AccuWeather
For Business

Our Outlook for Winter 2022-2023

Weather Projections and Gas Market Analyses for Energy Industry Professionals

October 2022

Preface

AccuWeather For Business (AFB) is the global leader in providing weather alerts and warnings and a broad portfolio of content, data, and analytics. Our clients include more than half of the Fortune 500, 78 of the Global 100, and thousands of other businesses and government agencies that rely on AccuWeather's weather intelligence to protect their property, people, and profits. AccuWeather's B2B solutions have helped organizations across industries keep employees and customers safe while saving millions of dollars with site-specific weather insights and alerts that inform critical decisions, such as when to close facilities, halt production, reconfigure transportation networks, or change operational tactics. Whether a company is threatened by adverse weather or facing challenging decisions on addressing natural disasters, AccuWeather for Business' weather tools helps them conduct their operations more efficiently while mitigating risks and liability.

The effects of the global COVID-19 pandemic reinforced the importance of data-driven contingency planning for any emergency. Now, as companies face a lengthy recovery period, AccuWeather for Business' tools and data will be increasingly necessary. Businesses face more pressure than ever to seamlessly navigate operational challenges like weather events. Our insights provide clarity and confidence for this decision-making even under the most trying conditions to reduce risks while increasing operational efficiency and profits. Although there's typically ample time to reach routine business decisions, this is not always the case for weather-related decisions, especially when lives are at risk or millions of dollars are at stake. Customers trust AccuWeather for Business to repeatedly provide the most accurate and actionable weather insights in these critical situations.

AccuWeather for Business' array of tools includes the patented SkyGuard severe weather warnings, which provide proactive, site-specific notifications with double the advance notice time of other sources and routinely deliver life-saving alerts when no warnings are issued from any other source; historical data with over 300 metrics; business analytics grounded in AccuWeather's big data API; and proprietary GIS layers that can be easily integrated into existing operations platforms.

Access 24/7 is also available to AccuWeather's team of more than 100 expert meteorologists, who are available by phone for an individualized consultation, especially during times of need, providing up-to-the-minute trusted insights and enabling customers to make the best decisions when severe weather threatens.

AccuWeather For Business' Web Portal supports organizations before, during, and after disaster strikes with an array of global weather hazard and risk mitigation tools and quickly customizable reports showing assets most at risk from impactful weather. This robust and reliable situational awareness tool provides instant access to live lightning strikes, local storm reports, and high-resolution Doppler radar, all close to company assets. In addition, the SkyGuard Mobile App offers clients a centralized way to protect people and property from any location. Available on iOS and Android, this companion application seamlessly syncs with Portal settings, delivering critical weather information and insight via native push notifications. The app features instant delivery of SkyGuard's Severe Weather Warnings, lightning tools, and live updated radar.

Preface, Cont.

The effects of climate change are already dramatically impacting our planet, leading to questions about how the future will unfold. In recent years, significant weather and climate events have increased in number and severity. As average temperatures have risen and precipitation patterns have shifted, droughts have become pervasive, and wildfires have become significant annual events. In stark contrast, other regions have experienced episodes of seemingly endless rain, with 100-year floods occurring much more frequently than in the past. For the last several years, the top issues by risk cited by the World Economic Forum have been extreme weather events and climate change failure. These conditions are expected to continue and accelerate in the decades ahead.

The impacts associated with climate change will financially alter the course of most companies in ways never imagined and, globally, will divert trillions of dollars in new directions as companies adapt to a changing climate playing field. This is especially true when considering the secondary impacts, such as political and socioeconomic effects, associated with the transition to a lower-carbon economy.

Understanding our climate and its changes in the future represents one of the most difficult challenges to modern science. The complexity of the atmosphere and its interaction with the dynamically changing oceans and landmasses has created a puzzle of such immense proportions; it isn't easy to know where to begin. Being the best in one's industry provides little solace and guidance in dealing with the magnitude of environmental change ahead of us.

For 60 years, AccuWeather and AccuWeather for Business have been at the center of the weather services industry, providing the most accurate weather forecasts, warnings, and alerts and creating new technologies, many of which have been patented globally. Our products, services, and insights have allowed people to live safer, more enriched lives while protecting property. Similarly, with its decades-long expertise in creating and maintaining deep and diverse weather and climate datasets, AFB has an enviable track record for extracting critical insights and information that can benefit every organization.

Our Analyses

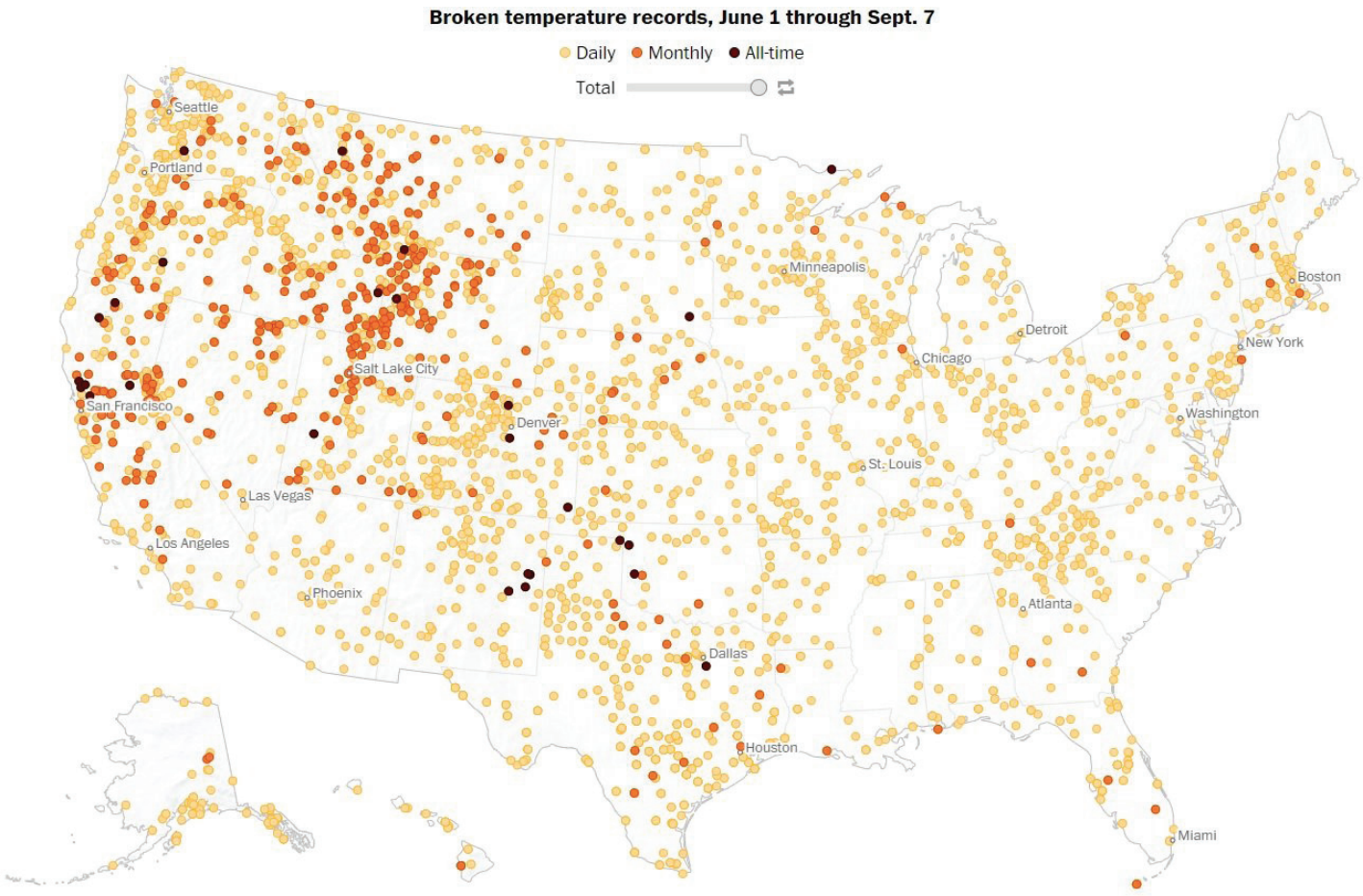

Figure 1. *Broken temperature records, summer 2022, including daily, monthly, and all-time.*
Graphic Source: washingtonpost.com/climate=environment/interactive/2022/temperature-records-summer/
Data Source: ncei.noaa.gov/products/land-based-station/global-historical-climatology-network-daily?itid=lk_inline_enhanced-template

The temperatures this summer were brutal. More than 7,000 daily temperature records across the United States were broken, with more than 400 monthly records and 27 all-time records also falling (see Figure 1 above). And alarmingly, August 2022 was the hottest August recorded in North America and Europe and the second warmest globally.

The extreme summer temperatures also elevated Natural Gas prices, causing spikes in prices above $9.00 per MMBtu in late July and again in late August. Natural gas prices have somewhat moderated since then. At the time of this writing (early October), gas prices for November delivery have been retreating and are now below $7.00 per MMBtu (see Figure 2 on the following page).

After the extremes in pricing during the last several months, the question is: "Where are prices headed this fall and winter?" We believe the answer can be extracted from historical records, namely gas in storage data and our records regarding heating degree days.

Our Analyses

Figure 2. Natural Gas pricing and volume for November 2022 delivery, captured on September 26, 2022, at 3:00 PM PDT. Graphic Source: https://www.cmegroup.com/markets/energy/natural-gas/natural-gas.quotes.html

The EIA website (www.eia.gov) contains a tremendous amount of valuable data. We retrieved the weekly storage data beginning with the data from January 17, 1997, through September 23, 2022, a total of 1,341 weekly values (25.8 years). The weekly storage values, when plotted, can be seen in Figure 3 on the following page.

By examining Figure 3, one can see that the general trend has been to add more gas into storage beginning around June of 2000 (see the red moving average line in Figure 3). Furthermore, there were three winters with extreme withdrawals of natural gas from storage (see the red arrows in Figure 3).

These included:

- Late winter of 2000-2001 (lowest storage value = 738 BCFG on March 30, 2001);
- Late winter of 2002-2003 (lowest storage value = 654 BCFG on March 13, 2003); and
- Late winter of 2013-2014 (lowest storage value = 822 BCFG on March 28, 2014).

By plotting the weekly average natural gas price ($/MMBtu) against the weekly storage data (BCFG) shown in Figure 4 (following page), one sees a somewhat confusing picture of the interaction of the two metrics. There seems to be a correlation between storage values and gas price, although the Correlation Coefficient (R) is weak and insignificant at -0.136 (gas price to storage levels is an inverse relationship).

Our Analyses

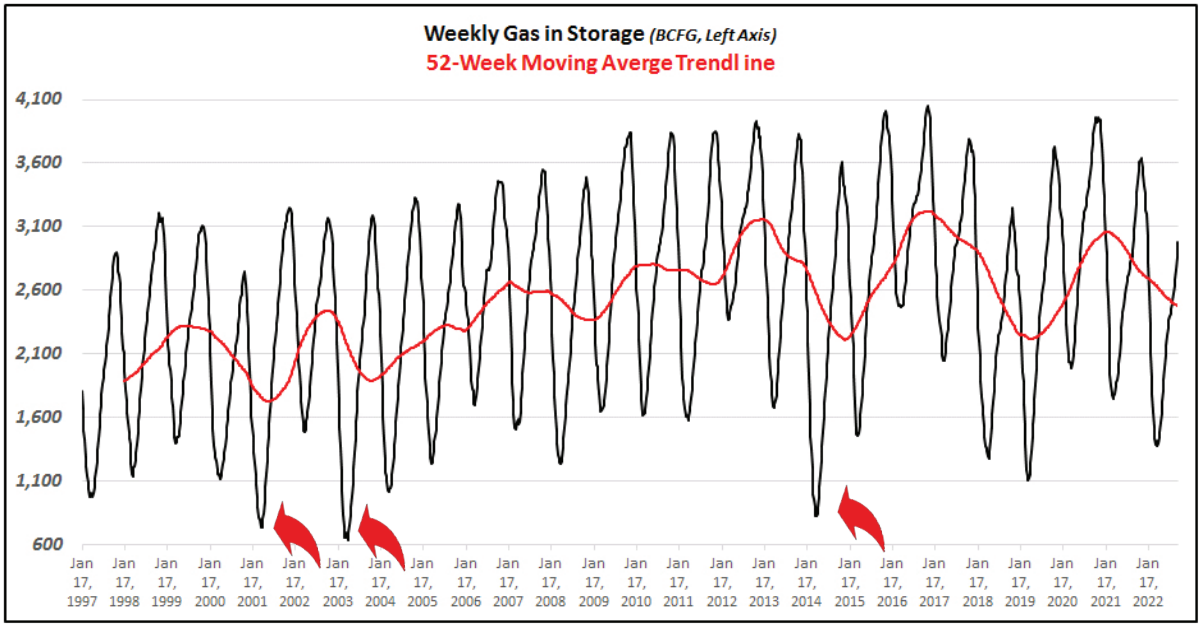

Figure 3. *Weekly gas in storage (BCFG), 17-JAN-1997 through 23-SEP-2022 as the black line (1,341 weekly values; 25.8 years). A 52-week moving average (MA) is shown as the red line. The Y-Axis is in BCFG; the X-Axis is a dateline with an interval of one year. Data Source: www.eia.gov Graphic by Michael Root.*

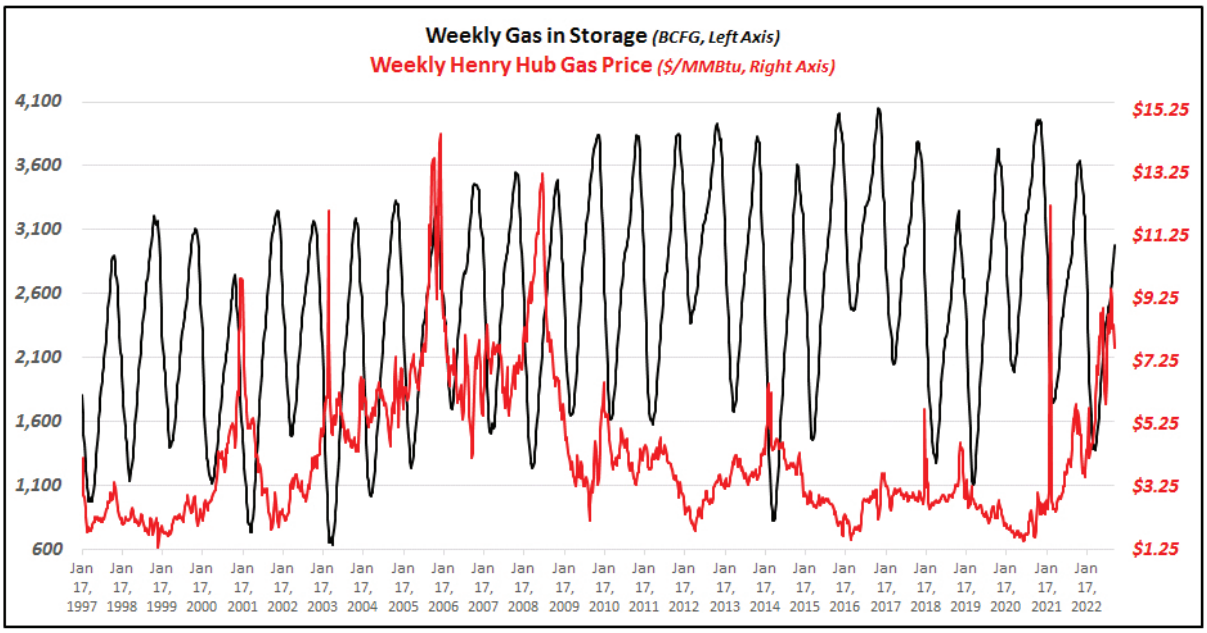

Figure 4. *Weekly gas in storage (BCFG, black line), 17-JAN-1997 through 23-SEP-2022 in blue (1,341 weekly values; 25.8 years). The weekly average Natural Gas prices are shown as the red line.The Y-Left axis is in BCFG; the Y-Right axis is $/MMBtu; and the X-axis is a dateline with an interval of one year. Data Source: www.eia.gov Graphic by Michael Root.*

Our Analyses

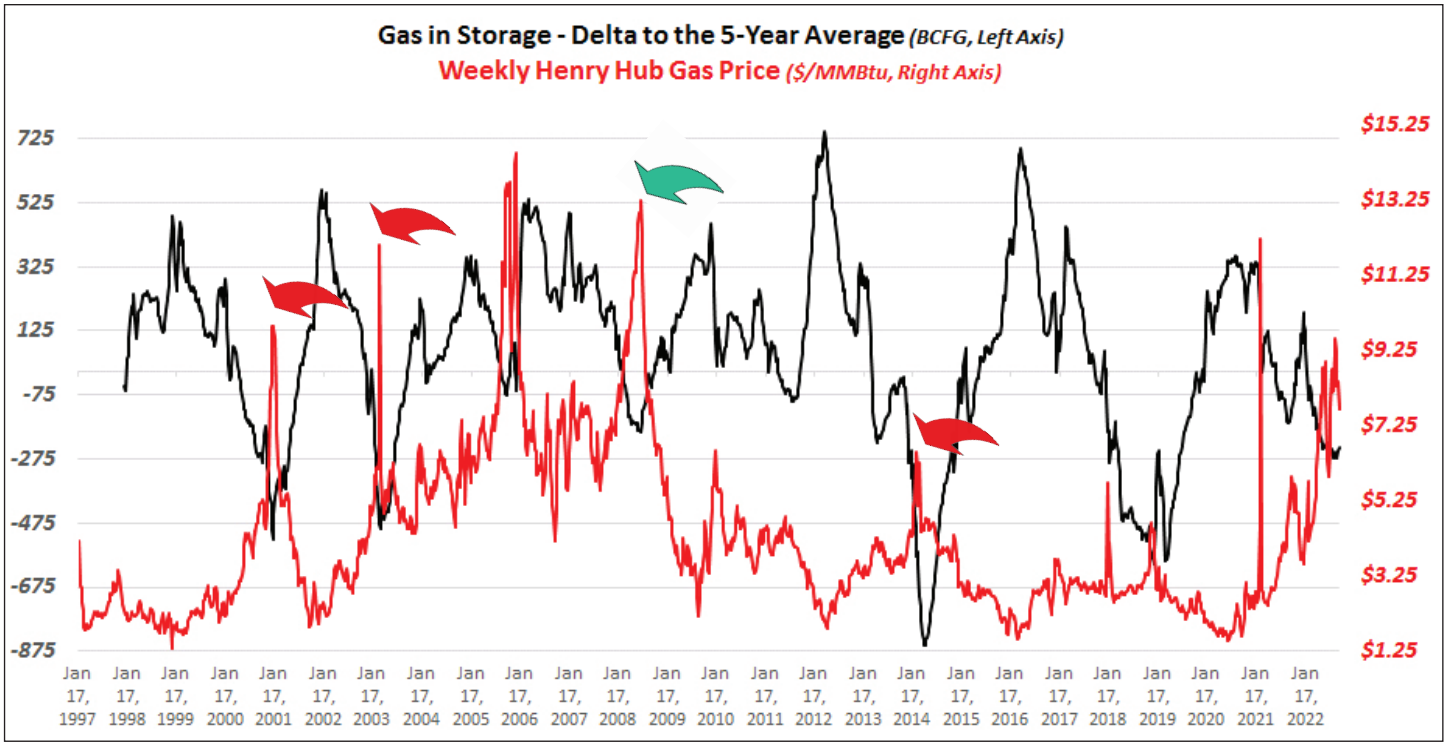

Figure 5. The weekly gas in storage values (BCFG, black line) compared to the weekly five-year rolling average gas in storage values, 17-JAN-1997 through 23-SEP-2022 (1,341 weekly values; 25.8 years). The weekly average Natural Gas prices are shown as the red line. The Y-Left axis is in BCFG; the Y-Right axis is $/MMBtu; and the X-axis is a dateline with an interval of one year. Data Source: www.eia.gov Graphic by Michael Root.

Another method to correlate storage data with natural gas prices would be to use the delta in the actual weekly storage values to the rolling 5-year average of storage values. These metrics are presented, above, in Figure 5 over the same period. As you can see from Figure 5, the winters of 2000-2001, 2002-2003, and 2013-2014 (red arrows) saw dramatic withdrawals from storage and coincided with significant prices for natural gas. Other times also stand out, for example, the winter of 2007-2008 (green arrow). In this case, the Correlation Coefficient (R) is slightly better but still weak and insignificant at -0.200 (again, gas price to storage levels is an inverse relationship).

However, a metric that can be forecasted and back-tested for its correlation to gas prices would be a better approach to understanding the market conditions for this coming winter.

AccuWeather has broken the U.S. and southern Canada into 65 climatic zones and determined the departure from the 30-year normal for Heating Degree Days (HDD DFN), based on a proxy city for each zone. The climatic zones and the proxy city (3-letter code) are shown in Figure 6 on the following page.

Our Analyses

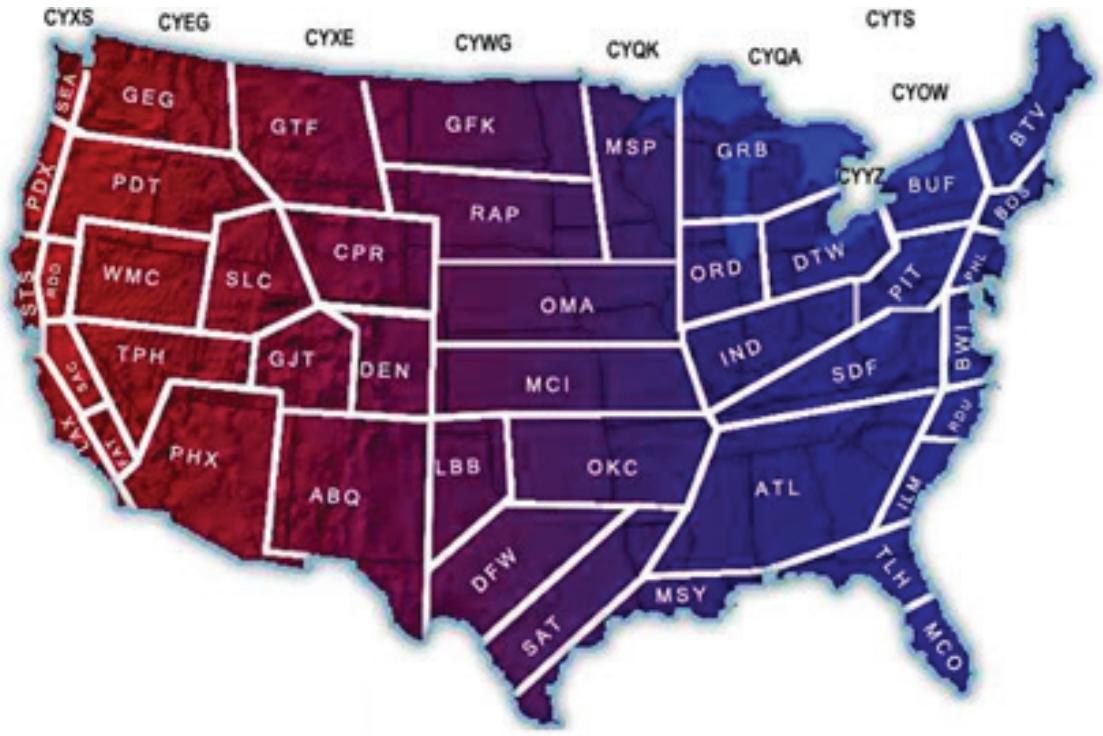

Figure 6. AccuWeather's Climatic Zones for the U.S. and southern Canada. The proxy city for each zone is shown as the 3-letter abbreviation within each zone. Graphic by Steve Root.

By plotting HDD DFN against historical natural gas prices, you can better understand the effect of an extremely harsh winter on gas prices. Figure 7, on the following page, illustrates the HDD DFN to natural gas prices for the last 25.8 years. In this case, several winters with significantly high values of HDD DFN correlate to spikes in the price of natural gas. Examples include the eight winters of 2000-2001, 2002-2003, 2005-2006, 2007-2008, 2009-2010, 2013-2014, 2017-2018, and 2020-2021 (red arrows).

The current AccuWeather forecasts for the winters of 2022-2023 and 2023-2024 are for milder temperatures that are below normal compared to the rolling 30-year average. Reviewing the data associated with the climate zones (and their proxy cities) from 19 gas-consuming states, the HDD forecast for the 2022-2023 winter (October 15th through April 15th) will be -4,428 below the rolling 30-year average. The 2023-2024 winter forecast is closer to normal, with a seasonal HDD value of -2,011. The winters of 2011-2012 and 2015-2016 were also mild and can be viewed as analogs to this coming winter and the 2023-2024 winter. The prices for natural gas during those winters were significantly below the 52-week moving average. As such, we expect the price for natural gas this winter to stay below the late summer highs and most likely in the range of $6.50 to $7.50 per MMBtu, assuming no geopolitical events or other shocks to the market.

As we proceed into the early winter months, please reconnect with us to obtain updates on the winter forecasts and our forecasts for spring and summer 2023. Furthermore, should you need historical weather data or projected climate datasets for your models, we can provide these quickly and affordably.

All data used in this column came from AccuWeather and www.eia.gov.

Our Analyses

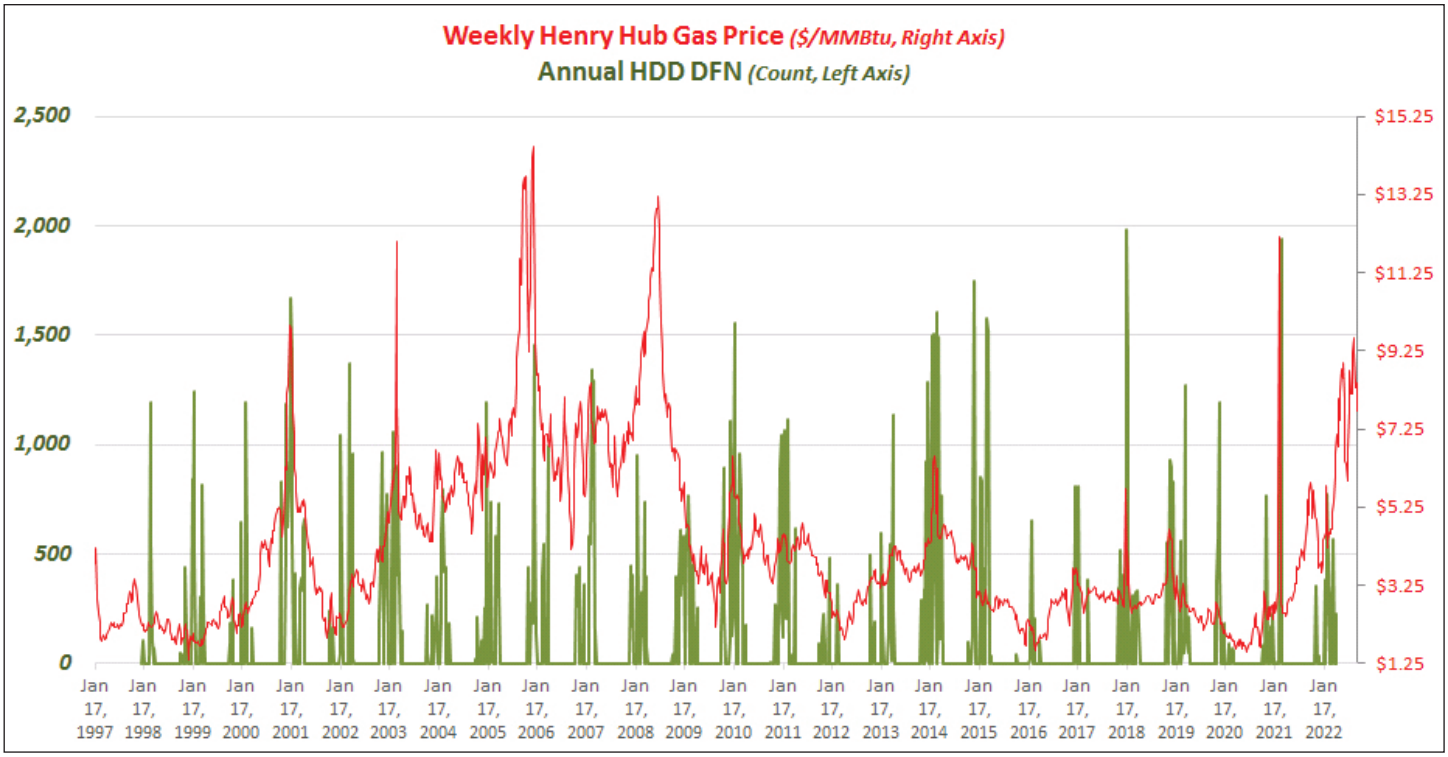

Figure 7. *The HDD DFN for the period of 17-JAN-1997 through 23-SEP-2022 (1,341 weekly values; 25.8 years). The weekly average Natural Gas prices are shown as the red line; the HDD DFN values are shown in green. The Y-Left axis is in HDD; the Y-Right axis is $/MMBtu; and the X-axis is a dateline with an interval of one year. Data Source: www.eia.gov Graphic by Michael Root.*

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