005 (Hurricanes Katrina and Rita), with the experience in 2008 (Hurricanes Gustav and Ike) and 2017 (Hurricanes Harvey and Irma).

Bomb Cyclone

PJM, ISO-NE, and NYISO all published post-mortem reports examining performance during the Bomb Cyclone. Meanwhile, the U.S. Energy Information Administration (EIA) published a single overall report on all three. The EIA report’s comprehensive view is best summarized by the main headline of the report: “Market design changes and winter preparedness actions help Northeast and Mid-Atlantic electricity markets handle January’s bomb cyclone weather event.”

Figure 3 is EIA’s summary of the generation mix by fuel in the three power markets. Of the three markets, only New England saw a sharp drop in gas-fired generation (the blue line) and a corresponding increase in alternate fuel during the Bomb Cyclone, representing the use of oil (black) to avoid high spot prices for generators that did not have firm transportation available.

Figure 3: Power Generation by Fuel Source During Bomb Cyclone



PJM (whose electric load was six times as large as either New England or New York) saw a significant increase in coal use (brown), rather than a turn-up of gas facilities. As PJM has explained, this was strictly an economic decision, not a lack of availability of gas.

IN SUMMARY: Resilience and Reliability of Natural Gas Sector Unshaken Through Severe Weather Events

This study sought to examine the natural gas sector’s performance through three of the most severe weather events in recent history. Data was gathered from the field, through interviews conducted with company officials, public records, regional transmission operators’ reports, media reports and official government records. The results are clear: despite some of nature’s harshest conditions, the natural gas sector proved exceedingly reliable and resilient.

Reliability and resilience were demonstrated through the continued service and availability of natural gas despite threatening weather and outages on the electric grid. In the rare instances of natural gas service interruption, the industry demonstrated rapid recovery, thereby minimizing impacts to a negligible amount.

The findings in this study further demonstrate the critical role that contractual agreements serve in enhancing reliability of natural gas service. The Bomb Cyclone spiked spot prices for natural gas temporarily, causing some power generation to switch to alternative fuel sources to minimize cost. Entities such as local distribution companies, that contract for firm natural gas service, were not impacted by these price swings. The findings underscore the significance of appropriate service contracts to meet the needs of the customer.