

# Impact of the 2008 Hurricanes on the Natural Gas Industry

This report provides an overview of the 2008 Atlantic hurricane season and its impacts on the natural gas industry. Data in this report were collected from various sources, including the Minerals Management Service, the National Oceanic and Atmospheric Administration, and the Department of Energy. Information on natural gas processing plants was collected on the Energy Information Administration's Form EIA-757, "Survey of Natural Gas Processing Plants," Schedule B, "Emergency Status Report" and various industry sources. Questions or comments on the contents of this article, or Form EIA-757, should be directed to Lejla Alic at [Lejla.Alic@eia.doe.gov](mailto:Lejla.Alic@eia.doe.gov) or (202) 586-0858.

Hurricanes Gustav and Ike inflicted significant damage to the nation's oil and natural gas infrastructure, causing devastating impacts on offshore natural gas production, shutting in production facilities and the pipelines that move the natural gas to processors along the Gulf coast. As a result of the two storms, almost all of the natural gas production and processing capacity in the area was shut in, with continued shut-ins affecting production into December 2008. There were 55 major natural gas processing plants in Texas, Louisiana, Mississippi, and Alabama that were in the path of Hurricanes Gustav and Ike, representing about 38 percent of the U.S. processing capacity.<sup>1</sup> Twenty-eight pipelines declared force majeure during early September.<sup>2</sup> Most of these pipelines move natural gas from offshore production platforms to onshore processing plants and many of them were effectively shutdown. Onshore interstate pipeline companies also were affected, with about a dozen interstate pipelines experiencing lower-than-normal flows in the aftermath of the hurricanes.

## ***Overview of Hurricane Activity***

The 2008 Atlantic hurricane season was the most active since 2005 and the fourth most active since 1944, with 16 named storms, half of which were hurricanes, and 5 of which were major at category 3 strength or greater.<sup>3,4</sup> While only three hurricanes made landfall in the United States, a series of tropical storms also caused significant damage to production, transmission, and distribution systems throughout the Gulf of Mexico and East Coast regions (Figure 1). Within 2 months (between July 23 and September 13), the United States was hit by three hurricanes and two tropical storms.

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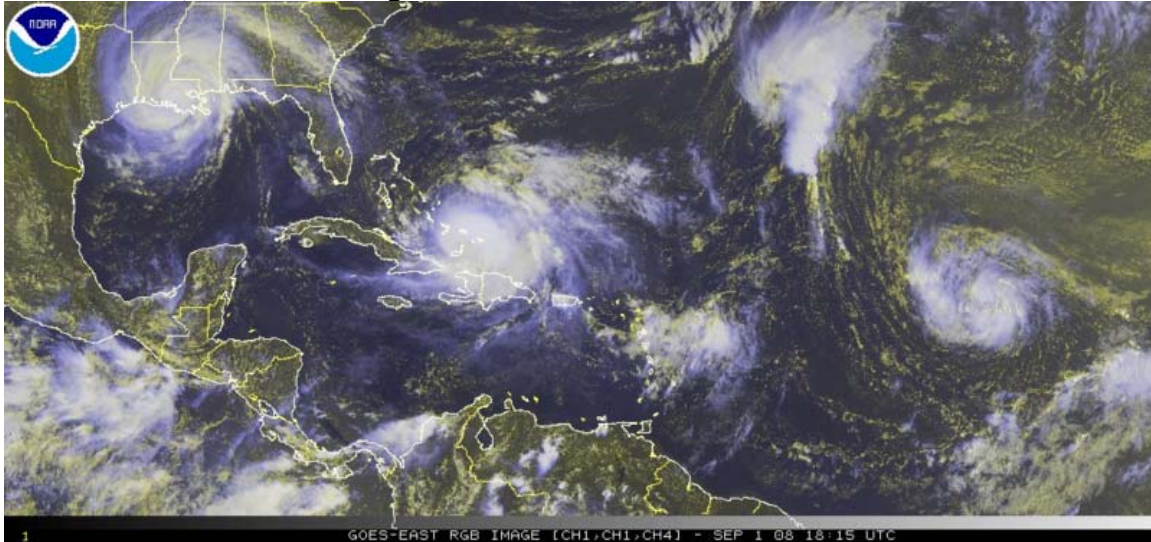
<sup>1</sup> Major processing plants refer to those that have a natural gas processing capacity of 150 million cubic feet per day or greater.

<sup>2</sup> Force majeure is defined as any occurrence (e.g., natural or man-made disasters, industrial disturbances, accidents, or other cause) that is beyond the control of a pipeline exercising due diligence.

<sup>3</sup> The 2008 hurricane season was classified as active based on the number of storms that occurred between June 1 and November 30.

<sup>4</sup> National Oceanic and Atmosphere Administration, "Atlantic Hurricane Season Sets Records," November 26, 2008, [http://www.noaanews.noaa.gov/stories2008/20081126\\_hurricanesseason.html](http://www.noaanews.noaa.gov/stories2008/20081126_hurricanesseason.html).

**Figure 1. Three Storms Heading for the Gulf of Mexico: Gustav Making Landfall, Hannah in the Caribbean, and Ike Forming in the Atlantic**



Source: National Oceanic and Atmospheric Administration, September 1, 2008.

The most destructive storms in order of landfall of the 2008 hurricane season were:

- **Hurricane Dolly**, a Category 2 hurricane, hit the Texas/Mexican border on July 23, causing damage in the Gulf of Mexico oil and natural gas production fields and pipelines.
- **Tropical Storm Edouard** arrived 2 weeks later and hit the Texas-Louisiana border causing significant shut-ins of Gulf of Mexico oil and natural gas platforms, as well as creating hazardous marine conditions that resulted in closed ports.
- **Hurricane Gustav** made landfall on September 1, before the oil and natural gas delivery systems disrupted by Edouard were fully restored. This strong Category 2 storm brought significant flooding as far north as Baton Rouge.
- **Tropical Storm Hanna** hit the U.S. Southeast 5 days later, further disrupting waterborne shipments of petroleum products.
- By the time **Hurricane Ike** made landfall near Baytown, Texas, on September 13, (a strong Category 2 hurricane) significant portions of the production, processing, and pipeline infrastructure along the Gulf coast in East Texas and Louisiana were shut in. Hurricane Ike caused significant destruction to electric transmission and distribution lines, and these damages delayed the restart of major processing plants, pipelines, and refineries. As many as 3.7 million customers were without electric power following the storm, with about 2.5 million in Texas alone. Hurricane Ike was the most powerful storm of the season.

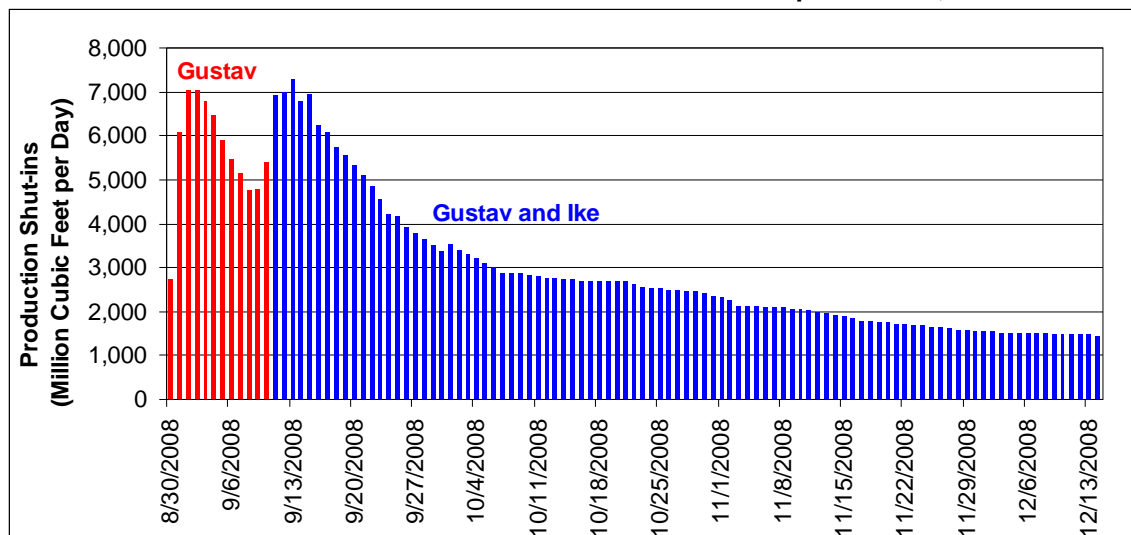
## ***Production***

The offshore Gulf of Mexico yields a significant portion of domestically-produced natural gas. Immediately before Hurricanes Gustav and Ike, the Federal Offshore provided approximately 7 billion cubic feet (Bcf) per day of natural gas, which is about 12 percent of total domestic production. The Minerals Management Service (MMS) estimated that about 2,127 oil and natural gas production platforms in the Gulf were exposed to hurricane conditions from both storms, with winds greater than 74 miles per

hour. As of August 2008, there were more than 3,800 production platforms in the Gulf. At one time during the storms, nearly all manned platforms and rigs were evacuated.

Because of the large amount of infrastructure located in the Gulf of Mexico, damage from the two storms was extensive. MMS reported that 60 offshore platforms were destroyed, which accounted for a total of 96.5 million cubic feet (MMcf) per day of production.<sup>5</sup> Natural gas production in the Gulf declined to 0.3 Bcf per day after Hurricane Gustav made landfall on September 1, 2008. The low production also resulted from shutting down production platforms threatened, but not damaged, by the hurricane. In the storms' aftermath, recovery commenced quickly and within a few days production had reached 2.7 Bcf per day when, two weeks later, Hurricane Ike approached, forcing nearly all of the natural gas production to be shut in once again (Figure 2). After Hurricane Ike made landfall, 98 percent of the production was shut in, and natural gas was produced at the rate of 0.1 Bcf per day. This time recovery was much slower and by mid-December 2008, Federal Gulf of Mexico production had returned to 5.9 Bcf per day (Table 1).

**Figure 2. Federal Gulf of Mexico Shut-ins Reached a Peak of 7.3 Billion Cubic Feet per Day or 99 Percent of Total Federal Gulf of Mexico Production on September 15, 2008**



Source: Energy Information Administration, derived from data published by Minerals Management Service.

According to the *Natural Gas Monthly, December 2008*, published by the Energy Information Administration (EIA), natural gas production in the Federal Gulf of Mexico in September 2008 decreased 68 percent to 2.2 Bcf per day compared with 6.9 Bcf per day in August 2008. Natural gas production in States along the Gulf coast also decreased in September from the month earlier levels. Production in Texas and Louisiana, including the onshore and offshore areas of each State, decreased in September as well, albeit by

<sup>5</sup> While extensive, the damage resulting from the 2008 hurricanes was less than that from the hurricanes of 2005. Hurricane Katrina, a Category 5 storm, destroyed 44 platforms and damaged 20 others, while Hurricane Rita (Category 4) destroyed 69 platforms and damaged 32 others. Source: U.S. Department of Energy, Office of Fossil Energy, *Impact of the 2005 Hurricanes on the Natural Gas Industry in the Gulf of Mexico Region*, Washington DC, 2006.

smaller percentages. Daily Texas production fell by 4 percent compared with August 2008 to 18.7 Bcf per day. Shut-in production in Texas for the month of September was offset somewhat by the continued success from unconventional resources, such as the Barnett Shale in the northeast part of the State. Total U.S. daily dry natural gas production in September 2008 was 11 percent less than in August 2008.

Louisiana daily natural gas production in September 2008 decreased by approximately 19 percent to 3.0 Bcf per day, and it was about 17 percent lower than the September 2007 production. However, the post-hurricane recovery of the infrastructure in the State continues, and the Louisiana Department of Natural Resources reported in December that about 74 percent of the total daily natural gas production capacity had been restored.<sup>6</sup>

**Table 1. Post-Hurricane Production Statistics in the Offshore Gulf of Mexico**

	Worst Day Outages		Recent Outages
	Gustav (9/2/08)	Ike (9/14/08)	12/16/2008
Billion Cubic Feet per Day	7.1	7.3	1.5
Percent of Gulf Production	95	98	20
Percent of U.S. Production	13	14	3

Note: Data in the table represent production in the Federal Gulf of Mexico waters.

Source: Energy Information Administration, Office of Oil and Gas, derived from data published by the Minerals Management Service.

## **Pipelines**

The natural gas and petroleum transportation network in the Gulf of Mexico is made up of more than 33,000 miles of pipelines that link 3,800 production platforms with supporting onshore infrastructure.<sup>7</sup> These pipeline systems include subsea pipes, valves, compressors, and dehydration and separation facilities.

As a result of Hurricanes Gustav and Ike, 28 of the pipelines operating in the Gulf declared *force majeure*, and many of these pipelines were completely shut down. Because of the shut-in production platforms, very little natural gas was flowing through these lines. Large interstate pipelines located onshore were affected marginally, and mostly as a result of low pipeline pressure. About a dozen interstate pipelines had lower-than-normal flows in the aftermath of the hurricanes, but they returned to normal operating levels within a few days by utilizing storage supplies to keep the lines full.

Hurricanes Gustav and Ike's landfalls necessitated the closure of the Henry Hub in Louisiana, which, in addition to being one of the most important trading locations in the

<sup>6</sup> Louisiana Department of Natural Resources, *Louisiana In-State Production Weekly Status Update December 22, 2008*. This report covers 126 operators with producing wells in a 17-parish region, including Acadia, Assumption, Calcasieu, Cameron, Iberia, Jefferson, Jefferson Davis, Lafayette, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. Martin, St. Mary, Terrebonne, and Vermilion. The report does not include information on Federal wells in the Outer Continental Shelf region. The status of 153 MMcf per day (9.3 percent) of natural gas production capacity in the 17-parish region has not been confirmed.

<sup>7</sup> Source: Pipelines: U.S. Department of Energy, Office of Fossil Energy, *Impact of the 2005 Hurricanes on the Natural Gas Industry in the Gulf of Mexico Region*, Washington DC, 2006; Production platforms: Minerals Management Service, *Hurricane Gustav/Hurricane Ike Activity Statistics Update*.

Lower 48 States is also an interconnect of four intrastate and nine interstate pipelines. Because of these interconnects, the Hub is of vital importance for transportation of natural gas from the producing region in the Gulf to the consuming markets in the Northeast and the Midwest.<sup>8</sup> Furthermore, since the physical delivery of natural gas traded at the New York Mercantile Exchange (NYMEX) occurs at the Henry Hub, the NYMEX physical deliveries of the August and September 2008 futures contracts were also impacted by the hurricanes.<sup>9</sup>

The 2008 hurricanes caused significant damage to the offshore pipelines. As of early December, several natural gas pipeline operators continued to repair their systems in the Gulf, expecting to resume operations on repaired segments in December 2008 or in some cases in early- to mid-2009. The pipeline companies still dealing with hurricane damage in November, included Enterprise Products Partners, Williams Company, Sea Robin Pipeline Company, Venice Gathering System, and El Paso Corporation. Enterprise Products Partners reported in late November that its 291-mile High Island Offshore System would not return to full operation until January 2009. The 42-inch mainline was broken 6 miles north of the High Island A-264 platform, and in November 2008 was moving 17 MMcf per day of gas compared with the pre-hurricane level of 330 MMcf per day. Similarly, Sea Robin Pipeline Company was restoring the system that carries natural gas from the Ship Shoal area to the East Cameron area with a capacity of 1 Bcf per day. Hurricane Ike toppled Sea Robin's East Cameron Block 265 platform and caused subsea damage. The pipeline company reported that subsea repairs were expected to be completed by the end of December 2008. Meanwhile, El Paso Corporation reported that segments of the Tennessee Gas Pipeline Company system were operating at one-fourth their usual flow, with 525 MMcf per day shut in. Total damage to the pipeline caused by Hurricane Ike was estimated between \$80 million and \$120 million.

### ***Natural Gas Processing Plants***

The natural gas that enters an interstate pipeline must meet specific requirements for the pipeline system to operate properly. In order to meet these requirements, natural gas produced at the wellhead often requires processing to remove oil, water, and elements such as helium, sulfur, carbon dioxide, and natural gas liquids (NGLs). While some of this processing takes place at the lease site, removal of contaminants, nitrogen extraction, demethanization, and NGL extraction and fractionation are done in processing plants.

When the 2008 hurricanes made landfall in the Gulf of Mexico, there were 55 major processing plants (those with more than 150 MMcf per day of capacity) located in the States of Texas, Louisiana, Mississippi, and Alabama, in the path of the two storms. The total processing capacity of these plants was 26.2 Bcf per day, which corresponds to about 38 percent of total U.S. processing capacity. Damage caused by the hurricanes

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<sup>8</sup> Henry Hub is the interconnecting location of following pipelines: Acadian, Columbia Gulf Transmission, Gulf South Pipeline, Bridgeline, NGPL, Sea Robin, Southern Natural Pipeline, Texas Gas Transmission, Transcontinental Pipeline, Trunkline Pipeline, Jefferson Island, and Sabine Pipe Line. There are two compressor stations at the Henry Hub, which can compress 520,000 decatherms per day. The transportation capacity at the Hub is more than 1.8 Bcf per day, according to Sabine Pipe Line, LLC.

<sup>9</sup> The Henry Hub was closed for spot natural gas trading on September 2 and 15; however, NYMEX physical deliveries did not take place between August 31 and September 5, and September 12 to 17, 2008.

resulted in dozens of plant shutdowns. While most of these plants have resumed operations, at least three remained shutdown at the end of December 2008.

According to EIA, causes for shutdowns at the processing plants varied and were the result of both internal and external factors. External factors include the lack of electric power experienced by many plants, lack of upstream supplies, inaccessibility to the plant because of road conditions, or lack of downstream capabilities to send out NGLs. Internal factors refer to plant-specific damages, which included flooding, debris damage, and equipment destruction.

In advance of Hurricane Gustav’s landfall, which occurred on September 1, operators shut down 25 plants, reducing the processing capacity in the region by 16 Bcf per day or 24 percent (Table 2). At least 16 of those plants were not operating because of external factors, while internal factors shut down the remaining nine. By the time Hurricane Ike made landfall, most of the plants that had shut down as a result of Hurricane Gustav were back online, with only four plants reporting that they were not operational. However, in anticipation of Hurricane Ike’s landfall on September 13, a total of 30 plants were completely shut down and were not able to resume operations for at least a few days. These 30 included the four shutdown plants that remained from Hurricane Gustav.

As in 2005, the majority of the plants cited external factors as the reason for the plant closures. A total of 21 plants reported external factors, while a handful of plants reported that internal problems caused the shutdowns. There was insufficient information to determine the cause of the shutdown for several of the plants immediately after the hurricanes. The unavailability of some large-volume fractionation sites, such as the Mount Belvieu complex and the Beaumont facility in Texas after Hurricane Ike made landfall, was cited by several processors as the reason their plants were not operating or not operating at pre-hurricane levels. The availability of downstream outlets for liquids is crucial for a natural gas processing plant, because without the ability to move co-products properly, processing plants cannot operate. At the same time, the shut-ins of pipelines that bring the wellhead natural gas to processing facilities caused the idling of several plants for a number of days following the hurricanes.

**Table 2. Natural Gas Processing Plants Following Hurricanes Gustav and Ike**

	Worst Day Outages		Recent Outages
	Gustav (9/02/08)	Ike (9/14/08)	12/03/2008
Number of Plants	25	30	5
Billion Cubic Feet per Day	16.1	14.5	3.2
Percent of Gulf Capacity	63	57	13
Percent of U.S. Capacity	24	21	5

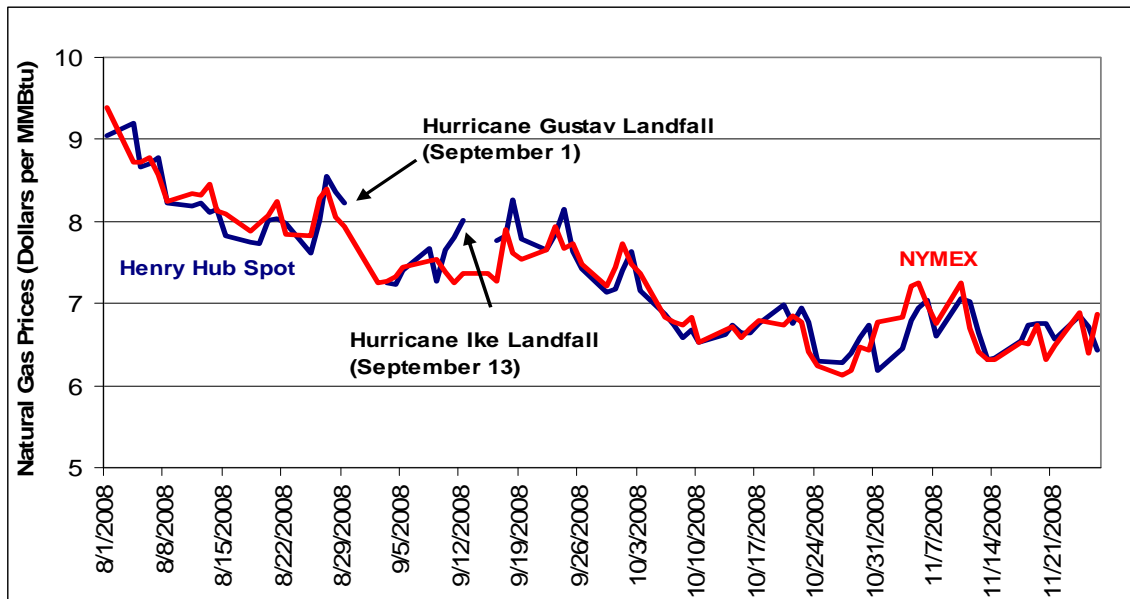
Source: Energy Information Administration, Office of Oil and Gas, derived from data collected on Form EIA-757 Schedule B, trade press, and natural gas processing plants operators’ press releases.

Plants affected by external factors were the first to come back online. Once the upstream flows returned and downstream capacity recovered, processing plants began operating first at reduced levels; afterward plants slowly ramped up their processing capabilities. By early November 2008, all but five plants were back online; those five plants, which suffered internal damage are not expected to return to service before the end of January 2009.

## Market Response to Hurricanes

Immediately following the news of the approaching hurricanes, natural gas prices increased slightly at both the spot and futures markets. The Henry Hub spot price rose slightly in the days preceding the landfall of Hurricane Gustav on September 1. However, the spot price at the Henry Hub was lower on September 3 (the first day Henry Hub was operational following its closure) than it was on August 29, 2008 (Figure 3). The Henry Hub spot price also had a slight uptick before and after Hurricane Ike's landfall on September 13 but has generally trended downward since then through the end of November.

**Figure 3. Henry Hub Spot Price and the NYMEX Futures Prices Increased Only Temporarily Following the Hurricanes**



Source: Natural Gas Intelligence, *Daily Gas Price Index*.

Similarly, the price of the near-month futures contracts has been on a decreasing trend, and the hurricanes in the Gulf of Mexico had only limited influence on futures prices. While there was a temporary uptick in prices immediately before Hurricane Gustav made landfall, this did not reverse the general downward trend that the futures prices have been exhibiting.

The response in spot and futures prices following the hurricanes' landfalls in 2008 was a stark contrast to the price response following the 2005 hurricanes, when the natural gas spot and futures prices nearly doubled. The Henry Hub spot price reached a high of \$15.40 per million Btu (MMBtu) in 2005, while the near-month futures prices jumped to more than \$14.00 per MMBtu.

A number of factors led to the limited price response in 2008. First, the 2008 hurricanes were not as powerful as the storms in 2005 in terms of wind and storm surge. Consequently, the 2008 storms caused significantly less damage than those in 2005. For example, the damage to the natural gas infrastructure in the Gulf in 2005 was much more extensive, with a total of 113 platforms destroyed and another 52 damaged, taking about

2 Bcf per day of production permanently offline. By comparison, 60 platforms were destroyed by the 2008 hurricanes with current estimates not indicating that any production will be permanently taken offline.<sup>10</sup>

Approximately the same number of natural gas processing plants had hurricane-related disruptions during 2008 as in 2005. However, because the extent of the damage was less severe in 2008 and fewer plants reported shutdowns as a result of internal factors, the natural gas processing plants recovered more quickly than in 2005. For example, in 2005, eight plants with 5.5 Bcf per day of processing capacity were still shutdown 2 months after the hurricanes. By comparison, 2 months after the 2008 hurricanes, five plants remained shutdown with a total processing capacity of 3.2 Bcf per day.

Furthermore, the natural gas market in 2008 did not show the supply-demand tightness that characterized the market in 2005. Natural gas spot prices were increasing prior to the hurricanes in 2005, increasing from \$7.01 per MMBtu on July 1 to an average of \$9.80 per MMBtu in the week prior to Hurricane Katrina's landfall. The damage caused by the storms exacerbated the price increases, which reached historical highs on some spot market locations in the Lower 48 States, including at the Henry Hub. The opposite occurred in 2008, when natural gas prices were on a downward trend since the beginning of July 2008, falling from more than \$13 per MMBtu to \$8.16 per MMBtu during the last week of August. Aside from the short-run price increases associated with each hurricane, both spot and futures prices continued to decline in September.

The declining prices observed following the 2008 hurricanes were the result of several supply and demand factors. The volume of natural gas in storage exceeded the historical average and continued to increase through the injection season. Additionally, increased onshore production, particularly production in the Barnett Shale limited the shock to the market.<sup>11</sup>

Demand during the latter half of 2008 also has been weak. The economic downturn contributed to a decrease in demand and downward pressure on commodity prices in general, particularly crude oil prices. Furthermore, the geographic area that was affected by the hurricanes in 2008 contributed to lower natural gas consumption, limiting the increase in prices. The storms shut down many of the Gulf area's numerous refineries, processing plants, and other industrial complexes that typically use significant amounts of natural gas as feedstock. EIA estimates that 84 percent of the drop in the industrial consumption in September 2008 was the direct result of consumption decreases in Texas and Louisiana, mainly because of the hurricanes. Furthermore, electric power service was

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<sup>10</sup> 2005 assessment: U.S. Department of Energy, Office of Fossil Energy, *Impact of the 2005 Hurricanes on the Natural Gas Industry in the Gulf of Mexico Region*, Washington DC, 2006. 2008 assessment: Energy Information Administration, Office of Oil and Gas, and Minerals Management Service, *Minerals Management Service Updates Number of Offshore Facilities Impacted by Hurricane Ike*.

<sup>11</sup> A similar market response was observed in the NGLs markets, where despite the hurricanes, prices significantly dropped in September 2008 for propane and pentanes. The lower prices occurred as NGL storage levels exceeded those recorded in both August 2007 and August 2008. The build-up in NGL inventories occurred as natural gas production (and processing) rose in onshore production regions. Additionally, there was a significant decline in crude oil prices, which undoubtedly influenced the price of alternative fuels. Based on NGL storage data from the Energy Information Administration and NGL prices from *Hart's Gas Processors Report*, November 5 and December 10, 2008.



interrupted for 3.7 million customers in Arkansas, Indiana, Kentucky, Louisiana, Ohio, and Texas in mid-September. In fact, after Hurricane Ike made landfall, 2.5 million customers (23 percent) in Texas were without electric power. Since Texas is the top consuming State of natural gas for electric power generation, the loss of electric power to so many consumers also significantly impacted total natural gas consumption for the month.<sup>12</sup>

## **Conclusion**

The 2008 Atlantic hurricane season was the fourth most active season since 1944 and the most active since 2005. While only three hurricanes made U.S. landfall, a series of tropical storms also caused significant damage to production, transmission, and distribution systems throughout the Gulf and East Coast regions.

Overall, the damage caused by the storms was significant, with most of the production facilities in the Gulf of Mexico being offline for at least a few days following Hurricanes Gustav and Ike. As a result of the production disruptions, per-day natural gas production fell by 68 percent in September 2008 compared with the previous month and 70 percent compared with September 2007.

As of December 2008, companies continued to repair damage that the hurricanes caused to their facilities, particularly the subsea lines that transport wellhead natural gas from production platforms to processing plants. While most of these facilities are operational, a few pipeline segments and platforms are still offline. Some reports indicate that several of the platforms will likely stay offline through mid-2009.

Most of the processing plants affected by the hurricanes did not sustain major internal damage. The plants that cited external factors as reasons for not operating have recovered, and all of them currently operate although some at reduced levels. Three plants are still shutdown as a result of extensive internal damage and are not expected to be back online until early 2009.

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<sup>12</sup> Texas natural gas consumption for electric power generation accounted for 22 percent of the U.S. natural gas deliveries to electric power customers and also accounted for about 7 percent of total U.S. consumption in 2007. Other top natural gas consuming States for electric power generation in 2007 were California (12 percent), Florida (11 percent), New York (6 percent), and Oklahoma (4 percent).