



Independent Statistics & Analysis
U.S. Energy Information
Administration

Natural Gas Consumption and Prices Short-Term Energy Outlook

June 2015



This report was prepared by the U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy. By law, EIA's data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views in this report therefore should not be construed as representing those of the Department of Energy or other Federal agencies.

Table of Contents

1. Overview	3
2. Data sources.....	6
3. Variable naming convention	8
4. Natural Gas Consumption.....	11
A. Residential Consumption.....	12
B. Commercial Consumption	13
C. Industrial Consumption	14
D. Regional residential, commercial, and industrial consumption	16
Residential regional consumption equations	16
Commercial regional consumption equations	18
Industrial regional consumption equations.....	19
E. Other Consumption.....	20
Lease and Plant Fuel.....	20
Pipeline and Distribution Use.....	21
Vehicle Fuel	21
5. Natural Gas Inventories.....	23
6. Natural Gas Prices	26
A. Henry Hub Spot Price.....	26
B. End-use sector prices.....	27
Residential Prices	27
Commercial Prices	30
Industrial Prices	32
7. Forecast Evaluations.....	35
Consumption	36
Storage.....	38
Prices	41
Appendix A. Variable Definitions.....	44
Appendix B. EViews Model Files	51
Appendix C: Regression Results.....	57

1. Overview

The natural gas consumption and price modules of the *Short-Term Energy Outlook* (STEO) model are designed to provide consumption and end-use retail price forecasts for the residential, commercial, and industrial sectors in the nine Census districts (Figure 1) and natural gas working inventories in three regions (Figure 2). Natural gas consumption shares and prices in each Census district are used to calculate an average U.S. retail price for each end-use sector.

Figure 1. Census districts and regions

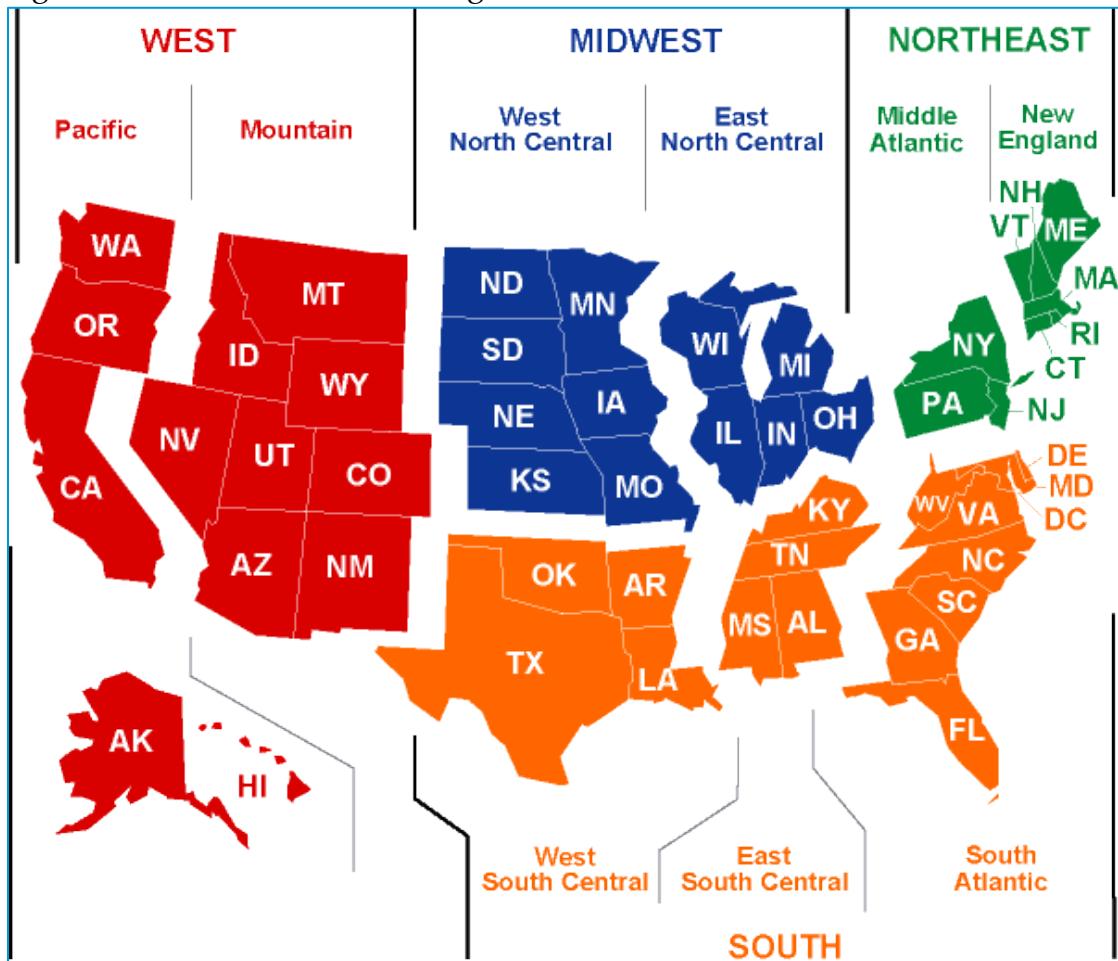
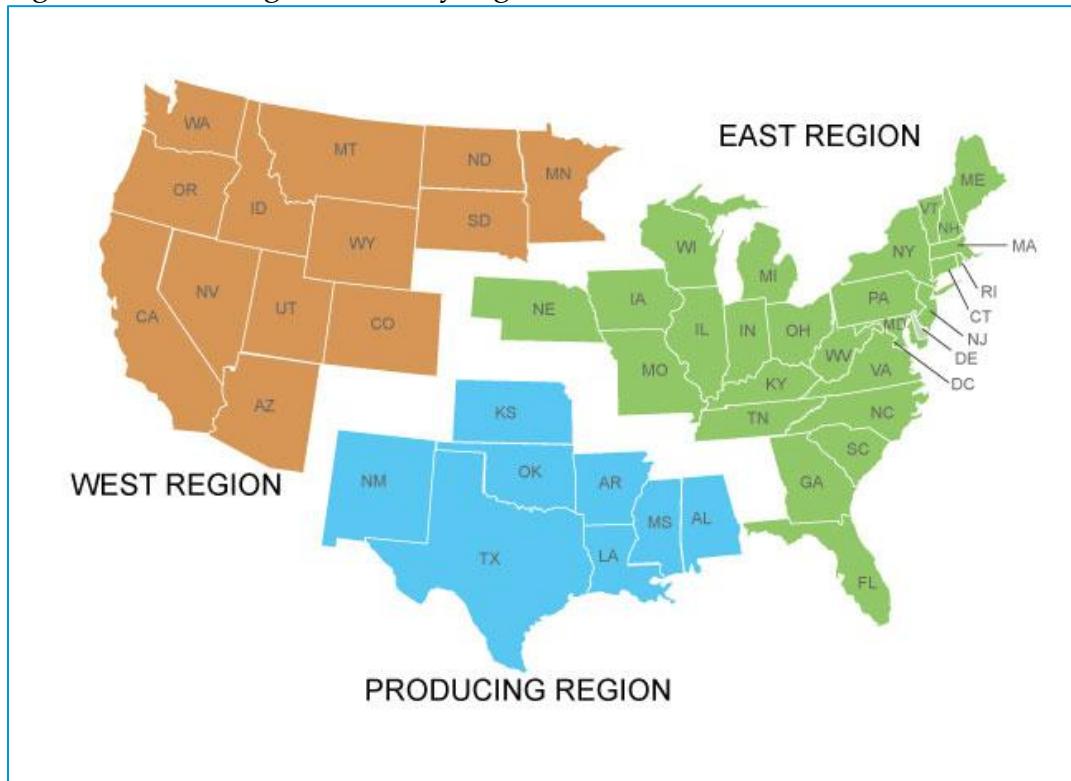


Figure 2. Natural gas inventory regions



In 2010, EIA implemented revisions to the EIA-857 natural gas survey to collect data on monthly sendout volumes by local distribution companies (LDCs) and pipelines in addition to billing volumes. Sendout data, which reflects actual deliveries rather than billed deliveries, provides a more accurate measure of aggregate natural gas deliveries during each calendar month. Sendout-based data were first reported in the *Natural Gas Monthly* in the October 2010 edition, which reports data through August 2010.

STEO implemented several changes because of the survey changes. Prior to the changes, U.S. residential, commercial, and industrial sector consumption forecasts were derived by summing regional consumption forecasts. Currently, the regional consumption volume forecasts are used only as weights in determining U.S. average national residential, commercial, and industrial prices. Once a sufficient number of observations of consistent (sendout-basis) history are available, the STEO model may be revised to calculate U.S. consumption volumes by summing regional consumption.

The frequency of the STEO model is monthly and the model equations are used to produce monthly forecasts over a 13-to-24 month horizon (every January the *STEO* forecast is extended through December of the following year).

The STEO model contains over 2,000 equations, of which about 450 are estimated regression equations. The regression equations are estimated and the forecast models are solved using the IHS EViews Econometric Software. The natural gas consumption and price modules contain 145 equations, of which 61 are estimated regression equations. Some input variables to the *STEO* model are exogenous, coming from other modules in the *STEO* model or forecasts produced by other organizations (e.g., weather forecasts from the National Oceanic and Atmospheric Administration).

2. Data sources

The sources for monthly U.S. natural gas consumption, end-use prices, and end-of-month inventories are:

- EIA *Weekly Natural Gas Storage* report for estimated end-of-month inventories for the two most recent months
- EIA *Natural Gas Monthly* (NGM) for preliminary monthly data
- EIA *Natural Gas Annual* (NGA) for revised final monthly data

Monthly Henry Hub natural gas spot prices are averaged from the Thomson Reuters daily price service. Additionally, daily data from Bentek Energy provide guidance about production, consumption, imports, and exports for the two months for which historical EIA data are not available.

The STEO model uses macroeconomic variables such as population, gross domestic product (GDP), income, employment, and industrial production as explanatory variables in the generation of the forecast. The macroeconomic forecasts are generated by models developed by IHS/Global Insight Inc. (GI). GI updates its national macroeconomic forecasts monthly using its model of the U.S. economy. EIA re-runs the GI model to produce macroeconomic forecasts that are consistent with the STEO energy price forecasts.

The number of households that use natural gas as their primary space heating fuel comes from the Census Bureau's annual [American Community Survey](#). Forecasts are developed based on simple linear trends of the number of households using natural gas in each Census region as a share of all households in that region times the forecast of total households in that region from the GI macroeconomic model.

The industrial sector natural gas forecast uses a natural gas-weighted industrial production index. The index is based on the growth rates of individual manufacturing subsectors from the GI macroeconomic model and their respective shares of the total natural gas consumed by all manufacturing subsectors (see [Short-Term Energy Outlook Supplement: Energy-weighted Industrial Production Indices](#)). The activities of 14 specific manufacturing subsectors, identified by North American Industry Classification System

(NAICS) code, contribute to the natural gas-weighted index. The index reflects the growth of the underlying manufacturing subsectors and the relative importance of those subsectors to total natural gas consumption. Each subsector's share of natural gas consumption is based on data from EIA's [*2010 Manufacturing Energy Consumption Survey*](#) (MECS), which is completed every four years. Because these shares are assumed to remain constant, the index does not capture changes in consumption patterns within an industry, such as fuel switching or changes in energy intensity.

Heating degree day history and projections are obtained from the National Oceanic and Atmospheric Administration (NOAA). EIA derives U.S. population-weighted degree days using current-year rather than base-year (typically the most recent decennial census) populations to weight State degree days to capture the effect of population migration on space cooling and heating demand (see [*Short-Term Energy Outlook Supplement: Change in STEO Regional and U.S. Degree Day Calculations*](#)). NOAA also publishes forecasts of population-weighted regional heating degree days up to 14 months out. Where the *STEO* forecast horizon goes beyond the NOAA forecast period, "normal" heating degree days (20-year average, 1991-2010) is used.

3. Variable naming convention

Over 2,000 variables are used by the STEO for model estimation, analysis, and reporting. In the following example, NGRCPUS is the variable name for natural gas sector (NG) residential consumption (RC) measured in physical units (P) for the entire United States (US).

Characters	NG	RC	P	US
Positions	1 and 2	3 and 4	5	6 - 8
Identity	Energy sector or source	Energy activity or end-use sector	Type of data	Geographic area

Some examples of the identifiers used in this naming convention are:

Type of energy categories:

NG = natural gas

Energy activity or consumption end-use sectors:

CC = commercial sector

EP = electric power sector

IC = industrial sector

IN = industrial sector

RC = residential sector

TC = total consumption

WG = working gas inventory

Type of data:

P = data in physical units

R = retail price (including taxes) per physical unit

X = share or ratio expressed as a fraction

U = price per physical unit

The physical units for natural gas series represented by a "P" in the fifth character are in billion cubic feet (Bcf) for inventories or billion cubic feet per day (Bcf/d) for flows. The pricing units for natural gas end-use are dollars per thousand cubic feet. Henry Hub

spot prices are reported both in dollars per thousand cubic feet (mcf) and dollars per million Btu (mmBtu).

Geographic identification:

ENC = East North Central Census division
ESC = East South Central Census division
MAC = Middle Atlantic Census division
MTN = Mountain Census division
NEC = Northeast Census division
PAC = Pacific Census division
SAC = South Atlantic Census division
US = United States
WNC = West North Central Census division
WSC = West South Central Census division

Total U.S. consumption series may end with either "_US" or "USX". For example, NGRCP_US and NGRCPUSX both represent U.S. residential gas consumption, but they are not necessarily equal over the forecast. NGRCP_US is the sum of consumption in each Census district. NGRCPUSX indicates the series is a forecast derived from total U.S. consumption and is not an aggregation of the Census districts.

The inventory variables follow the naming convention:

Characters	NG	WG	ECON
Positions	1 and 2	3 and 4	5 - 8
Identity	Energy source	Type of gas storage	Geographic area

Geographic identification:

ECON = East consuming region
PROD = Producing region
WCON = West consuming region

Some series are deseasonalized using the Census X-11 method. Deseasonalized series are identified with an "_SA" at the end of the series name (e.g., NGRCPUS_SA for

deseasonalized consumption) and seasonal factors are identified with an "_SF" and the end of the series name (e.g., NGRCPUS_SF for the consumption seasonal factor).

Most regression equations include monthly dummy variables to capture the normal seasonality in the data series. For example, JAN equals 1 for every January in the time series and is equal to 0 in every other month.

Dummy variables for specific months may also be included in regression equations where the observed data may be outliers because of infrequent and unpredictable events such as hurricanes, survey error, or other factors. Generally, dummy variables are introduced when the absolute value of the estimated regression error is more than two times the standard error of the regression (the standard error of the regression is a summary measure based on the estimated variance of the residuals). No attempt was made to identify the market or survey factors that may have contributed to the identified outliers.

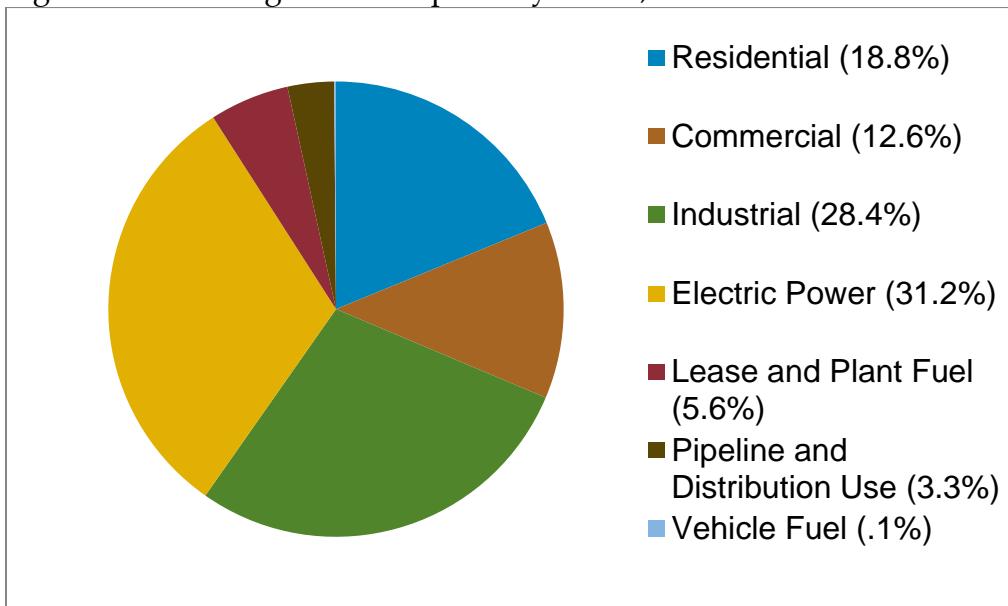
Dummy variables for specific months are generally designated Dyyymm, where yy = the last two digits of the year and mm = the number of the month (from "01" for January to "12" for December). Thus, a monthly dummy variable for March 2002 would be D0203 (i.e., D0203 = 1 if March 2002, = 0 otherwise).

Dummy variables for specific years are designated Dyy, where yy = the last two digits of the year. Thus, a dummy variable for all months of 2002 would be D02 (i.e., D02= 1 if January through December 2002, 0 otherwise). A dummy variable might also be included in an equation to show a structural shift in the relationship between two time periods. Generally, these type of shifts are modeled using dummy variables designated DxxON, where xx = the last two digits of the years at the beginning of the latter shift period. For example, D03ON = 1 for January 2003 and all months after that date, = 0 for all months prior to 2003.

4. Natural Gas Consumption

Natural gas is consumed by four main sectors: residential, commercial, industrial, and electric power. The electric power sector is the largest natural gas consuming sector, followed by industrial (Figure 3). However, during the winter, residential and commercial consumption make up a much larger share of total natural gas consumption. Residential and commercial consumers use natural gas primarily for space heating during the winter months. A small amount of natural gas is consumed throughout the year in the residential and commercial sector for other uses, such as hot-water heating, cooking, and laundry.

Figure 3. Natural gas consumption by sector, 2013



Source: Energy Information Administration, *Natural Gas Monthly*

Total U.S. natural gas consumption in the STEO model is the sum of end-use sector consumption estimates (equation 1)

$$\begin{aligned} \text{NGTCPUS} = & \text{NGRCPUS} + \text{NGCCPUS} + \text{NGINX} \\ & + \text{NGACPUS} + \text{NGLPPUS} + \text{NGEPCON} + \text{NGVHPUS} \end{aligned} \quad (1)$$

Where,

NGTCPUS = U.S. total natural gas consumption, Bcf/d

NGACPUS = U.S. natural gas pipeline and distribution use, Bcf/d
 NGCCPUS = U.S. commercial sector natural gas consumption, Bcf/d
 NGEPCON = U.S. electric power sector natural gas consumption, Bcf/d
 NGINX = U.S. industrial sector natural gas consumption, Bcf/d
 NGLPPUS = U.S. natural gas lease and plant fuel consumption, Bcf/d
 NGRCPUS = U.S. residential sector natural gas consumption, Bcf/d
 NGVHPUS = U.S. natural gas vehicle consumption, Bcf/d

A. Residential Consumption

U.S. residential sector natural gas consumption is estimated as a function of heating degree day deviations from normal and the number of households that use natural gas as their primary space heating fuel (equation 2).

$$\begin{aligned}
 \text{NGRCPUSX} = & a_0 + a_1 * (\text{ZWHD_NGRC} - \text{ZWHN_NGRC}) / \text{ZSAJQUS} \\
 & + a_2 * \text{QHNG_US} * \text{NGRCPUSX_SF} \\
 & + \text{monthly dummy variables}
 \end{aligned} \tag{2}$$

Where,

NGRCPUSX = U.S. residential sector natural gas consumption, Bcf/d
 NGRCPUSX_SF = residential natural gas consumption seasonal factor
 QHNG_US = number of households that use natural gas as their primary space heating fuel, millions
 ZWHD_NGRC = residential natural gas-weighted heating degree days
 ZWHN_NGRC = residential natural gas-weighted normal (20-year average, 1991-2010) heating degree days
 ZSAJQUS = number of days in the month

Residential natural gas-weighted heating degree days is calculated by multiplying the share of U.S. households in a Census district that use natural gas as their primary space heating fuel times the number of heating degree days in the district, and summing across all districts. The estimated regression equation coefficient indicates that each 1 degree deviation in average daily heating degree days from normal increases or reduces residential natural gas consumption by 0.86 Bcf/d. For example, in January 2014,

heating degree days were 117 degree days above the 20-year average, or an average of 3.79 degree days per day. Consequently, residential natural gas consumption was estimated to be 3.3 Bcf/d higher than "normal".

Residential natural gas consumption is expected to increase as the number of households that use natural gas as their primary space heating fuel increases. The increase in consumption varies seasonally according to the estimated residential natural gas seasonal factor. On average for the year, a 1 million increase in the number of households increases annual average residential natural gas consumption by 0.11 Bcf/d, ranging from a low of 0.06 Bcf/d in August to a high of 0.23 Bcf/d in January. Unfortunately, a similar series for the number of households that use natural gas as their secondary heating fuel source, e.g., as a backup fuel for heat pumps, is not available.

The STEO model then merges the historical U.S. residential consumption reported in the EIA *Natural Gas Monthly* (NGRCPUS) with consumption derived from the model (NGRCPUSX) (equation 3).

$$\text{NGRCPUS} = \text{NGRCPUSX} \quad (3)$$

B. Commercial Consumption

U.S. commercial sector natural gas consumption is estimated as a function of heating degree day deviations from normal and commercial sector employment (equation 4).

$$\begin{aligned} \text{NGCCPUSX} = & a_0 + a_1 * (\text{ZWHD_NGCC} - \text{ZWHN_NGCC}) / \text{ZSAJQUS} \\ & + a_2 * \text{EMCMPUS} * \text{NGCCPUSX_SF} \\ & + \text{monthly dummy variables} \end{aligned} \quad (4)$$

Where

NGCCPUSX = U.S. commercial sector natural gas consumption, Bcf/d

NGCCPUSX_SF = commercial natural gas consumption seasonal factor

EMCMPUS = commercial sector employment, millions

ZWHD_NGCC = heating degree days weighted by number of natural gas customers

ZWHN_NGCC = normal (20-year average, 1991-2010) heating degree days weighted by number of natural gas customers

ZSAJQUS = number of days in the month

Commercial natural gas-weighted heating degree days is calculated by multiplying the share of commercial natural gas customers in a Census district times the number of heating degree days in the district, and summing across all districts. Commercial natural gas consumption is expected to be directly related to heating degree days. Each 1 degree deviation in average daily heating degree days from normal is estimated to increase or reduce annual commercial natural gas consumption by an average 0.40 Bcf/d.

Commercial natural gas consumption is expected to increase with an increase in commercial sector employment, which is a proxy for commercial floor space. The increase in consumption varies seasonally according to the estimated commercial natural gas seasonal factor. On average for the year, a 1 million increase in employment increases annual average commercial natural gas consumption by 0.022 Bcf/d, ranging from a low of 0.012 Bcf/d in July to a high of 0.39 Bcf/d in January.

The STEO model then merges the historical U.S. commercial consumption reported in the EIA *Natural Gas Monthly* (NGCCPUS) with consumption derived from the model (NGCCPUSX) (equation 5).

$$\text{NGCCPUS} = \text{NGCCPUSX} \quad (5)$$

C. Industrial Consumption

Industrial sector natural gas consumption is the sum of two variables (equation 6): (1) use by industrial consumers (where gas is used as a feedstock as well as for heating); and (2) combined heat and power use, which represents onsite electricity generation at industrial facilities.

$$\text{NGINX} = \text{NGICPUS} + \text{NGCGCON_EL} \quad (6)$$

Where,

NGINX = industrial sector natural gas consumption, Bcf/d

NGICPUS = industrial sector natural gas use for feedstock and heating, Bcf/d

NGCGCON_EL = industrial sector combined heat and power natural gas use, Bcf/d

Industrial sector use for combined heat and power forecast is determined in the [electric power model](#) and is not documented in this report.

Industrial sector use of natural gas for feedstock and heating is estimated as a function of the natural gas-weighted industrial production index, the price of natural gas to the industrial sector, and heating degree day deviations from normal in the East North Central and West South Central Census districts (equation 7).

$$\begin{aligned} \text{NGICPUS} = & a_0 + a_1 * \text{QSIC_NG} \\ & + a_2 * \text{NGICUUS} \\ & + a_3 * (\text{ZWHD_ENC} - \text{ZWHN_ENC})/\text{ZSAJQUS} \\ & + a_4 * (\text{ZWHD_WSC} - \text{ZWHN_WSC})/\text{ZSAJQUS} \\ & + \text{monthly dummy variables} \end{aligned} \quad (7)$$

Where

NGICPUS = U.S. natural gas industrial sector consumption, Bcf/d

NGICUUS = U.S. natural gas industrial sector price, \$/mcf

QSIC_NG = natural gas-weighted industrial production index

ZWHD_{xxx} = heating degree days in Census district xxx

ZWHN_{xxx} = normal heating degree days in Census district xxx

ZSAJQUS = number of days in month

The natural gas-weighted industrial production index is based on the growth rates of individual manufacturing subsectors and their respective shares of the total natural gas consumed by all manufacturing subsectors (see [Short-Term Energy Outlook Supplement: Energy-weighted Industrial Production Indices](#)). For example, because the basic chemicals

subsector consumes the largest share of industrial natural gas consumption, representing about 20% of all industrial natural gas use, that subsector has the largest weight in the IP index. The coefficient on the natural gas-weighted industrial production index is positive and statistically significant.

The next two variables represent the daily average heating degree day deviation from normal in a given month in the East North Central and West South Central Census divisions. This captures the effect of heating demand in the two divisions that have the most industrial consumption.

D. Regional residential, commercial, and industrial consumption

In 2010, EIA implemented revisions to the EIA-857 survey to collect data on monthly sendout volumes by LDCs and pipelines in addition to billing volumes. Sendout data, which reflects actual deliveries rather than billed deliveries, provides a more accurate measure of aggregate natural gas deliveries during each calendar month. Sendout-based data were first reported in the *Natural Gas Monthly* in the October 2010 edition, which reports data through August 2010.

STEO implemented several changes because of the survey changes. Prior to the changes, U.S. residential, commercial, and industrial sector consumption forecasts were derived by summing regional consumption forecasts. Currently, the regional consumption volume forecasts are used only as weights in determining U.S. average national residential, commercial, and industrial prices. Once a sufficient number of observations of consistent (sendout basis) history are available, the STEO model may be revised to calculate U.S. consumption volumes by summing regional consumption.

Residential regional consumption equations

Residential sector deseasonalized consumption per household that uses natural gas as their primary space heating fuel for the nine Census regions is a function of current and lagged heating degree day deviations from normal, the inflation-adjusted

deseasonalized residential natural gas price, real personal income, and the number of working days in the month (equation 8).

$$\begin{aligned}
 \text{NGRCP_QH}_{xxx}\text{_SA} / \text{QHNG}_{xxx} &= a0 \\
 &+ a1 * ((\text{ZWHD}_{xxx} - \text{ZWHN}_{xxx}) / \text{ZSAJQUS}) \\
 &+ a2 * ((\text{ZWHD}_{xxx}(-1) - \text{ZWHN}_{xxx}(-1)) / \text{ZSAJQUS}(-1)) \\
 &+ a3 * \text{NGRCU}_{xxx}\text{_SA} / \text{CICPIUS} \\
 &+ a4 * \text{CYRPIC}_{xxx} \\
 &+ a5 * \text{WORKDAYS} / \text{ZSAJQUS}
 \end{aligned} \tag{8}$$

Where,

$\text{NGRCP_QH}_{xxx}\text{_SA}$ = deseasonalized residential sector consumption per household in Census district xxx , Bcf/d

QHNG_{xxx} = number of households that use natural gas as their primary space heating fuel in Census district xxx , millions

ZWHD_{xxx} = heating degree days in Census district xxx

ZWHN_{xxx} = normal heating degree days in Census district xxx

$\text{NGRCU}_{xxx}\text{_SA}$ = deseasonalized residential price in Census district xxx , dollars per Mcf

CICPIUS = consumer price index, 1982-84 = 1.0

CYRPIC_{xxx} = real personal income in Census district xxx , billion chained 2009 dollars

WORKDAYS = workdays in month

ZSAJQUS = number of days in month

Deseasonalized consumption is converted to actual or forecast consumption volumes by multiplying by the seasonal factor (equation 9)

$$\text{NGRCP_QH}_{xxx} = \text{NGRCP_QH}_{xxx}\text{_SA} * \text{NGRCP_QH}_{xxx}\text{_SF} \tag{9}$$

Where,

$\text{NGRCP_QH}_{xxx}\text{_SF}$ = seasonal factor for residential consumption in Census district xxx

Total regional residential natural gas consumption is then calculated as per household consumption times the number of households in each region (equation 10).

$$\text{NGRCP}_{xxx} = \text{NGRCP}_{QH_{xxx}} * \text{QHNG}_{xxx} \quad (10)$$

Total U.S. residential sector natural gas consumption can be calculated by summing the 9 census regions (equation 11).

$$\begin{aligned} \text{NGRCP_US} = & \text{NGRCP_ENC} + \text{NGRCP_ESC} + \text{NGRCP_MAC} \\ & + \text{NGRCP_MTN} + \text{NGRCP_PAC} + \text{NGRCP_NEC} \\ & + \text{NGRCP_SAC} + \text{NGRCP_WNC} + \text{NGRCP_WSC} \end{aligned} \quad (11)$$

Where,

NGRCP_US = U.S. residential sector natural gas consumption derived from regional consumption estimates, Bcf/d

Commercial regional consumption equations

Regional deseasonalized commercial sector natural gas consumption is a function of heating degree day deviations from normal, the inflation-adjusted commercial sector natural gas price, the number of working days in the month, and a lagged dependent variable (equation 12).

$$\begin{aligned} \text{NGCCP}_{xxx_SA} = & a0 + a1 * \text{EESPP}_{xxx} \\ & + a2 * \text{NGCCU}_{xxx_SA}/\text{CPI2000}_{xxx}(-1) \\ & + a3 * ((\text{ZWHD}_{xxx} - \text{ZWHN}_{xxx})/\text{ZSAJQUS}) \\ & + a4 * \text{WORKDAYS}/\text{ZSAJQUS} \\ & + a5 * \text{NGCCP}_{xxx_SA}(-1) \end{aligned} \quad (12)$$

Where

NGCCP_{xxx} = commercial sector natural gas consumption in Census district xxx , Bcf/d

EESPP_{xxx} = private sector employment in Census district xxx , millions

ZWHD_{xxx} = heating degree days in Census district xxx

ZWHN_xxx = normal heating degree days in Census district xxx

NGCCU_xxx = commercial price in Census district xxx, dollars per Mcf

CPI2000 = consumer price index, base year 2000

WORKDAYS = workdays in month

ZSAJQUS = number of days in month

Deseasonalized consumption is converted to actual or forecast consumption volumes by multiplying by the seasonal factor (equation 13)

$$\text{NGCCP}_{\text{xxx}} = \text{NGCCP}_{\text{xxx}} \text{ SA} * \text{NGCCP}_{\text{xxx}} \text{ SF} \quad (13)$$

Where,

$\text{NGCCP}_{\text{xxx}} \text{ SF}$ = Seasonal factor for commercial sector natural gas consumption in Census district xxx

Total U.S. commercial sector natural gas consumption can be calculated by summing the 9 census regions (equation 14).

$$\begin{aligned} \text{NGCCP}_{\text{US}} &= \text{NGCCP}_{\text{ENC}} + \text{NGCCP}_{\text{ESC}} + \text{NGCCP}_{\text{MAC}} \\ &\quad + \text{NGCCP}_{\text{MTN}} + \text{NGCCP}_{\text{PAC}} + \text{NGCCP}_{\text{NEC}} \\ &\quad + \text{NGCCP}_{\text{SAC}} + \text{NGCCP}_{\text{WNC}} + \text{NGCCP}_{\text{WSC}} \end{aligned} \quad (14)$$

Where,

NGCCP_{US} = U.S. commercial sector natural gas consumption derived from regional consumption estimates, Bcf/d

Industrial regional consumption equations

The regional industrial sector natural gas consumption equations use three main independent variables: gross state products for each region, industrial prices in the region, and heating degree day deviation from normal. The equation also includes a lagged dependent variable, representing the previous month's consumption (equation 15)

$$\begin{aligned}
\text{NGINX_xxx} = & \text{a0} + \text{a1} * \text{CGSPMFG_xxx} * \text{NGINX_xxx_SF} \\
& + \text{a2} * (\text{NGINX_xxx_SF} * \text{NGICU_xxx}(-1) / \text{CPI2000_xxx}(-1)) \\
& + \text{a3} * (\text{ZWHD_xxx} - \text{ZWHN_xxx}) / \text{ZSAJQUS} \\
& + \text{a4} * \text{NGINX_xxx}(-1) \\
& + \text{monthly dummies}
\end{aligned} \tag{15}$$

Where

NGINX_xxx = industrial sector consumption in Census district xxx , Bcf/d

CGSPMFG_xxx = real gross state product in Census district xxx

ZWHD_xxx = heating degree days in Census district xxx

ZWHN_xxx = normal heating degree days in Census district xxx

NGICU_xxx = industrial price in Census district xxx , dollars per Mcf

CPI2000 = consumer price index, base year 2000

ZSAJQUS = number of days in month

Total U.S. industrial sector natural gas consumption can be calculated by summing the 9 census regions (equation 16).

$$\begin{aligned}
\text{NGINX_US} = & \text{NGINX_ENC} + \text{NGINX_ESC} + \text{NGINX_MAC} \\
& + \text{NGINX_MTN} + \text{NGINX_PAC} + \text{NGINX_NEC} \\
& + \text{NGINX_SAC} + \text{NGINX_WNC} + \text{NGINX_WSC}
\end{aligned} \tag{16}$$

Where,

NGINX_US = U.S. industrial sector natural gas consumption, Bcf/d

E. Other Consumption

Lease and Plant Fuel

Preliminary monthly lease and plant fuel consumption data in the *Natural Gas Monthly* are estimated based on lease and plant fuel consumption as an annual percentage of marketed production. Monthly data are revised with publication of the *Natural Gas Annual*. Final monthly plant fuel data are based on a revised annual ratio of plant fuel

consumption to marketed production from survey form EIA-176. This ratio is applied to each month's revised marketed production figure to compute final monthly plant fuel consumption estimates. Final monthly lease data are collected on the survey form EIA-895 and estimates from the survey form EIA-176.

Lease and plant fuel use in the STEO is an identity that assumes the last published monthly estimate of lease and plant fuel use as a share of marketed natural gas production continues over the forecast (equation 17).

$$\text{NGLPPUS} = \text{NGMPPUS} * (\text{NGLPPUS}(-1) / \text{NGMPPUS}(-1)) \quad (17)$$

Where,

NGLPPUS = U.S. natural gas lease and plant fuel consumption, Bcf/d

NGMPPUS = U.S. marketed natural gas production, Bcf/d

Pipeline and Distribution Use

Preliminary monthly historical estimates in the *Natural Gas Monthly* are based on pipeline fuel consumption as an annual percentage of total consumption from the previous year. This percentage is applied to each month's sum of total deliveries plus lease and plant fuel to compute the monthly estimate. Final monthly data are based on the revised annual ratio of pipeline fuel consumption to total consumption from the survey form EIA-176.

Pipeline and distribution use in the STEO is an identity that assumes the last published monthly estimate of pipeline and distribution use as a share of natural gas deliveries continues over the forecast (equation 18).

$$\text{NGACPUS} = (\text{NGRCPUS} + \text{NGCCPUS} + \text{NGINX} + \text{NGEPCON}) \quad (18)$$

$$* (\text{NGACPUS}(-1) / (\text{NGRCPUS}(-1) + \text{NGCCPUS}(-1) + \text{NGINX}(-1) + \text{NGEPCON}(-1)))$$

Where,

NGACPUS = U.S. natural gas pipeline and distribution use, Bcf/d

Vehicle Fuel

Monthly estimates of natural gas (compressed or liquefied) used as vehicle fuel that are published in the *Natural Gas Monthly* are derived from annual estimates of vehicle fuel use provided by the EIA Office of Energy Consumption and Efficiency Statistics.

Vehicle fuel use in the STEO is an identity that assumes the last published monthly estimate in the *Natural Gas Monthly* continues over the forecast (equation 19).

$$\text{NGVHPUS} = \text{NGVHPUS}(-1) \quad (19)$$

Where,

NGVHPUS = U.S. natural gas vehicle consumption, Bcf/d

5. Natural Gas Inventories

Natural gas inventory withdrawals provide the second largest source of natural gas during the winter heating season after field production. During the peak consumption months of December, January, and February, natural gas inventories account for over 20% of total U.S. natural gas supply on average. Inventories are built up during the spring and summer months, and typically peak near the end of October and reach their lowest point in March.

The STEO forecasts natural gas storage in the three regions reported in the *Weekly Natural Gas Storage Report* and *Natural Gas Monthly*: East consuming region (ECON), producing region (PROD), and West consuming region (WCON). Beginning in the first half of 2015, the *Weekly Natural Gas Storage Report* will move from reporting three regions to five, and a data history will be provided. This will add two extra econometric equations, but the fundamental structure of the storage model should not change.

Total U.S. natural gas inventory is the sum of base gas inventory and working gas inventory (equation 20). Working gas inventory is the quantity of natural gas in the reservoir that is in addition to the base gas volume.

$$\text{NGUSPUS} = \text{NGBGPUS} + \text{NGWGPUS} \quad (20)$$

Where,

NGUSPUS = total U.S. natural gas inventory, Bcf

NGBGPUS = total U.S. base gas inventory, Bcf

NGWGPUS = total U.S. working gas inventory, Bcf

Base gas inventory is the quantity of natural gas needed to maintain adequate reservoir pressures and deliverability rates throughout the withdrawal season. Base gas usually is not withdrawn and remains in the reservoir. All natural gas native to a depleted reservoir is included in the base gas volume. The base gas inventory forecast is set equal to the most recently reported volume (equation 21).

$$\text{NGBGPUS} = \text{NGBGPUS}(-1) \quad (21)$$

Working gas inventory may or may not be completely withdrawn during any particular withdrawal season. The storage model forecasts monthly working gas inventory changes, rather than inventory levels. Storage withdrawals and builds for all three regions are highly dependent on heating and cooling degree days and the deviation in the beginning-of-month inventory level from the prior 7-year average for that month (equation 22).

$$\begin{aligned}
 \text{NGWG}_{xxxx} - \text{NGWG}_{xxxx}(-1) = & a_0 \\
 & + a_1 * (\text{ZWHD}_{xxx} - \text{ZWHN}_{xxx})/\text{ZSAJQUS} \\
 & + a_2 * (\text{ZWCD}_{xxx} - \text{ZWCN}_{xxx})/\text{ZSAJQUS} \\
 & + a_3 * (\text{NGWG}_{xxxx}(-1) - \text{NGWG}_{xxxx}(\text{average})) \\
 & + \text{monthly dummies}
 \end{aligned} \tag{22}$$

Where

- NGWG_{xxxx} = working gas in storage in region $xxxx$, Bcf
- $\text{NGWG}_{xxxx}(\text{average})$ = prior 7-year average inventory level in region $xxxx$, Bcf
- ZWHD_{xxx} = heating degree days in region $xxxx$
- ZWHN_{xxx} = normal heating degree days in region $xxxx$
- ZWCD_{xxx} = cooling degree days in region $xxxx$
- ZWCN_{xxx} = normal cooling degree days in region $xxxx$
- ZSAJQUS = number of days in the month

The equation uses the heating degree day deviations from normal in the Census divisions found in each of the three storage regions. For example, the East Region uses data from the New England, Middle Atlantic, and East North Central Census divisions. The STEO creates regional heating degree day averages by weighting the heating degree days in each division by the number of households that use natural gas as a primary heating fuel in that division. Colder weather (an increase in heating degree days) is expected to increase the inventory draw (or reduce the inventory build). The estimated coefficients on heating degree day normal were negative and statistically significant in each region.

Regional cooling degree day deviations from normal limit inventory builds in the summer because natural gas may be used to meet demand in the electric power sector

for space cooling. The Producing Region is unique, in that many storage facilities in that region are salt dome facilities, which allow gas to be withdrawn as well as injected in the same season, and withdrawals in the summer are common. The estimated coefficient was negative in each region as expected, but not statistically significant in the Pacific region.

Inventory changes are expected to be dependent on the deviation in the beginning-of-month (end-of-previous month) from the desired level. The average over the previous seven years is used as a proxy for the desired level of inventory. When inventories are higher than the previous 7-year average we expect the inventory build to be smaller or the inventory draw to be larger than normal. The estimated coefficient was negative and statistically significant in each region.

Total U.S. working gas inventory is the sum of inventories in the three regions (equation 23).

$$\text{NGWGPUS} = \text{NGWG_ECON} + \text{NGWG_WCON} + \text{NGWG_PROD} \quad (23)$$

Where,

NGWG_ECON = Natural gas working inventory in East consuming region, Bcf

NGWG_PROD = Natural gas working inventory in producing region, Bcf

NGWG_WCON = Natural gas working inventory in West consuming region, Bcf

6. Natural Gas Prices

The STEO publishes prices for the Henry Hub spot price and regional prices for the residential, commercial, and industrial sectors. National prices for the residential, commercial, and industrial sectors are a weighted average of the regional prices.

A. Henry Hub Spot Price

The log of the Henry Hub spot price is estimated as a function of the deviation in the working gas inventory from the previous 3-year average, heating and cooling degree day deviations from normal, and a lagged dependent variable (Equation 24):

$$\begin{aligned} \text{Log(NGHHUUS)} = & a_0 + a_1 * \text{Log}((\text{NGWGPUS}(-1) - (\text{NGWGPUS}(\text{average}))) \\ & + a_2 * ((\text{ZWHDPUS} - \text{ZWHNPUS})/\text{ZSAJQUS})) \\ & + a_3 * ((\text{ZWCDPUS} - \text{ZWCNPUS})/\text{ZSAJQUS})) \\ & + \text{Log}(\text{NGHHUUS}(-1)) \\ & + \text{monthly dummies} \end{aligned} \quad (24)$$

Where

NGHHUUS = Henry Hub spot price, dollars per million Btu

NGWGPUS = total U.S. working gas inventory, Bcf

NGWGPUS(average) = total U.S. working gas in storage, previous 3-year average, Bcf

ZWHDPUS = heating degree days, U.S. population-weighted average

ZWHNPUS = normal heating degree days, U.S. population-weighted average

ZSAJQUS = number of days in month

ZWCDPUS = cooling degree days, U.S. population-weighted average

ZWCNPUS = normal cooling degree days, U.S. population-weighted average

The equation forecasts in logs to prevent a possible negative value. The equation generates a base forecast and the lagged dependent variable has strong influence, particularly on the closer months. Although this equation is used as a forecasting tool, the Henry Hub spot price is generally determined by analyst judgment.

The Henry Hub spot price is converted from dollars per MMBtu to dollars per Mcf by multiplying by the typical energy content (equation 25).

$$\text{NGHHMCF} = 1.03 * \text{NGHHUUS} \quad (25)$$

Where,

NGHHMCF = Natural gas spot price, dollars per mcf

B. End-use sector prices

The STEO forecasts regional prices for residential, commercial, and industrial consumers. The prices include all fees and taxes, and represent the per-unit cost to the consumer. The price model does not directly forecast prices; instead, residential, commercial, and industrial prices are determined by forecasting the premium or discount to the Henry Hub spot price.

Residential Prices

Residential natural gas prices are regulated by the State or municipality, and consist of a fixed component (representing the utility company's costs of infrastructure and delivery) and a variable component (representing the commodity cost). Fixed costs do not vary with demand and, during the summer months, can represent a large proportion of the average delivered price. During the winter, per-unit delivered prices are much lower than in the summer, as the commodity charge, due to higher demand, makes up a greater portion of the price.

Regional natural gas residential sector price differentials to the Henry Hub spot price are estimated as a function of the change in the Henry Hub spot price from the previous month, deviation in working gas inventory from the prior 3-year average, deviations in heating and cooling degree days from normal for both the current and previous months, and a lagged dependent variable (equation 26):

$$\begin{aligned} \text{NGRCU}_{xxx} - \text{NGHHMCF} = & a0 + a1 * (\text{NGHHMCF} - \text{NGHHMCF}_{t-1}) \\ & + a2 * (\text{NGWG}_{xxxx}(-1) - \text{NGWG}_{xxxx}(\text{average})) \\ & + a3 * ((\text{ZWHD}_{xxx} - \text{ZWHN}_{xxx}) / \text{ZSAJQUS}) \end{aligned} \quad (26)$$

+ a4 * ((ZWHD_xxx(-1) – ZWHNxxx(-1))/ZSAJQUS)
+ a5 * (NGRCU_xxx(-1) – NGHHMCF(-1))
+ monthly dummies

Where

NGRCU_xxx = residential sector natural gas price in district *xxx*, dollars per mcf
NGHHMCF = Henry Hub spot price, dollars per mcf
NGWG_xxxx = working gas inventory in storage region *xxxx*, Bcf
NGWG_xxxx(average) = working gas inventory in storage in region *xxxx*
 previous 3-year average, Bcf
ZWHD_xxx = heating degree days in district *xxx*
ZWHN_xxx = normal heating degree days in district *xxx*
ZSAJQUS = number of days in the month

A change in the Henry Hub spot price from the previous month is expected to be passed on to residential prices with a lag. The estimated coefficients on the change in the Henry Hub spot price from the prior month range from -0.79 (West North Central district) to -1.11 (Mountain district) and indicate that the residential price is relatively insensitive to changes in the spot price. However, the estimated coefficients must be interpreted with caution since the speed with which spot price changes may be passed through to end-use prices will also be affected by the size of the estimated coefficient on the lagged dependent variable.

The expected relationship between the residential and spot natural gas price spread and the deviation in working gas inventory from the previous 3-year average (a proxy from the "desired" level of inventories) is ambiguous where inventory levels may affect spot prices and residential prices differently. The estimated coefficients were positive in five of the nine Census districts but statistically significant in only four (East North Central, Middle Atlantic, South Atlantic, and Pacific). The estimated coefficients were negative in the other four districts, but statistically significant only in the West North Central and West South Central.

The relationship between the residential and spot natural gas price spread and current-month heating degree day deviations from normal was negative in all districts and

statistically significant in each except for New England. Consequently, cold weather, which is expected to boost spot natural gas prices, reduces the spread between residential and spot natural gas prices. Heating degree day deviations from normal lagged one month had no statistically significant relationship with the price spread, except for the East North Central District where the relationship was positive.

Deseasonalized regional prices, which are used in the regional consumption equations, are calculated using seasonal factors derived from the Census X-11 method (equation 27).

$$\text{NGRCU}_{xxx}\text{SA} = \text{NGRCU}_{xxx} / \text{NGRCU}_{xxx}\text{SF} \quad (27)$$

Where

$\text{NGRCU}_{xxx}\text{SA}$ = deseasonalized residential natural gas price in Census district xxx , dollars per mcf

$\text{NGRCU}_{xxx}\text{SF}$ = residential natural gas price in Census district xxx seasonal factor

The U.S. average residential natural gas price is a volume-weighted average of the regional prices (equation 28).

$$\begin{aligned} \text{NGRCU_US} = & (\text{NGRCU_NEC} * \text{NGRCP_NEC} \\ & + \text{NGRCU_MAC} * \text{NGRCP_MAC} + \text{NGRCU_ENC} * \text{NGRCP_ENC} \\ & + \text{NGRCU_WNC} * \text{NGRCP_WNC} + \text{NGRCU_SAC} * \text{NGRCP_SAC} \\ & + \text{NGRCU_ESC} * \text{NGRCP_ESC} + \text{NGRCU_WSC} * \text{NGRCP_WSC} \\ & + \text{NGRCU_MTN} * \text{NGRCP_MTN} + \text{NGRCU_PAC} * \text{NGRCP_PAC}) \\ & / \text{NGRCP_US} \end{aligned} \quad (28)$$

Where,

NGRCU_US = residential sector natural gas price derived from volume-weighted Census district prices, dollars per mcf

The STEO model then merges the historical U.S. average commercial natural gas price reported in the EIA Natural Gas monthly (NGRCUUS) with the U.S. average price forecast derived from the volume-weighted regional prices (NGRCU_US) (equation 29).

$$\text{NGRCUUS} = \text{NGRCU_US} \quad (29)$$

Where,

NGRCUUS = residential sector natural gas price, dollars per mcf

Commercial Prices

Regional natural gas commercial sector price differentials to the Henry Hub spot price are estimated as a function of the change in the Henry Hub spot price from the previous month, deviation in working gas inventory from the prior 3-year average, deviations in heating and cooling degree days from normal, and a lagged dependent variable (equation 30):

$$\begin{aligned} \text{NGCCU}_{xxx} - \text{NGHHMCF} = & a0 + a1 * (\text{NGHHMCF} - \text{NGHHMCF}(-1)) \quad (30) \\ & + a2 * (\text{NGWG}_{xxxx}(-1) - \text{NGWG}_{xxxx}(\text{average})) \\ & + a3 * (\text{ZWHD}_{xxx} - \text{ZWHN}_{xxx})/\text{ZSAJQUS} \\ & + a4 * (\text{ZWHD}_{xxx}(-1) - \text{ZWHN}_{xxx}(-1))/\text{ZSAJQUS}(-1) \\ & + a5 * (\text{NGCCU}_{xxx}(-1) - \text{NGHHMCF}(-1)) \\ & + \text{monthly dummies} \end{aligned}$$

Where,

NGCCU_{xxx} = commercial sector natural gas price in district xxx , dollars per mcf

NGHHMCF = Henry Hub spot price, dollars per mcf

NGWG_{xxxx} = working gas inventory in storage in region $xxxx$, Bcf

$\text{NGWG}_{xxxx}(\text{average})$ = working gas inventory in storage region $xxxx$ previous 3-year average, Bcf

ZSAJQUS = number of days in month

ZWHD_{xxx} = heating degree days in district xxx

ZWHN_{xxx} = normal heating degree days in district xxx

The regression results for commercial natural gas price spreads were similar to those for residential prices. Commercial natural gas prices were insensitive to changes in the spot price in the very short run with the estimated coefficients on the change in the Henry Hub spot price ranging from -0.70 (West North Central district) to -1.05 (Mountain district).

Deseasonalized regional prices, which are used in the regional consumption equations, are calculated using seasonal factors derived from the Census X-11 method (equation 31).

$$\text{NGRCU}_{xxx}\text{SA} = \text{NGCU}_{xxx} / \text{NGCU}_{xxx}\text{SF} \quad (31)$$

Where

$\text{NGCU}_{xxx}\text{SA}$ = deseasonalized commercial natural gas price in Census district xxx , dollars per mcf

$\text{NGCU}_{xxx}\text{SF}$ = commercial natural gas price in Census district xxx seasonal factor

Commercial sector price data in the EIA *Natural Gas Monthly* are representative of prices for gas sold and delivered to commercial consumers. These prices do not reflect average prices of natural gas transported to consumers for the account of third parties or "spot-market" prices. Consequently, regional and U.S. average prices are volume-weighted prices using only the volumes included in the price data. The model assumes that the average volume percentages over the last 3 years are carried forward over the forecast (equation 32).

$$\begin{aligned} \text{NGCOM_ONSYS}_{xxx} &= (\text{NGCOM_ONSYS}_{xxx}(-12) \\ &+ \text{NGCOM_ONSYS}_{xxx}(-24) + \text{NGCOM_ONSYS}_{xxx}(-36)) / 3 \end{aligned} \quad (32)$$

Where,

NGCOM_ONSYS_{xxx} = Percentage of volume of commercial sector deliveries included in price average in district xxx .

The average U.S. price is then a volume-weighted average based on the total volume of deliveries times the percentage of that volume included in the price (equation 33).

$$\text{NGCCU_US} = \frac{\sum(\text{NGCCU}_{xxx} * \text{NGCCP}_{xxx} * \text{NGCOM_ONSYS}_{xxx})}{\sum(\text{NGCCP}_{xxx} * \text{NGCOM_ONSYS}_{xxx})} \quad (33)$$

Where,

NGCCU_US = commercial sector natural gas price derived from volume-weighted Census district prices, dollars per mcf

The STEO model then merges the historical U.S. average commercial natural gas price reported in the EIA Natural Gas monthly (NGCCUUS) with the U.S. average price forecast derived from the volume-weighted regional prices (NGCCU_US) (equation 34).

$$\text{NGCCUUS} = \text{NGCCU_US} \quad (34)$$

Where,

NGCCUUS = commercial sector natural gas price, dollars per mcf

Industrial Prices

Industrial prices are forecast in the same way as residential and commercial prices (equation 35). Industrial prices have lower associated distribution costs, are much lower than residential and commercial prices, and more strongly correlated with the Henry Hub spot price. While the same factors drive the industrial price, the spot price plays a larger role and there is less seasonality in the industrial - Henry Hub price spread.

$$\begin{aligned} \text{NGICU}_{xxx} - \text{NGHHMCF} &= a_0 + a_1 * (\text{NGHHMCF} - \text{NGHHMCF}(-1)) \quad (35) \\ &+ a_2 * ((\text{NGWG}_{xxxx}(-1) - \text{NGWG}_{xxxx}(\text{average})) \\ &+ a_3 * (\text{ZWHD}_{xxx} - \text{ZWHN}_{xxx})/\text{ZSAJQUS}) \\ &+ a_4 * (\text{ZWHD}_{xxx}(-1) - \text{ZWHN}_{xxx}(-1))/\text{ZSAJQUS}(-1) \\ &+ a_5 * (\text{NGICU}_{xxx}(-1) - \text{NGHHMCF}(-1)) \\ &+ \text{monthly dummies} \end{aligned}$$

Where

NGICU_{xxx} = Natural gas industrial price in district xxx , dollars per mcf

NGHHMCF = Henry Hub spot price, dollars per mcf

$NGWG_{xxxx}$ = Working gas inventory in storage in region $xxxx$, Bcf

$NGWG_{xxxx}(\text{average})$ = Working gas inventory in storage in region $xxxx$
previous 3-year average, Bcf

$ZSAJQUS$ = number of days in the month

$ZWHD_{xxx}$ = Heating degree days in district xxx

$ZWHN_{xxx}$ = Normal heating degree days in district xxx

Industrial sector price data in the EIA *Natural Gas Monthly* are representative of prices for gas sold and delivered to industrial consumers. These prices do not reflect average prices of natural gas transported to consumers for the account of third parties or "spot-market" prices. Consequently, regional and U.S. average prices are volume-weighted prices using only the volumes included in the price data. The model assumes that the average volume percentages over the last 3 years are carried forward over the forecast (equation 36).

$$\begin{aligned} NGIND_ONSYS_{xxx} &= (NGIND_ONSYS_{xxx}(-12) \\ &\quad + NGIND_ONSYS_{xxx}(-24) + NGIND_ONSYS_{xxx}(-36)) / 3 \end{aligned} \tag{36}$$

Where

$NGIND_ONSYS_{xxx}$ = Percentage of volume of deliveries included in price average in district xxx .

The average U.S. price is then a volume-weighted average based on the total volume of deliveries times the percentage of that volume included in the price (equation 37).

$$\begin{aligned} NGICU_US &= \frac{\sum(NGICU_{xxx} * NGINX_{xxx} * NGIND_ONSYS_{xxx})}{\sum(NGINX_{xxx} * NGIND_ONSYS_{xxx})} \end{aligned} \tag{37}$$

Where,

$NGICU_US$ = industrial sector natural gas price derived from volume-weighted Census district prices, dollars per mcf

The STEO model then merges the historical U.S. average commercial natural gas price reported in the EIA Natural Gas monthly (NGICUUS) with the U.S. average price forecast derived from the volume-weighted regional prices (NGICU_US) (equation 38).

$$\text{NGICUUS} = \text{NGICU_US} \quad (38)$$

Where,

NGICUUS = industrial sector natural gas price, dollars per mcf

7. Forecast Evaluations

In order to evaluate the reliability of the forecasts, EIA generated out-of-sample forecasts and calculated forecast errors. Each equation was estimated through December 2012. Dynamic forecasts were then generated for the period January 2013 through December 2014 using each regression equation. The out-of-sample forecasts are then compared with actual outcomes.

Dynamic forecasts of each equation use the actual values of the exogenous variables on the right-hand side of the regression equations (e.g., consumption and price) but simulated values of the lagged dependent variable. Consequently, the calculated forecast error is not the same as a calculated regression error, which uses the actual value for the lagged dependent variable.

Summary forecast error statistics are reported for each regression equation. The root mean squared error (RMSE) and the mean absolute error (MAE) both depend on the scale of the dependent variable. These are generally used as relative measures to compare forecasts for the same series using different equations; the smaller the error, the better the forecasting ability of that model.

The mean absolute percentage error (MAPE) and the Theil inequality coefficient are invariant to scale. The smaller the values, the better the model fit. The Theil inequality coefficient always lies between zero and one, where zero indicates a perfect fit. The Theil inequality coefficient is broken out into bias, variance, and covariance proportions, which sum to 1. The bias proportion indicates how far the mean of the forecast is from the mean of the actual series signaling systematic error. The variance proportion indicates how far the variation of the forecast is from the variation of the actual series. This will be high if the actual data fluctuates significantly but the forecast fails to track these variations from the mean. The covariance proportion measures the remaining unsystematic forecasting errors. For a “good” forecast the bias and variance proportions should be small with most of the forecast error concentrated in the covariance proportion.

Most of the regression equations are estimated with sample periods beginning in 2010 because of the revisions in the EIA-857 survey. Because of the short sample period for equation estimates used to derive the out-of-sample forecasts, there is significant uncertainty in the forecasts, which is reflected in the out-of-sample forecast errors.

Consumption

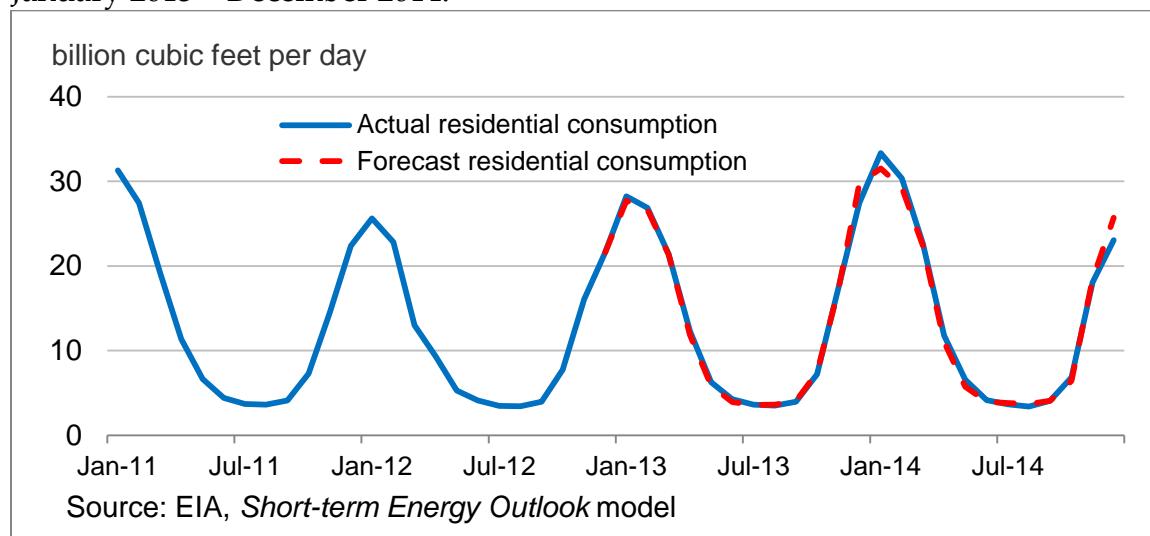
Table 1 provides a comparison of the out-of-sample forecasts and actual natural gas consumption by sector for each natural gas consumption regression equation for the out-of-forecast sample period.

Table 1. Actual and out-of-sample forecast consumption (billion cubic feet per day).

	2013		2014		Average 2013-14	
	Forecast	Actual	Forecast	Actual	Forecast	Actual
Residential consumption (NGRCPUSX)	13.50	13.46	13.75	13.90	13.62	13.68
Commercial consumption (NGCCPUSX)	8.68	8.98	8.72	9.48	8.70	9.23
Industrial consumption (NGICPUS)	18.40	18.55	18.61	19.31	18.50	18.93

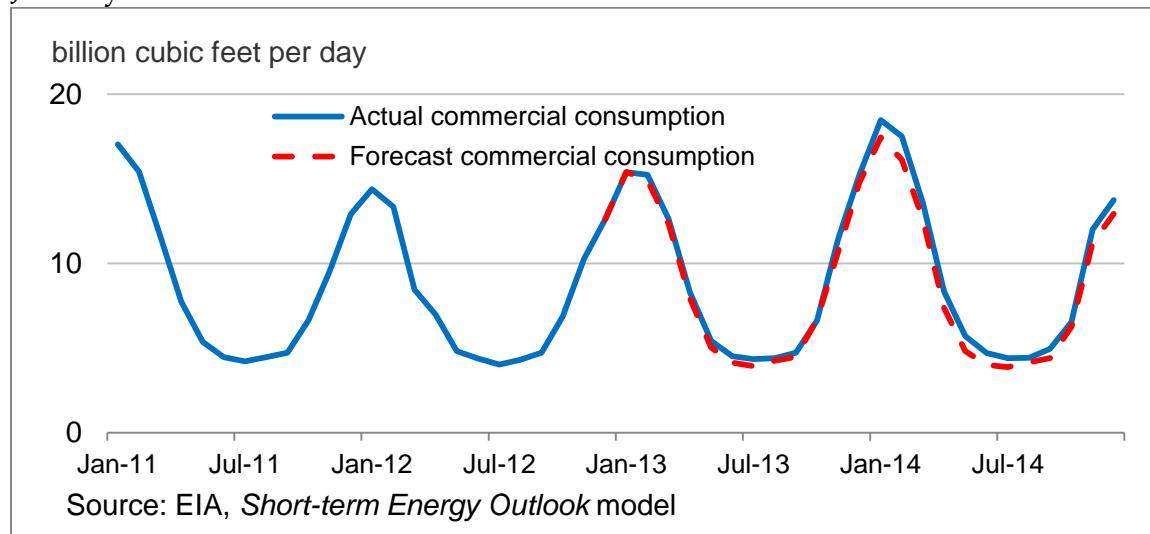
The out-of-sample residential consumption forecast averaged 0.06 Bcf per day (0.4%) below actual consumption during 2013 and 2014 (Figure 4). The largest forecast volume errors were in December in both years when the forecasts averaged about 2.4 Bcf per day below actual.

Figure 4. NGRCPUSX, residential consumption out-of-sample forecast versus actual, January 2013 – December 2014.



The out-of-sample commercial consumption forecast averaged 0.53 Bcf per day (5.8%) below actual consumption during 2013 and 2014 (Figure 5).

Figure 5. NGCCPUSX, commercial consumption out-of-sample forecast versus actual, January 2013 – December 2014.



The out-of-sample industrial consumption forecast averaged 0.43 Bcf per day (2.2%) below actual consumption during 2013 and 2014 (Figure 6).

Figure 6. NGICPUS, industrial consumption out-of-sample forecast versus actual, January 2013 – December 2014.

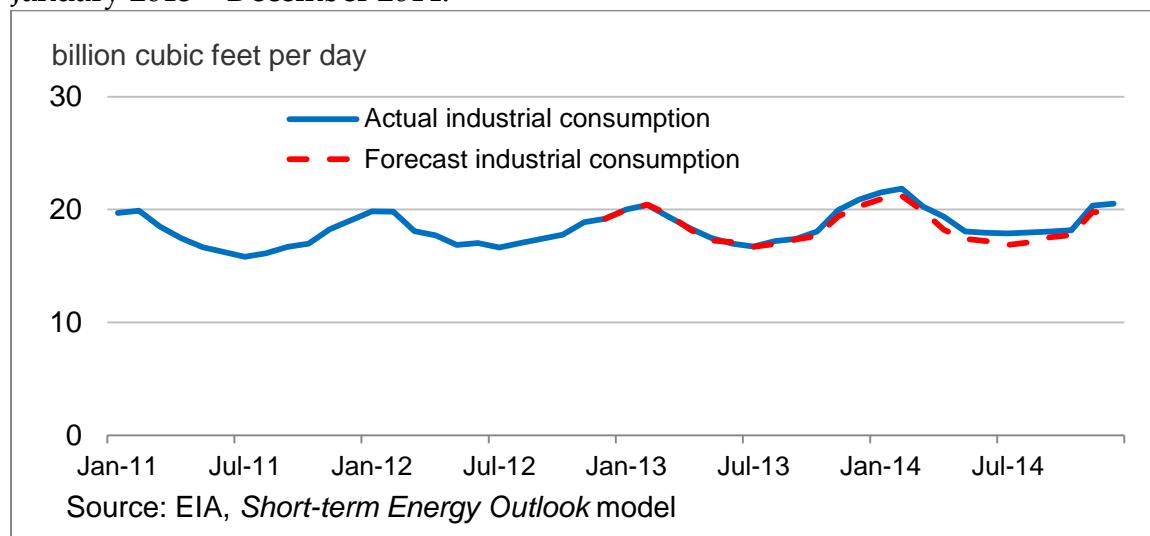


Table 2 reports summary forecast error statistics for each regression equation. Residential consumption performed the best, with most of its error concentrated in the covariance proportion. Industrial consumption, with its relatively high bias proportion, did not capture increase in growth rates in the sector in 2013 and 2014. The commercial consumption forecast, with the highest bias proportion, fell as much as 1.3 Bcf/d below actual consumption during the very cold winter months of 2013-14,

Table 2. Natural gas consumption out-of-sample simulation error statistics.

	Residential Consumption	Commercial Consumption	Industrial Consumption
Root mean squared error	0.89	0.64	0.56
Mean absolute error	0.58	0.54	0.46
Means absolute percent error	4.50	6.76	2.39
Theil inequality coefficient	0.026	0.031	0.015
Bias proportion	0.01	0.71	0.59
Variance proportion	0.02	0.04	0.01
Covariance proportion	0.99	0.25	0.41

Storage

Forecasting natural gas working inventories in 2013 and 2014 was particularly difficult because heating degree days during the 2013-14 winter averaged 10% higher than the previous 10-year average. Generally, the out-of-sample inventory forecasts were higher than the actual inventory levels. For example, between October 2013 and March 2014, which is the typical winter inventory withdrawal season, the forecast draw in the East consuming region was 1,621 Bcf compared with an actual inventory draw of 1,674 Bcf (Figure 7). The largest inventory draw under-prediction was in the Producing region with a forecast inventory draw of 627 Bcf compared with an actual draw of 911 Bcf (Figure 9). The forecast 242 Bcf inventory draw in the West consuming region during the winter of 2013-14 was higher than the actual 201 Bcf draw (Figure 8).

Table 3 provides a comparison of the out-of-sample dynamic forecasts and actual natural gas average end-of-month working gas inventories.

Table 3. Actual and out-of-sample forecast average end-of-month working inventories by region (billion cubic feet per day).

	2013		2014		Average 2013-14	
	Forecast	Actual	Forecast	Actual	Forecast	Actual
East region (NGWG_ECON)	1,457	1,325	1,363	1,133	1,410	1,229
Producing region (NGWG_WEST)	1,059	993	998	760	1,028	876
West Region (NGWG_WEST)	446	457	460	366	453	412

Figures 7 - 9 provide a comparison of monthly out-of-sample forecast and actual values for regional working gas inventories.

Figure 7. NGWG_ECON, East consuming region natural gas working inventory monthly changes out-of-sample forecast versus actual, January 2013 – December 2014.

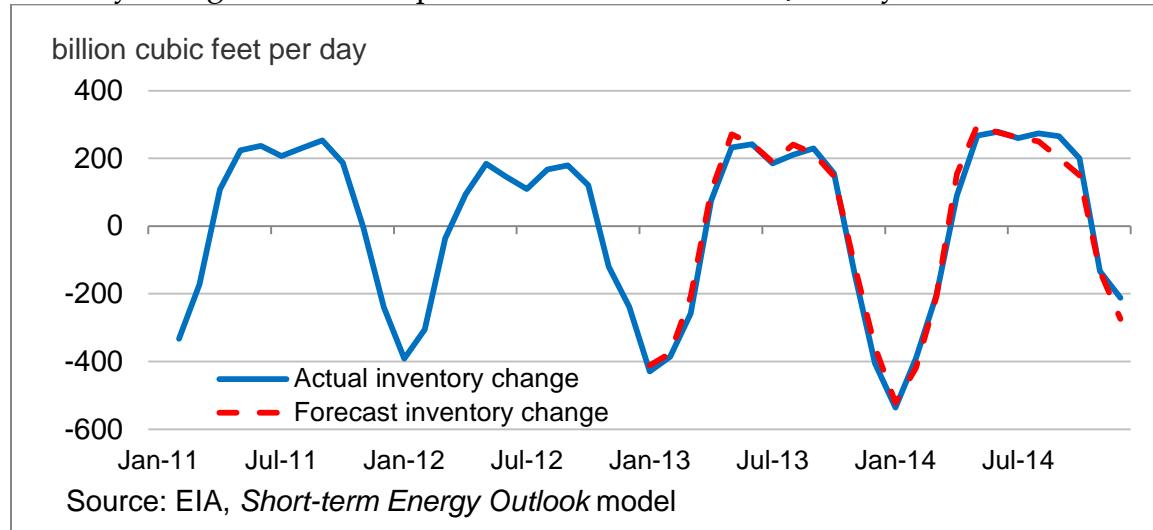


Figure 8. NGWG_WCON, West consuming region natural gas working inventory monthly changes out-of-sample forecast versus actual, January 2013 – December 2014.

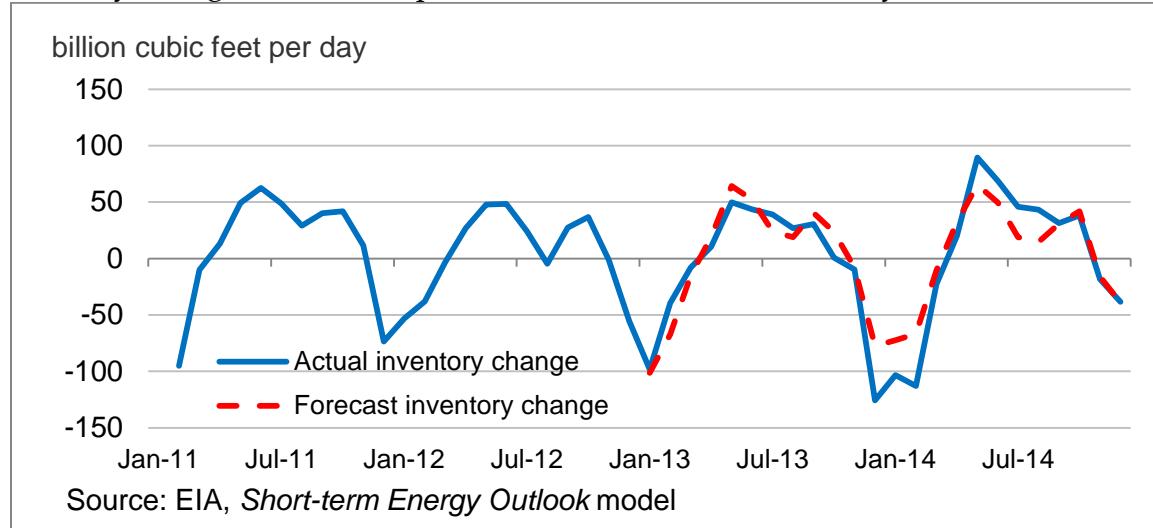


Figure 9. NGWG_PROD, Producing region natural gas working inventory monthly changes out-of-sample forecast versus actual, January 2013 – December 2014.

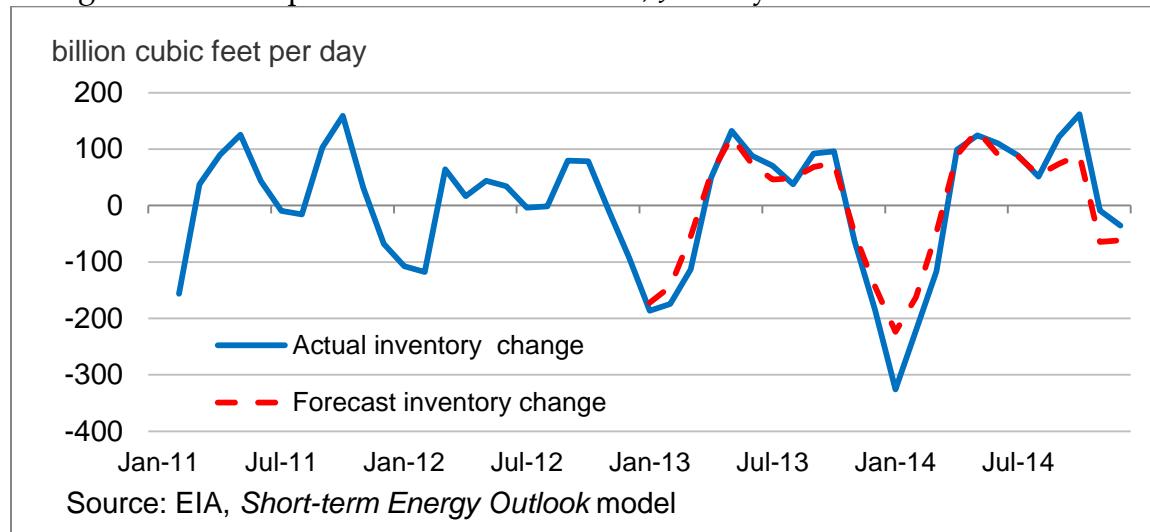


Table 4 shows summary statistics for the out-of-sample forecast errors for the equations for monthly inventory changes in the three storage regions. While the bias proportion was low in all three regions, the variance proportions were relatively high in the Producing and West consuming regions.

Table 4. Natural gas working inventory monthly change out-of-sample simulation error statistics.

	East Region	Producing Region	West Region
Root mean squared error	1.04	0.73	1.43
Mean absolute error	0.84	0.56	1.11
Mean absolute percent error	13.0	164	43.6
Theil inequality coefficient	0.057	0.22	0.18
Bias proportion	0.02	0.01	0.04
Variance proportion	0.00	0.31	0.39
Covariance proportion	0.98	0.68	0.56

Prices

Table 5 provides a comparison of the annual average out-of-sample dynamic forecasts and actual natural gas prices for the out-of-forecast sample period. Figure 10 provides a

comparison of monthly out-of-sample forecast and actual values for the natural gas spot prices.

Overall the Henry Hub spot price forecast performed well in the out-of-sample period. Despite this, spot prices are still highly unpredictable and difficult to forecast.

The commercial price equation forecast a price that averaged 11% higher than actual in 2013 and 2% lower than actual in 2014. The largest commercial price forecast errors tended to occur in the first and third quarters when spot price movements were greatest (first quarter) or consumption was at its lowest (third quarter).

The industrial price forecast equation generated the lowest average forecast error. However, the price forecast error was still relatively large in some months with the over-prediction of prices in some summer months offsetting under-prediction during some winter months.

The residential price forecast error in 2013 was relatively small with the out-of-sample forecast averaging \$0.29/Mcf (3.3%) lower than the actual price. The price forecast error becomes much larger during the first half of 2014, and peaked in February 2014 when very cold weather through much of the country pushed the Henry Hub monthly average spot price to a high of \$6.00 per MMBtu.

Table 5. Actual and out-of-sample forecast Henry Hub spot prices (dollars per MMBtu) and end-use sector prices (dollars per Mcf).

	2013		2014		Average 2013-14	
	Forecast	Actual	Forecast	Actual	Forecast	Actual
Henry Hub Spot Prices	3.71	3.73	4.50	4.39	4.10	4.06
Commercial sector price	7.88	7.11	8.23	8.41	8.06	7.79
Industrial sector price	3.82	3.92	4.64	4.71	4.24	4.32
Residential sector price	8.45	8.74	8.30	9.70	8.37	9.24

Figure 10. Natural gas price out-of-sample forecasts versus actuals, January 2013 – December 2014.

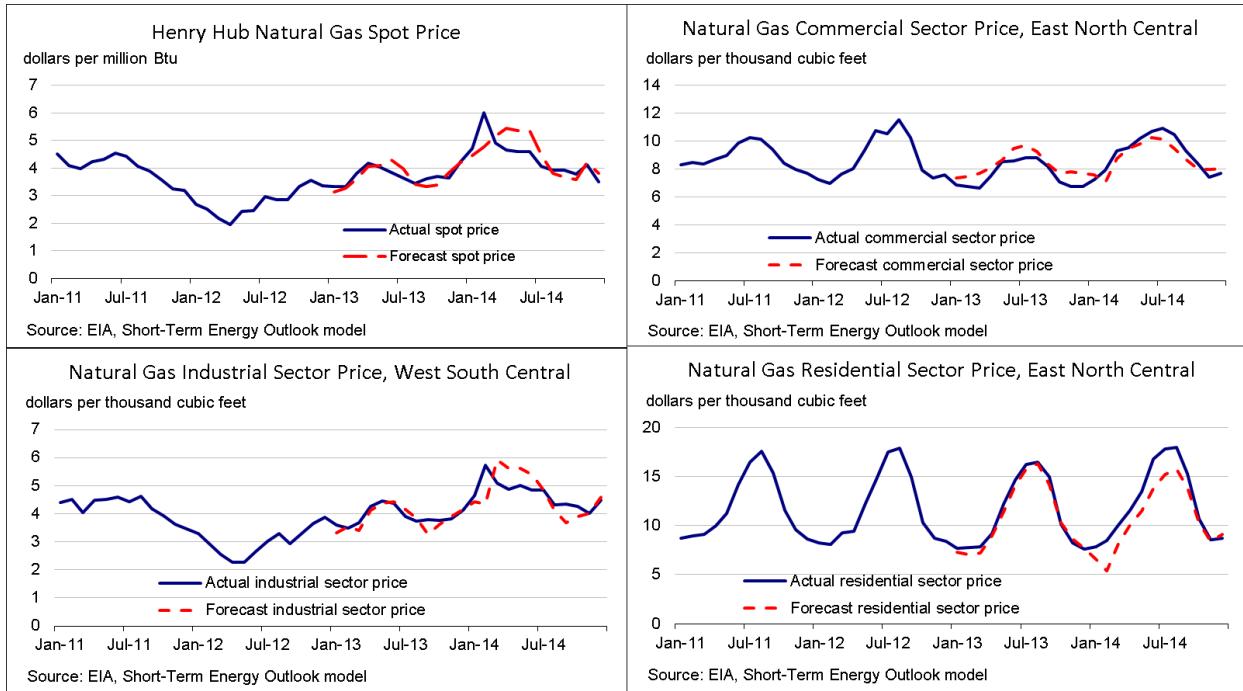


Table 6 shows summary statistics for the out-of-sample forecast errors for the natural gas Henry Hub spot price and end-use prices in the largest consuming regions for each end-use sector.

Table 6. Natural gas prices out-of-sample simulation error statistics.

	Henry Hub spot price	Commercial Price, East North Central	Industrial Price, West South Central	Residential Price, East North Central
Root mean squared error	0.44	0.78	0.22	1.53
Mean absolute error	0.32	0.70	0.17	1.10
Means absolute percent error	7.5	8.5	3.9	8.8
Theil inequality coefficient	0.053	0.046	0.025	0.066
Bias proportion	0.01	0.03	0.12	0.45
Variance proportion	0.03	0.69	0.00	0.09
Covariance proportion	0.96	0.28	0.87	0.46

Appendix A. Variable Definitions

Units Key

DD	Degree day
Bcf	Billion cubic feet
Bcf/d	Billion cubic feet per day
\$/MCF	Dollars per thousand cubic feet
MCF/D	Thousand cubic feet per day
\$/MMBtu	Dollars per million British thermal units

Variable	Description	Units
APR	=1 if April, 0 otherwise	--
AUG	=1 if August, 0 otherwise	--
CGSP_SAC	Real gross state product, aggregate, South Atlantic	Billion chained 2009 \$
CGSPMFG_ENC	Real gross state product, manufacturing, East North Central	Billion chained 2009 \$
CGSPMFG_ESC	Real gross state product, manufacturing, East South Central	Billion chained 2009 \$
CGSPMFG_MAC	Real gross state product, manufacturing, Middle Atlantic	Billion chained 2009 \$
CGSPMFG_MTN	Real gross state product, manufacturing, Mountain	Billion chained 2009 \$
CGSPMFG_NEA	Real gross state product, manufacturing, New England	Billion chained 2009 \$
CGSPMFG_PAC	Real gross state product, manufacturing, Pacific	Billion chained 2009 \$
CGSPMFG_SAC	Real gross state product, manufacturing, South Atlantic	Billion chained 2009 \$
CGSPMFG_WNC	Real gross state product, manufacturing, West North Central	Billion chained 2009 \$
CGSPMFG_WSC	Real gross state product, manufacturing, West South Central	Billion chained 2009 \$
CICPIUS	Consumer price index, all items, 1982-84 = 1.0	--
CPI2000_ENC	Consumer price index, base 2000, East North Central	--
CPI2000_ESC	Consumer price index, base 2000, East South Central	--
CPI2000_MAC	Consumer price index, base 2000, Middle Atlantic	--
CPI2000_MTN	Consumer price index, base 2000, Mountain	--
CPI2000_NEA	Consumer price index, base 2000, New England	--
CPI2000_PAC	Consumer price index, base 2000, Pacific	--
CPI2000_SAC	Consumer price index, base 2000, South Atlantic	--
CPI2000_WNC	Consumer price index, base 2000, West North Central	--
CPI2000_WSC	Consumer price index, base 2000, West South Central	--

CYRPIC_ENC	Real personal income, East North Central	Billion chained 2009 \$
CYRPIC_ESC	Real personal income, East South Central	Billion chained 2009 \$
CYRPIC_MAC	Real personal income, Middle Atlantic	Billion chained 2009 \$
CYRPIC_MTN	Real personal income, Mountain	Billion chained 2009 \$
CYRPIC_NEA	Real personal income, New England	Billion chained 2009 \$
CYRPIC_PAC	Real personal income, Pacific	Billion chained 2009 \$
CYRPIC_SAC	Real personal income, South Atlantic	Billion chained 2009 \$
CYRPIC_WNC	Real personal income, West North Central	Billion chained 2009 \$
CYRPIC_WSC	Real personal income, West South Central	Billion chained 2009 \$
DEC	=1 if December, 0 otherwise	--
EESPP_ENC	Private sector employment, East North Central	millions
EESPP_ESC	Private sector employment, East South Central	millions
EESPP_MAC	Private sector employment, Middle Atlantic	millions
EESPP_MTN	Private sector employment, Mountain	millions
EESPP_NEA	Private sector employment, New England	millions
EESPP_PAC	Private sector employment, Pacific	millions
EESPP_SAC	Private sector employment, South Atlantic	millions
EESPP_WNC	Private sector employment, West North Central	millions
EESPP_WSC	Private sector employment, West South Central	millions
EMCMPUS	Commercial sector employment, U.S.	millions
FEB	=1 if February, 0 otherwise	--
JAN	=1 if January, 0 otherwise	--
JUL	=1 if July, 0 otherwise	--
JUN	=1 if June, 0 otherwise	--
MAR	=1 if March, 0 otherwise	--
MAY	=1 if May, 0 otherwise	--
NGACPUS	Pipeline and distribution gas use	Bcf/d
NGBGPUS	Base gas in underground storage, U.S.	Bcf
NGCCP_ENC	Commercial consumption, East North Central	Bcf/d
NGCCP_ESC	Commercial consumption, East South Central	Bcf/d
NGCCP_MAC	Commercial consumption, Middle Atlantic	Bcf/d
NGCCP_MTN	Commercial consumption, Mountain	Bcf/d
NGCCP_NEA	Commercial consumption, New England	Bcf/d
NGCCP_PAC	Commercial consumption, Pacific	Bcf/d
NGCCP_SAC	Commercial consumption, South Atlantic	Bcf/d
NGCCP_WNC	Commercial consumption, West North Central	Bcf/d
NGCCP_WSC	Commercial consumption, West South Central	Bcf/d

NGCCPUS	Total commercial consumption , U.S.	Bcf/d
NGCCPUSX	Total commercial consumption, U.S.	Bcf/d
NGCCU_ENC	Natural gas commercial price, East North Central	\$/Mcf
NGCCU_ESC	Natural gas commercial price, East South Central	\$/Mcf
NGCCU_MAC	Natural gas commercial price, Middle Atlantic	\$/Mcf
NGCCU_MTN	Natural gas commercial price, Mountain	\$/Mcf
NGCCU_NEC	Natural gas commercial price, New England	\$/Mcf
NGCCU_PAC	Natural gas commercial price, Pacific	\$/Mcf
NGCCU_SAC	Natural gas commercial price, South Atlantic	\$/Mcf
NGCCU_US	Natural gas commercial price, U.S.	\$/Mcf
NGCCU_WNC	Natural gas commercial price, West North Central	\$/Mcf
NGCCU_WSC	Natural gas commercial price, West South Central	\$/Mcf
NGCCUUS	Natural gas commercial price, U.S.	\$/Mcf
NGCGCON_EL	Energy inputs for electric plants from natural gas industrial sector	Bcf/d
NGCOM_ONSYS_ENC	Natural gas commercial on-system sales, East North Central	Bcf/d
NGCOM_ONSYS_ESC	Natural gas commercial on-system sales, East South Central	Bcf/d
NGCOM_ONSYS_MAC	Natural gas commercial on-system sales, Middle Atlantic	Bcf/d
NGCOM_ONSYS_MTN	Natural gas commercial on-system sales, Mountain	Bcf/d
NGCOM_ONSYS_NEC	Natural gas commercial on-system sales, New England	Bcf/d
NGCOM_ONSYS_PAC	Natural gas commercial on-system sales, Pacific	Bcf/d
NGCOM_ONSYS_SAC	Natural gas commercial on-system sales, South Atlantic	Bcf/d
NGCOM_ONSYS_US	Natural gas commercial on-system sales, U.S.	Bcf/d
NGCOM_ONSYS_WNC	Natural gas commercial on-system sales, West North Central	Bcf/d
NGCOM_ONSYS_WSC	Natural gas commercial on-system sales, West South Central	Bcf/d
NGEPCON	Natural gas consumption, electric power sector total	Bcf/d
NGHHMCF	Henry Hub natural gas spot price	\$/Mcf
NGHHUUS	Henry Hub natural gas spot price	\$/MMBtu
NGICPUS	Natural gas consumption: electric power sector excl. cogeneration	Bcf/d
NGICU_ENC	Price of natural gas, industrial sector, East North Central	\$/Mcf
NGICU_ESC	Price of natural gas, industrial sector, East South Central	\$/Mcf
NGICU_MAC	Price of natural gas, industrial sector, Middle Atlantic	\$/Mcf
NGICU_MTN	Price of natural gas, industrial sector, Mountain	\$/Mcf
NGICU_PAC	Price of natural gas, industrial sector, Pacific	\$/Mcf
NGICU_SAC	Price of natural gas, industrial sector, South Atlantic	\$/Mcf
NGICU_US	Price of natural gas, industrial sector, U.S.	\$/Mcf
NGICU_WNC	Price of natural gas, industrial sector, West North Central	\$/Mcf
NGICU_WSC	Price of natural gas, industrial sector, West South Central	\$/Mcf
NGICUUS	Price of natural gas, industrial sector, U.S.	\$/Mcf
NGIND_ONSYS_ENC	Natural gas industrial on-system sales, East North Central	Bcf/d
NGIND_ONSYS_ESC	Natural gas industrial on-system sales, East South Central	Bcf/d

NGIND_ONSYS_MAC	Natural gas industrial on-system sales, Middle Atlantic	Bcf/d
NGIND_ONSYS_MTN	Natural gas industrial on-system sales, Mountain	Bcf/d
NGIND_ONSYS_NEC	Natural gas industrial on-system sales, New England	Bcf/d
NGIND_ONSYS_PAC	Natural gas industrial on-system sales, Pacific	Bcf/d
NGIND_ONSYS_SAC	Natural gas industrial on-system sales, South Atlantic	Bcf/d
NGIND_ONSYS_US	Natural gas industrial on-system sales, U.S.	Bcf/d
NGIND_ONSYS_WNC	Natural gas industrial on-system sales, West North Central	Bcf/d
NGIND_ONSYS_WSC	Natural gas industrial on-system sales, West South Central	Bcf/d
NGINX	Natural gas industrial consumption, incl. cogeneration, U.S.	Bcf/d
NGINX_ENC	Natural gas industrial consumption, East North Central	Bcf/d
NGINX_ESC	Natural gas industrial consumption, East South Central	Bcf/d
NGINX_MAC	Natural gas industrial consumption, Middle Atlantic	Bcf/d
NGINX_MTN	Natural gas industrial consumption, Mountain	Bcf/d
NGINX_NEC	Natural gas industrial consumption, New England	Bcf/d
NGINX_PAC	Natural gas industrial consumption, Pacific	Bcf/d
NGINX_SAC	Natural gas industrial consumption, South Atlantic	Bcf/d
NGINX_US	Natural gas industrial consumption, U.S.	Bcf/d
NGINX_WNC	Natural gas industrial consumption, West North Central	Bcf/d
NGINX_WSC	Natural gas industrial consumption, West South Central	Bcf/d
NGLPPUS	Natural gas lease and plant fuel use	Bcf/d
NGNWPUS	Net natural gas withdrawals from storage	Bcf/d
NGRCP_ENC	Natural gas residential consumption, East North Central	Bcf/d
NGRCP_ESC	Natural gas residential consumption, East South Central	Bcf/d
NGRCP_MAC	Natural gas residential consumption, Middle Atlantic	Bcf/d
NGRCP_MTN	Natural gas residential consumption, Mountain	Bcf/d
NGRCP_NEC	Natural gas residential consumption, New England	Bcf/d
NGRCP_PAC	Natural gas residential consumption, Pacific	Bcf/d
NGRCP_QH_ENC	Natural gas residential consumption per household, East North Central	Bcf/d
NGRCP_QH_ESC	Natural gas residential consumption per household, East South Central	Bcf/d
NGRCP_QH_MAC	Natural gas residential consumption per household, Middle Atlantic	Bcf/d
NGRCP_QH_MTN	Natural gas residential consumption per household, Mountain	Bcf/d
NGRCP_QH_NEC	Natural gas residential consumption per household, New England	Bcf/d
NGRCP_QH_PAC	Natural gas residential consumption per household, Pacific	Bcf/d
NGRCP_QH_SAC	Natural gas residential consumption per household, South Atlantic	Bcf/d
NGRCP_QH_WNC	Natural gas residential consumption per household, West North Central	Bcf/d

NGRCP_QH_WSC	Natural gas residential consumption per household, West South Central	Bcf/d
NGRCP_SAC	Natural gas residential consumption, South Atlantic	Bcf/d
NGRCP_US	Natural gas residential consumption, U.S. (sum of regions)	Bcf/d
NGRCP_WNC	Natural gas residential consumption, West North Central	Bcf/d
NGRCP_WSC	Natural gas residential consumption, West South Central	Bcf/d
NGRCUPUS	Natural gas residential consumption, U.S.	Bcf/d
NGRCPUSX	Natural gas residential consumption, U.S.	Bcf/d
NGRCU_ENC	Natural gas residential price, East North Central	\$/Mcf
NGRCU_ESC	Natural gas residential price, East South Central	\$/Mcf
NGRCU_MAC	Natural gas residential price, Middle Atlantic	\$/Mcf
NGRCU_MTN	Natural gas residential price, Mountain	\$/Mcf
NGRCU_NEA	Natural gas residential price, New England	\$/Mcf
NGRCU_PAC	Natural gas residential price, Pacific	\$/Mcf
NGRCU_SAC	Natural gas residential price, South Atlantic	\$/Mcf
NGRCU_US	Natural gas residential price, U.S.	\$/Mcf
NGRCU_WNC	Natural gas residential price, West North Central	\$/Mcf
NGRCU_WSC	Natural gas residential price, West South Central	\$/Mcf
NGRCUUS	Natural gas residential price, U.S.	\$/Mcf
NGTCPUS	Natural gas consumption, total	Bcf/d
NGUSPUS	Total natural gas underground storage inventory, U.S.	Bcf
NGVHPUS	Natural gas vehicle fuel	Bcf/d
NGWG_DRAW	Natural gas working inventories withdrawal, U.S.	Bcf/d
NGWG_ECON	Natural gas working inventories, East Consuming Region	Bcf
NGWG_PROD	Natural gas working inventories, Producing Region	Bcf
NGWG_WCON	Natural gas working inventories, West Consuming Region	Bcf
NGWGPUS	Natural gas working inventories, U.S.	Bcf
NOV	=1 if November, 0 otherwise	--
OCT	=1 if October, 0 otherwise	--
QHNG_ENC	Number of households with natural gas as primary heating fuel, East North Central	Millions
QHNG_ESC	Number of households with natural gas as primary heating fuel, East South Central	Millions
QHNG_MAC	Number of households with natural gas as primary heating fuel, Middle Atlantic	Millions
QHNG_MTN	Number of households with natural gas as primary heating fuel, Mountain	Millions
QHNG_NEA	Number of households with natural gas as primary heating fuel, New England	Millions
QHNG_PAC	Number of households with natural gas as primary heating fuel, Pacific	Millions
QHNG_SAC	Number of households with natural gas as primary heating fuel, South Atlantic	Millions
QHNG_WNC	Number of households with natural gas as primary	Millions

	heating fuel, West North Central	
QHNG_WSC	Number of households with natural gas as primary heating fuel, West South Central	Millions
QSIC_NG	Natural gas-weighted industrial production index, 2007 = 100	--
SEP	=1 if September, 0 otherwise	--
WORKDAYS	Number workdays in month	--
ZSAJQUS	Number of days in month	--
ZWCD_MAC	Population-weighted cooling degree days, Middle Atlantic	DD
ZWCD_PAC	Population-weighted cooling degree days, Pacific	DD
ZWCDPUS	Population-weighted cooling degree days, U.S.	DD
ZWCN_MAC	Population-weighted cooling degree days, Middle Atlantic	DD
ZWHD_ENC	Population-weighted heating degree days, East North Central	DD
ZWHD_ESC	Population-weighted heating degree days, East South Central	DD
ZWHD_MAC	Population-weighted heating degree days, Middle Atlantic	DD
ZWHD_MTN	Population-weighted heating degree days, Mountain	DD
ZWHD_MW	Population-weighted heating degree days, Midwest	DD
ZWHD_NEA	Population-weighted heating degree days, New England	DD
ZWHD_NGCC	Heating degree days weighted by number of natural gas commercial customers, U.S.	DD
ZWHD_NGRCC	Heating degree days weighted by number of households that use natural gas as their primary space heating fuel, U.S.	DD
ZWHD_PAC	Population-weighted heating degree days, Pacific	DD
ZWHD_SAC	Population-weighted heating degree days, South Atlantic	DD
ZWHD_WNC	Population-weighted heating degree days, West North Central	DD
ZWHD_WSC	Population-weighted heating degree days, West South Central	DD
ZWHDPUS	Population-weighted heating degree days, U.S.	DD
ZWHN_ENC	Population-weighted heating degree days, normal, East North Central	DD
ZWHN_ESC	Population-weighted heating degree days, normal, East South Central	DD
ZWHN_MAC	Population-weighted heating degree days, normal, Middle Atlantic	DD
ZWHN_MTN	Population-weighted heating degree days, normal, Mountain	DD
ZWHN_MW	Population-weighted heating degree days, normal, Midwest	DD
ZWHN_NEA	Population-weighted heating degree days, normal, New	DD

	England	
ZWHN_NGCC	Heating degree days weighted by natural gas commercial consumption, normal	DD
ZWHN_NGRC	Heating degree days weighted by natural gas residential consumption, normal	DD
ZWHN_PAC	Population-weighted heating degree days, normal, Pacific	DD
ZWHN_SAC	Population-weighted heating degree days, normal, South Atlantic	DD
ZWHN_WNC	Population-weighted heating degree days, normal, West North Central	DD
ZWHN_WSC	Population-weighted heating degree days, normal, West South Central	DD
ZWHNPUS	Population-weighted heating degree days, normal, U.S.	DD

Appendix B. EViews Model Files

Consumption

```
@IDENTITY NGTCPUS = NGRPCUS + NGCCPUS + NGINX + NGACPUS + NGLPPUS + NGEPCON + NGVHPUS
```

```
:EQ_NGRCPUSX
```

```
@IDENTITY NGRPCUS = NGRPCUSX
```

```
:EQ_NGCCPUSX
```

```
@IDENTITY NGCCPUS = NGCCPUSX
```

```
@IDENTITY NGINX = NGICPUS + NGCGCON_EL
```

```
:EQ_NGICPUS
```

```
@IDENTITY NGLPPUS = NGMPPUS * (NGLPPUS(-1) / NGMPPUS(-1))
```

```
NGACPUS = (NGRPCUS + NGCCPUS + NGINX + NGEPCON) * (NGACPUS(-1) / (NGRPCUS(-1) + NGCCPUS(-1) + NGINX(-1) + NGEPCON(-1)))
```

```
@IDENTITY NGVHPUS = NGVHPUS(-1)
```

```
'----- Regional Residential Consumption
```

```
:EQ_NGRCP_QH_ENC
```

```
:EQ_NGRCP_QH_ESC
```

```
:EQ_NGRCP_QH_MAC
```

```
:EQ_NGRCP_QH_MTN
```

```
:EQ_NGRCP_QH_NEC
```

```
:EQ_NGRCP_QH_PAC
```

```
:EQ_NGRCP_QH_SAC
```

```
:EQ_NGRCP_QH_WNC
```

```
:EQ_NGRCP_QH_WSC
```

```
@IDENTITY NGRCP_QH_ENC = NGRCP_QH_ENC_SA * NGRCP_QH_ENC_SF
```

```
@IDENTITY NGRCP_QH_ESC = NGRCP_QH_ESC_SA * NGRCP_QH_ESC_SF
```

```
@IDENTITY NGRCP_QH_MAC = NGRCP_QH_MAC_SA * NGRCP_QH_MAC_SF
```

```
@IDENTITY NGRCP_QH_MTN = NGRCP_QH_MTN_SA * NGRCP_QH_MTN_SF
```

```
@IDENTITY NGRCP_QH_NEC = NGRCP_QH_NEC_SA * NGRCP_QH_NEC_SF
```

```
@IDENTITY NGRCP_QH_PAC = NGRCP_QH_PAC_SA * NGRCP_QH_PAC_SF
```

```
@IDENTITY NGRCP_QH_SAC = NGRCP_QH_SAC_SA * NGRCP_QH_SAC_SF
```

```
@IDENTITY NGRCP_QH_WNC = NGRCP_QH_WNC_SA * NGRCP_QH_WNC_SF
```

```

@IDENTITY NGRCP_QH_WSC = NGRCP_QH_WSC_SA * NGRCP_QH_WSC_SF

@IDENTITY NGRCP_ENC = NGRCP_QH_ENC * QHNG_ENC
@IDENTITY NGRCP_ESC = NGRCP_QH_ESC * QHNG_ESC
@IDENTITY NGRCP_MAC = NGRCP_QH_MAC * QHNG_MAC
@IDENTITY NGRCP_MTN = NGRCP_QH_MTN * QHNG_MTN
@IDENTITY NGRCP_NECK = NGRCP_QH_NECK * QHNG_NECK
@IDENTITY NGRCP_PAC = NGRCP_QH_PAC * QHNG_PAC
@IDENTITY NGRCP_SAC = NGRCP_QH_SAC * QHNG_SAC
@IDENTITY NGRCP_WNC = NGRCP_QH_WNC * QHNG_WNC
@IDENTITY NGRCP_WSC = NGRCP_QH_WSC * QHNG_WSC

@IDENTITY NGRCP_US = NGRCP_NECK + NGRCP_MAC + NGRCP_ENC + NGRCP_WNC + NGRCP_SAC + NGRCP_ESC
+ NGRCP_WSC + NGRCP_MTN + NGRCP_PAC

'----- Regional Commercial Consumption

:EQ_NGCCP_ENC
:EQ_NGCCP_ESC
:EQ_NGCCP_MAC
:EQ_NGCCP_MTN
:EQ_NGCCP_NECK
:EQ_NGCCP_PAC
:EQ_NGCCP_SAC
:EQ_NGCCP_WNC
:EQ_NGCCP_WSC

@IDENTITY NGCCP_ENC = NGCCP_ENC_SA * NGCCP_ENC_SF
@IDENTITY NGCCP_ESC = NGCCP_ESC_SA * NGCCP_ESC_SF
@IDENTITY NGCCP_MAC = NGCCP_MAC_SA * NGCCP_MAC_SF
@IDENTITY NGCCP_MTN = NGCCP_MTN_SA * NGCCP_MTN_SF
@IDENTITY NGCCP_NECK = NGCCP_NECK_SA * NGCCP_NECK_SF
@IDENTITY NGCCP_PAC = NGCCP_PAC_SA * NGCCP_PAC_SF
@IDENTITY NGCCP_SAC = NGCCP_SAC_SA * NGCCP_SAC_SF
@IDENTITY NGCCP_WNC = NGCCP_WNC_SA * NGCCP_WNC_SF
@IDENTITY NGCCP_WSC = NGCCP_WSC_SA * NGCCP_WSC_SF

@IDENTITY NGCCP_US = NGCCP_ENC + NGCCP_ESC + NGCCP_MAC + NGCCP_MTN + NGCCP_NECK + NGCCP_PAC +
NGCCP_WNC + NGCCP_SAC + NGCCP_WSC

```

'----- Regional Industrial Consumption

```

:EQ_NGINX_ENC
:EQ_NGINX_ESC
:EQ_NGINX_MAC
:EQ_NGINX_MTN

```

:EQ_NGINX_NE
:EQ_NGINX_PAC
:EQ_NGINX_SAC
:EQ_NGINX_WNC
:EQ_NGINX_WSC

@IDENTITY NGINX_US = NGINX_NE + NGINX_MAC + NGINX_ENC + NGINX_WNC + NGINX_SAC + NGINX_ESC +
NGINX_WSC + NGINX_MTN + NGINX_PAC

Inventories

:EQ_NGWG_ECON
:EQ_NGWG_PROD
:EQ_NGWG_WCON

@IDENTITY NGWGPUS = NGWG_ECON + NGWG_WCON + NGWG_PROD

@IDENTITY NGBGPUS = NGBGPUS(-1)

@IDENTITY NGUSPUS = NGWGPUS + NGBGPUS

Prices

:EQ_NGHHUUS
'----- Residential Sector Prices

:EQ_NGRCU_ENC
:EQ_NGRCU_ESC
:EQ_NGRCU_MAC
:EQ_NGRCU_MTN
:EQ_NGRCU_NE
:EQ_NGRCU_PAC
:EQ_NGRCU_SAC
:EQ_NGRCU_WNC
:EQ_NGRCU_WSC

@IDENTITY NGRCU_ENC_SA = NGRCU_ENC / NGRCU_ENC_SF
@IDENTITY NGRCU_ESC_SA = NGRCU_ESC / NGRCU_ESC_SF
@IDENTITY NGRCU_MAC_SA = NGRCU_MAC / NGRCU_MAC_SF
@IDENTITY NGRCU_MTN_SA = NGRCU_MTN / NGRCU_MTN_SF
@IDENTITY NGRCU_NE_SA = NGRCU_NE / NGRCU_NE_SF

```

@IDENTITY NGRCU_PAC_SA = NGRCU_PAC / NGRCU_PAC_SF
@IDENTITY NGRCU_SAC_SA = NGRCU_SAC / NGRCU_SAC_SF
@IDENTITY NGRCU_WNC_SA = NGRCU_WNC / NGRCU_WNC_SF
@IDENTITY NGRCU_WSC_SA = NGRCU_WSC / NGRCU_WSC_SF

@IDENTITY NGRCU_US = (NGRCU_NEC * NGRCP_NEC + NGRCU_MAC * NGRCP_MAC + NGRCU_ENC *
    NGRCP_ENC + NGRCU_WNC * NGRCP_WNC + NGRCU_SAC * NGRCP_SAC + NGRCU_ESC * NGRCP_ESC +
    NGRCU_WSC * NGRCP_WSC + NGRCU_MTN * NGRCP_MTN + NGRCU_PAC * NGRCP_PAC) /
    NGRCP_US

@IDENTITY NGRCUUS = NGRCU_US

'----- Commercial Sector Prices

:EQ_NGCCU_ENC
:EQ_NGCCU_ESC
:EQ_NGCCU_MAC
:EQ_NGCCU_MTN
:EQ_NGCCU_NEC
:EQ_NGCCU_PAC
:EQ_NGCCU_SAC
:EQ_NGCCU_WNC
:EQ_NGCCU_WSC

@IDENTITY NGCCU_ENC_SA = NGCCU_ENC / NGCCU_ENC_SF
@IDENTITY NGCCU_ESC_SA = NGCCU_ESC / NGCCU_ESC_SF
@IDENTITY NGCCU_MAC_SA = NGCCU_MAC / NGCCU_MAC_SF
@IDENTITY NGCCU_MTN_SA = NGCCU_MTN / NGCCU_MTN_SF
@IDENTITY NGCCU_NEC_SA = NGCCU_NEC / NGCCU_NEC_SF
@IDENTITY NGCCU_PAC_SA = NGCCU_PAC / NGCCU_PAC_SF
@IDENTITY NGCCU_SAC_SA = NGCCU_SAC / NGCCU_SAC_SF
@IDENTITY NGCCU_WNC_SA = NGCCU_WNC / NGCCU_WNC_SF
@IDENTITY NGCCU_WSC_SA = NGCCU_WSC / NGCCU_WSC_SF

@IDENTITY NGCOM_ONSYS_NEC = (NGCOM_ONSYS_NEC(-12) + NGCOM_ONSYS_NEC(-24) +
    NGCOM_ONSYS_NEC(-36)) / 3

@IDENTITY NGCOM_ONSYS_MAC = (NGCOM_ONSYS_MAC(-12) + NGCOM_ONSYS_MAC(-24) +
    NGCOM_ONSYS_MAC(-36)) / 3

@IDENTITY NGCOM_ONSYS_ENC = (NGCOM_ONSYS_ENC(-12) + NGCOM_ONSYS_ENC(-24) +
    NGCOM_ONSYS_ENC(-36)) / 3

@IDENTITY NGCOM_ONSYS_WNC = (NGCOM_ONSYS_WNC(-12) + NGCOM_ONSYS_WNC(-24) +
    NGCOM_ONSYS_WNC(-36)) / 3

```

```

@IDENTITY NGCOM_ONSYS_SAC = (NGCOM_ONSYS_SAC(-12) + NGCOM_ONSYS_SAC(-24) +
    NGCOM_ONSYS_SAC(-36)) / 3

@IDENTITY NGCOM_ONSYS_ESC = (NGCOM_ONSYS_ESC(-12) + NGCOM_ONSYS_ESC(-24) +
    NGCOM_ONSYS_ESC(-36)) / 3

@IDENTITY NGCOM_ONSYS_WSC = (NGCOM_ONSYS_WSC(-12) + NGCOM_ONSYS_WSC(-24) +
    NGCOM_ONSYS_WSC(-36)) / 3

@IDENTITY NGCOM_ONSYS_MTN = (NGCOM_ONSYS_MTN(-12) + NGCOM_ONSYS_MTN(-24) +
    NGCOM_ONSYS_MTN(-36)) / 3

@IDENTITY NGCOM_ONSYS_PAC = (NGCOM_ONSYS_PAC(-12) + NGCOM_ONSYS_PAC(-24) +
    NGCOM_ONSYS_PAC(-36)) / 3

@IDENTITY NGCOM_ONSYS_US = (NGCOM_ONSYS_NECK * NGCCP_NECK + NGCOM_ONSYS_MACK * NGCCP_MACK +
    NGCOM_ONSYS_ENC * NGCCP_ENCK + NGCOM_ONSYS_WNC * NGCCP_WNC + NGCOM_ONSYS_SACK *
    NGCCP_SACK + NGCOM_ONSYS_ESCK * NGCCP_ESCK + NGCOM_ONSYS_WSC * NGCCP_WSC +
    NGCOM_ONSYS_MTNK * NGCCP_MTNK + NGCOM_ONSYS_PACK * NGCCP_PACK) / NGCCP_US

@IDENTITY NGCCU_US = (NGCCU_NECK * NGCCP_NECK * NGCOM_ONSYS_NECK + NGCCU_MACK * NGCCP_MACK *
    NGCOM_ONSYS_MAC + NGCCU_ENC * NGCCP_ENCK * NGCOM_ONSYS_ENC + NGCCU_WNC *
    NGCCP_WNC * NGCOM_ONSYS_WNC + NGCCU_SACK * NGCCP_SACK * NGCOM_ONSYS_SACK +
    NGCCU_ESCK * NGCCP_ESCK * NGCOM_ONSYS_ESCK + NGCCU_WSC * NGCCP_WSC *
    NGCOM_ONSYS_WSC + NGCCU_MTNK * NGCCP_MTNK * NGCOM_ONSYS_MTNK + NGCCU_PACK *
    NGCCP_PACK * NGCOM_ONSYS_PACK) / (NGCCP_NECK * NGCOM_ONSYS_NECK + NGCCP_MACK *
    NGCOM_ONSYS_MAC + NGCCP_ENC * NGCOM_ONSYS_ENC + NGCCP_WNC * NGCOM_ONSYS_WNC +
    NGCCP_SACK * NGCOM_ONSYS_SACK + NGCCP_ESCK * NGCOM_ONSYS_ESCK + NGCCP_WSC *
    NGCOM_ONSYS_WSC + NGCCP_MTNK * NGCOM_ONSYS_MTNK + NGCCP_PACK * NGCOM_ONSYS_PACK)

```

@IDENTITY NGCCUUS = NGCCU_US

'----- Industrial Sector Prices

- :EQ_NGICU_ENC
- :EQ_NGICU_ESC
- :EQ_NGICU_MAC
- :EQ_NGICU_MTN
- :EQ_NGICU_NECK
- :EQ_NGICU_PACK
- :EQ_NGICU_SACK
- :EQ_NGICU_WNC
- :EQ_NGICU_WSC

```

@IDENTITY NGIND_ONSYS_NECK = (NGIND_ONSYS_NECK(-12) + NGIND_ONSYS_NECK(-24) + NGIND_ONSYS_NECK(-
    36)) / 3

```

```

@IDENTITY NGIND_ONSYS_MAC = (NGIND_ONSYS_MAC(-12) + NGIND_ONSYS_MAC(-24) + NGIND_ONSYS_MAC(-36)) / 3

@IDENTITY NGIND_ONSYS_ENC = (NGIND_ONSYS_ENC(-12) + NGIND_ONSYS_ENC(-24) + NGIND_ONSYS_ENC(-36)) / 3

@IDENTITY NGIND_ONSYS_WNC = (NGIND_ONSYS_WNC(-12) + NGIND_ONSYS_WNC(-24) + NGIND_ONSYS_WNC(-36)) / 3

@IDENTITY NGIND_ONSYS_SAC = (NGIND_ONSYS_SAC(-12) + NGIND_ONSYS_SAC(-24) + NGIND_ONSYS_SAC(-36)) / 3

@IDENTITY NGIND_ONSYS_ESC = (NGIND_ONSYS_ESC(-12) + NGIND_ONSYS_ESC(-24) + NGIND_ONSYS_ESC(-36)) / 3

@IDENTITY NGIND_ONSYS_WSC = (NGIND_ONSYS_WSC(-12) + NGIND_ONSYS_WSC(-24) + NGIND_ONSYS_WSC(-36)) / 3

@IDENTITY NGIND_ONSYS_MTN = (NGIND_ONSYS_MTN(-12) + NGIND_ONSYS_MTN(-24) + NGIND_ONSYS_MTN(-36)) / 3

@IDENTITY NGIND_ONSYS_PAC = (NGIND_ONSYS_PAC(-12) + NGIND_ONSYS_PAC(-24) + NGIND_ONSYS_PAC(-36)) / 3

@IDENTITY NGIND_ONSYS_US = (NGIND_ONSYS_NE * NGINX_NE * NGIND_ONSYS_MAC * NGINX_MAC + NGIND_ONSYS_ENC * NGINX_ENC * NGIND_ONSYS_WNC * NGINX_WNC * NGIND_ONSYS_SAC * NGINX_SAC + NGIND_ONSYS_ESC * NGINX_ESC * NGIND_ONSYS_WSC * NGINX_WSC * NGIND_ONSYS_WSC + NGIND_ONSYS_MTN * NGINX_MTN * NGIND_ONSYS_PAC * NGINX_PAC) / NGINX_US

@IDENTITY NGICU_US = (NGICU_NE * NGINX_NE * NGIND_ONSYS_NE * NGICU_MAC * NGINX_MAC * NGIND_ONSYS_MAC * NGICU_ENC * NGINX_ENC * NGIND_ONSYS_ENC * NGICU_WNC * NGINX_WNC * NGIND_ONSYS_WNC * NGICU_SAC * NGINX_SAC * NGIND_ONSYS_SAC + NGICU_ESC * NGINX_ESC * NGIND_ONSYS_ESC * NGICU_WSC * NGINX_WSC * NGIND_ONSYS_WSC + NGICU_MTN * NGINX_MTN * NGIND_ONSYS_MTN + NGICU_PAC * NGINX_PAC * NGIND_ONSYS_PAC) / (NGINX_NE * NGIND_ONSYS_NE * NGINX_MAC * NGIND_ONSYS_MAC + NGINX_ENC * NGIND_ONSYS_ENC * NGINX_WNC * NGIND_ONSYS_WNC * NGINX_SAC * NGIND_ONSYS_SAC + NGINX_ESC * NGIND_ONSYS_ESC * NGINX_WSC * NGIND_ONSYS_WSC + NGINX_MTN * NGIND_ONSYS_MTN + NGINX_PAC * NGIND_ONSYS_PAC)

@IDENTITY NGICUUS = NGICU_US

```

Appendix C: Regression Results

Table C1 - NGRCPUSX, U.S. residential sector natural gas consumption	59
Table C2 - NGCCPUSX, U.S. commercial sector natural gas consumption	60
Table C3 - NGICPUS, U.S. industrial sector natural gas consumption, excluding cogeneration.....	61
Table C4 - NGWG_ECON, working gas in storage, East region	62
Table C5 - NGWG_PROD, working gas in storage, Producing region.....	63
Table C6 - NGWG_WCON, working gas in storage, West region	64
Table C7 - NGHHUUS, Henry Hub spot prices.....	65
Table C8 - NGRCU_ENC, residential sector delivered prices, East North Central	66
Table C9 - NGRCU_ESC, residential sector delivered prices, East South Central.....	67
Table C10 - NGRCU_MAC, residential sector delivered prices, Middle Atlantic	68
Table C11 - NGRCU_MTN, residential sector delivered prices, Mountain	69
Table C12 - NGRCU_NEA, residential sector delivered prices, New England	70
Table C13 - NGRCU_PAC, residential sector delivered prices, Pacific	71
Table C14 - NGRCU_SAC, residential sector delivered prices, South Atlantic.....	72
Table C15 - NGRCU_WNC, residential sector delivered prices, West North Central	73
Table C16 - NGRCU_WSC, residential sector delivered prices, West South Central.....	74
Table C17 - NGCCU_ENC, commercial sector delivered prices, East North Central	75
Table C18 - NGCCU_ESC, commercial sector delivered prices, East South Central.....	76
Table C19 - NGCCU_MAC, commercial sector delivered prices, Middle Atlantic	77
Table C20 - NGCCU_MTN, commercial sector delivered prices, Mountain	78
Table C21 - NGCCU_NEA, commercial sector delivered prices, New England	79
Table C22 - NGCCU_PAC, commercial sector delivered prices, Pacific	80
Table C23 - NGCCU_SAC, commercial sector delivered prices, South Atlantic	81
Table C24 - NGCCU_WNC, commercial sector delivered prices, West North Central..	82
Table C25 - NGCCU_WSC, commercial sector delivered prices, West South Central....	83
Table C26 - NGICU_ENC, industrial sector delivered prices, East North Central	84
Table C27 - NGICU_ESC, industrial sector delivered prices, East South Central.....	85
Table C28 - NGICU_MAC, industrial sector delivered prices, Middle Atlantic	86
Table C29 - NGICU_MTN, industrial sector delivered prices, Mountain.....	87
Table C30 - NGICU_NEA, industrial sector delivered prices, New England	88
Table C31 - NGICU_PAC, industrial sector delivered prices, Pacific.....	89

Table C32 - NGICU_SAC, industrial sector delivered prices, South Atlantic	90
Table C33 - NGICU_WNC, industrial sector delivered prices, West North Central.....	91
Table C34 - NGICU_WSC, industrial sector delivered prices, West South Central.....	92

Table C7 - NGRCPUSX, U.S. residential sector natural gas consumption

Dependent Variable: NGRCPUSX

Method: Least Squares

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.49239	1.451504	9.984397	0.0000
(ZWHD_NGRC-ZWHN_NGRC)/ZSAJQUS	0.860739	0.030673	28.06198	0.0000
QHNG_US*NGRCPUSX_SF	0.108843	0.012068	9.019376	0.0000
D1012	-2.572912	0.436757	-5.890942	0.0000
D1112	-2.475704	0.429190	-5.768323	0.0000
D1212	-2.247831	0.441880	-5.086968	0.0000
D1401	2.084575	0.431414	4.831957	0.0000
FEB	-1.444787	0.243828	-5.925434	0.0000
MAR	-5.072048	0.457952	-11.07551	0.0000
APR	-9.136412	0.863895	-10.57583	0.0000
MAY	-11.12975	1.121956	-9.919960	0.0000
JUN	-12.45510	1.226183	-10.15762	0.0000
JUL	-12.75621	1.255593	-10.15950	0.0000
AUG	-12.76166	1.263310	-10.10176	0.0000
SEP	-12.35782	1.240522	-9.961793	0.0000
OCT	-10.66504	1.055293	-10.10623	0.0000
NOV	-6.879211	0.660282	-10.41860	0.0000
R-squared	0.998859	Mean dependent var	12.93045	
Adjusted R-squared	0.998434	S.D. dependent var	9.712901	
S.E. of regression	0.384394	Akaike info criterion	1.159223	
Sum squared resid	6.353613	Schwarz criterion	1.752620	
Log likelihood	-17.77668	Hannan-Quinn criter.	1.391333	
F-statistic	2351.699	Durbin-Watson stat	1.976562	
Prob(F-statistic)	0.000000			

Table C8 - NGCCPUSX, U.S. commercial sector natural gas consumption

Dependent Variable: NGCCPUSX

Method: Least Squares

Sample: 2011M01 2014M12

Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.79057	1.324038	8.149738	0.0000
(ZWHD_NGCC-ZWHN_NGCC)/ZSAJQUS	0.403699	0.015059	26.80855	0.0000
EMCMPUS*NGCCPUSX_SF	0.022222	0.008889	2.499873	0.0179
D12	-0.156094	0.063089	-2.474177	0.0190
D1401+D1402	0.834773	0.147317	5.666516	0.0000
D1412	0.747831	0.192277	3.889343	0.0005
JAN	1.380112	0.202171	6.826451	0.0000
FEB	0.425042	0.152254	2.791663	0.0089
MAR	-1.979306	0.248434	-7.967138	0.0000
APR	-4.866095	0.595909	-8.165834	0.0000
MAY	-6.456548	0.810706	-7.964102	0.0000
JUN	-7.294700	0.888248	-8.212459	0.0000
JUL	-7.529270	0.912387	-8.252273	0.0000
AUG	-7.397072	0.902192	-8.198998	0.0000
SEP	-7.062288	0.872604	-8.093351	0.0000
OCT	-5.466514	0.708537	-7.715215	0.0000
NOV	-2.902229	0.390082	-7.440057	0.0000
R-squared	0.999132	Mean dependent var	8.784024	
Adjusted R-squared	0.998684	S.D. dependent var	4.497069	
S.E. of regression	0.163123	Akaike info criterion	-0.517501	
Sum squared resid	0.824886	Schwarz criterion	0.145216	
Log likelihood	29.42003	Hannan-Quinn criter.	-0.267060	
F-statistic	2230.632	Durbin-Watson stat	1.630675	
Prob(F-statistic)	0.000000			

Table C9 - NGICPUS, U.S. industrial sector natural gas consumption, excluding cogeneration

Dependent Variable: NGICPUS

Method: Least Squares

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.005701	2.313620	1.299134	0.2010
QSIC_NG	0.181096	0.027070	6.690001	0.0000
NGICUUS	0.153002	0.058609	2.610542	0.0125
(ZWHD_ENC-ZWHN_ENC)/ZSAJQUS	0.041332	0.011223	3.682850	0.0007
(ZWHD_WSC-ZWHN_WSC)/ZSAJQUS	0.088658	0.022861	3.878116	0.0004
FEB	0.081268	0.126393	0.642979	0.5237
MAR	-1.185097	0.129516	-9.150170	0.0000
APR	-2.051215	0.132507	-15.48007	0.0000
MAY	-2.886285	0.138173	-20.88889	0.0000
JUN	-3.158546	0.138547	-22.79773	0.0000
JUL	-3.551631	0.142236	-24.96998	0.0000
AUG	-3.298312	0.145461	-22.67486	0.0000
SEP	-2.942354	0.154083	-19.09593	0.0000
OCT	-2.614581	0.149235	-17.51985	0.0000
NOV	-1.244423	0.153356	-8.114623	0.0000
DEC	-0.496460	0.148935	-3.333397	0.0018
D10	-0.811787	0.160531	-5.056883	0.0000
D11	-0.401385	0.134572	-2.982665	0.0047
R-squared	0.988746	Mean dependent var	18.14429	
Adjusted R-squared	0.984191	S.D. dependent var	1.561839	
S.E. of regression	0.196376	Akaike info criterion	-0.174247	
Sum squared resid	1.619667	Schwarz criterion	0.454056	
Log likelihood	23.22742	Hannan-Quinn criter.	0.071517	
F-statistic	217.0622	Durbin-Watson stat	1.141674	
Prob(F-statistic)	0.000000			

Table C10 - NGWG_ECON, working gas in storage, East region

Dependent Variable: NGWG_ECON-NGWG_ECON(-1)

Method: Least Squares

Sample: 2008M01 2014M12

Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-430.3251	8.315835	-51.74767	0.0000
(QHNG_NECK*(ZWHD_NECK* ZWHN_NECK)+QHNG_MAC*(ZWHD_MA C- ZWHN_MAC)+QHNG_ENC*(ZWHD_ENC - ZWHN_ENC))/((QHNG_NECK+QHNG_MA C+QHNG_ENC)*ZSAJQUS)	-14.69563	0.899787	-16.33235	0.0000
(ZWCD_MAC-ZWCN_MAC)/ZSAJQUS	-14.99988	2.776658	-5.402136	0.0000
NGWG_ECON(-1)-((NGWG_ECON(- 13)+NGWG_ECON(-25)+NGWG_ECON(- 37)+NGWG_ECON(-49)+NGWG_ECON(- 61)+NGWG_ECON(-73)+NGWG_ECON(- 85))/7)	-0.101782	0.016144	-6.304505	0.0000
D1205+D1206+D1207+D1208+D1209+D 1210	-49.95894	10.14341	-4.925259	0.0000
D13	-34.27966	6.742696	-5.083969	0.0000
FEB	104.0173	11.35938	9.156946	0.0000
MAR	278.8063	11.55026	24.13853	0.0000
APR	539.8119	11.56289	46.68488	0.0000
MAY	663.9870	11.77279	56.40014	0.0000
JUN	668.5090	11.65945	57.33626	0.0000
JUL	662.6807	11.81332	56.09607	0.0000
AUG	651.4443	12.01108	54.23693	0.0000
SEP	654.8280	11.66811	56.12116	0.0000
OCT	596.5774	11.59095	51.46923	0.0000
NOV	369.3385	11.35099	32.53799	0.0000
DEC	111.2663	11.46135	9.707959	0.0000
R-squared	0.994552	Mean dependent var	0.248440	
Adjusted R-squared	0.993251	S.D. dependent var	257.8087	
S.E. of regression	21.18003	Akaike info criterion	9.122632	
Sum squared resid	30055.77	Schwarz criterion	9.614583	
Log likelihood	-366.1505	Hannan-Quinn criter.	9.320392	
F-statistic	764.4125	Durbin-Watson stat	1.577640	
Prob(F-statistic)	0.000000			

Table C11 - NGWG_PROD, working gas in storage, Producing region

Dependent Variable: NGWG_PROD-NGWG_PROD(-1)

Method: Least Squares

Sample: 2008M01 2014M12

Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-176.9032	13.78390	-12.83405	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-25)+NGWG_PROD(-37)+NGWG_PROD(-49)+NGWG_PROD(-61)+NGWG_PROD(-73)+NGWG_PROD(-85))/7)	-0.071726	0.024334	-2.947619	0.0044
(ZWHDPPUS-ZWHNPUS)/ZSAJQUS	-22.53876	2.445459	-9.216578	0.0000
(ZWCDPPUS-ZWCNPUS)/ZSAJQUS	-21.77184	6.747988	-3.226420	0.0019
FEB	62.00645	17.98839	3.447027	0.0010
MAR	182.1029	18.21602	9.996853	0.0000
APR	258.6903	18.36120	14.08896	0.0000
MAY	290.6726	18.39610	15.80077	0.0000
JUN	260.4279	18.66467	13.95298	0.0000
JUL	228.4486	18.43878	12.38957	0.0000
AUG	198.6014	18.33927	10.82929	0.0000
SEP	272.9947	18.37945	14.85326	0.0000
OCT	289.9172	18.28412	15.85623	0.0000
NOV	205.6212	18.01730	11.41243	0.0000
DEC	73.43055	18.10212	4.056462	0.0001
R-squared	0.927205	Mean dependent var	1.917893	
Adjusted R-squared	0.912435	S.D. dependent var	113.4991	
S.E. of regression	33.58606	Akaike info criterion	10.02653	
Sum squared resid	77833.63	Schwarz criterion	10.46061	
Log likelihood	-406.1143	Hannan-Quinn criter.	10.20103	
F-statistic	62.77586	Durbin-Watson stat	0.736552	
Prob(F-statistic)	0.000000			

Table C12 - NGWG_WCON, working gas in storage, West region

Dependent Variable: NGWG_WCON-NGWG_WCON(-1)

Method: Least Squares

Sample: 2008M01 2014M12

Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (QHNG_PAC*(ZWHD_PAC- ZWHN_PAC)+QHNG_MTN*(ZWHD_MTN - ZWHN_MTN)+QHNG_WNC*(ZWHD_WN C- ZWHN_WNC))/((QHNG_PAC+QHNG_MT N+QHNG_WNC)*ZSAJQUS) (ZWCD_PAC-ZWCN_PAC)/ZSAJQUS NGWG_WCON(-1)-((NGWG_WCON(- 13)+NGWG_WCON(- 25)+NGWG_WCON(- 37)+NGWG_WCON(- 49)+NGWG_WCON(- 61)+NGWG_WCON(- 73)+NGWG_WCON(-85))/7) FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC	-81.20385 -7.278519 -3.660974 -0.070485 36.87692 81.05086 115.2048 150.2576 138.5753 119.0700 105.8859 117.8760 114.8716 81.85536 22.62644	6.147898 1.389484 2.818642 0.033803 8.490672 8.219801 8.235176 8.311529 8.340224 8.271318 8.267550 8.435912 8.228777 8.243243 8.263429	-13.20839 -5.238289 -1.298843 -2.085181 4.343227 9.860441 13.98935 18.07821 16.61530 14.39553 12.80741 13.97312 13.95975 9.929994 2.738142	0.0000 0.0000 0.1983 0.0408 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0079
R-squared	0.927522	Mean dependent var	0.947012	
Adjusted R-squared	0.912817	S.D. dependent var	51.92558	
S.E. of regression	15.33197	Akaike info criterion	8.458190	
Sum squared resid	16219.78	Schwarz criterion	8.892264	
Log likelihood	-340.2440	Hannan-Quinn criter.	8.632684	
F-statistic	63.07269	Durbin-Watson stat	1.008215	
Prob(F-statistic)	0.000000			

Table C13 - NGHHUUS, Henry Hub spot prices

Dependent Variable: LOG(NGHHUUS)

Method: Least Squares

Sample: 2009M01 2014M12

Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.402100	0.056393	7.130324	0.0000
LOG(NGWGPUS(-1))-LOG((NGWGPUS(-13)+NGWGPUS(-25)+NGWGPUS(-37)+NGWGPUS(-49))/4)	-0.053410	0.040685	-1.312762	0.1954
(ZWHDPUS-ZWHNPUS)/ZSAJQUS	0.042811	0.003722	11.50161	0.0000
(ZWCDPUS-ZWCNPUS)/ZSAJQUS	0.046373	0.009519	4.871854	0.0000
D0904	-0.150192	0.051238	-2.931267	0.0051
D0910	0.148584	0.050383	2.949103	0.0049
D0912+D1001	0.209664	0.035836	5.850590	0.0000
D1204	-0.288874	0.054964	-5.255735	0.0000
D1206	-0.152032	0.052070	-2.919752	0.0053
D1402	0.217477	0.051186	4.248797	0.0001
D1403	-0.181599	0.053919	-3.368001	0.0015
FEB	-0.023417	0.027545	-0.850146	0.3994
MAR	0.010850	0.028085	0.386340	0.7009
APR	0.086442	0.030674	2.818072	0.0069
MAY	0.098061	0.027160	3.610463	0.0007
JUN	0.082092	0.028402	2.890334	0.0057
JUL	0.013338	0.026724	0.499098	0.6199
AUG	-0.005965	0.026595	-0.224276	0.8235
SEP	0.011961	0.026931	0.444141	0.6589
OCT	0.044876	0.028317	1.584756	0.1195
NOV	0.018306	0.026659	0.686674	0.4955
DEC	0.066879	0.026407	2.532602	0.0146
LOG(NGHHUUS(-1))	0.660311	0.037394	17.65823	0.0000
R-squared	0.970454	Mean dependent var	1.331063	
Adjusted R-squared	0.957188	S.D. dependent var	0.214139	
S.E. of regression	0.044307	Akaike info criterion	-3.141285	
Sum squared resid	0.096194	Schwarz criterion	-2.414017	
Log likelihood	136.0863	Hannan-Quinn criter.	-2.851758	
F-statistic	73.15576	Durbin-Watson stat	1.848938	
Prob(F-statistic)	0.000000			

Table C14 - NGRCU_ENC, residential sector delivered prices, East North Central

Dependent Variable: NGRCU_ENC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:43

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.391264	0.333807	4.167869	0.0002
NGHHMCF-NGHHMCF(-1)	-1.045566	0.138758	-7.535189	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	0.000867	0.000378	2.295297	0.0270
(ZWHD_ENC-ZWHN_ENC)/ZSAJQUS	-0.048276	0.018069	-2.671779	0.0109
(ZWHD_ENC(-1)-ZWHN_ENC(-1))/ZSAJQUS(-1)	0.073736	0.020690	3.563845	0.0010
D1105	-1.303620	0.380077	-3.429887	0.0014
D1207	1.327760	0.410838	3.231834	0.0025
D1406	1.220631	0.414711	2.943331	0.0054
FEB	0.142617	0.215420	0.662040	0.5117
MAR	0.488522	0.229500	2.128636	0.0395
APR	1.439299	0.226092	6.366000	0.0000
MAY	3.036191	0.276559	10.97844	0.0000
JUN	4.055266	0.338945	11.96439	0.0000
JUL	3.950272	0.503872	7.839834	0.0000
AUG	3.405877	0.643004	5.296819	0.0000
SEP	1.065709	0.684052	1.557936	0.1271
OCT	-1.868299	0.549965	-3.397126	0.0016
NOV	-0.899929	0.299304	-3.006742	0.0045
DEC	-0.273740	0.230963	-1.185210	0.2429
NGRCU_ENC(-1)-NGHHMCF(-1)	0.667561	0.069100	9.660858	0.0000
R-squared	0.993851	Mean dependent var	7.861187	
Adjusted R-squared	0.990930	S.D. dependent var	3.533248	
S.E. of regression	0.336502	Akaike info criterion	0.920779	
Sum squared resid	4.529357	Schwarz criterion	1.618894	
Log likelihood	-7.623376	Hannan-Quinn criter.	1.193850	
F-statistic	340.2445	Durbin-Watson stat	1.836726	
Prob(F-statistic)	0.000000			

Table C15 - NGRCU_ESC, residential sector delivered prices, East South Central

Dependent Variable: NGRCU_ESC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:43

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.495270	0.538745	2.775467	0.0084
NGHHMCF-NGHHMCF(-1)	-1.063851	0.188514	-5.643362	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-37))/3)	-0.000270	0.000443	-0.608017	0.5467
(ZWHD_ESC-ZWHN_ESC)/ZSAJQUS	-0.136467	0.029130	-4.684721	0.0000
(ZWHD_ESC(-1)-ZWHN_ESC(-1))/ZSAJQUS(-1)	0.024542	0.033557	0.731350	0.4689
D1204	1.825353	0.641923	2.843570	0.0071
D1209	-1.072192	0.547718	-1.957562	0.0575
D1305	-0.820343	0.566894	-1.447085	0.1559
D1401	1.117198	0.592788	1.884652	0.0669
FEB	0.556174	0.330922	1.680680	0.1008
MAR	0.941098	0.337976	2.784507	0.0082
APR	1.930337	0.367294	5.255562	0.0000
MAY	3.874016	0.409903	9.451057	0.0000
JUN	4.262881	0.504757	8.445412	0.0000
JUL	3.889474	0.655596	5.932733	0.0000
AUG	3.334795	0.755702	4.412844	0.0001
SEP	3.039094	0.783531	3.878715	0.0004
OCT	-0.039653	0.753771	-0.052607	0.9583
NOV	-1.432401	0.540487	-2.650206	0.0116
DEC	-0.440557	0.359238	-1.226365	0.2274
NGRCU_ESC(-1)-NGHHMCF(-1)	0.677681	0.079836	8.488419	0.0000
R-squared	0.988778	Mean dependent var	9.837378	
Adjusted R-squared	0.983023	S.D. dependent var	3.733380	
S.E. of regression	0.486445	Akaike info criterion	1.665831	
Sum squared resid	9.228515	Schwarz criterion	2.398851	
Log likelihood	-28.97492	Hannan-Quinn criter.	1.952555	
F-statistic	171.8137	Durbin-Watson stat	1.473887	
Prob(F-statistic)	0.000000			

Table C16 - NGRCU_MAC, residential sector delivered prices, Middle Atlantic

Dependent Variable: NGRCU_MAC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:45

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.044540	1.101376	1.856351	0.0712
NGHHMCF-NGHHMCF(-1)	-0.815531	0.133621	-6.103327	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	0.001025	0.000567	1.807779	0.0786
(ZWHD_MAC-ZWHN_MAC)/ZSAJQUS	-0.065187	0.022019	-2.960462	0.0053
(ZWHD_MAC(-1)-ZWHN_MAC(-1))/ZSAJQUS(-1)	0.018351	0.026663	0.688267	0.4955
D1011	0.857881	0.367876	2.331982	0.0251
D1207	-0.930333	0.389917	-2.385979	0.0221
D1212	1.019159	0.385842	2.641391	0.0119
D1305	0.757507	0.372883	2.031488	0.0492
D1401	0.795361	0.410732	1.936449	0.0603
FEB	0.249395	0.227606	1.095729	0.2801
MAR	0.623839	0.232366	2.684722	0.0107
APR	1.209903	0.224470	5.390056	0.0000
MAY	2.317256	0.281956	8.218491	0.0000
JUN	3.891501	0.440260	8.839092	0.0000
JUL	3.079658	0.780568	3.945405	0.0003
AUG	2.933949	0.922009	3.182125	0.0029
SEP	1.912268	1.011894	1.889791	0.0664
OCT	-0.234805	0.907818	-0.258647	0.7973
NOV	-1.201585	0.550016	-2.184637	0.0352
DEC	-0.662389	0.280545	-2.361078	0.0235
NGRCU_MAC(-1)-NGHHMCF(-1)	0.678061	0.142463	4.759549	0.0000
R-squared	0.991975	Mean dependent var	10.17257	
Adjusted R-squared	0.987540	S.D. dependent var	2.889441	
S.E. of regression	0.322538	Akaike info criterion	0.851386	
Sum squared resid	3.953181	Schwarz criterion	1.619313	
Log likelihood	-3.541589	Hannan-Quinn criter.	1.151764	
F-statistic	223.6650	Durbin-Watson stat	2.041789	
Prob(F-statistic)	0.000000			

Table C17 - NGRCU_MTN, residential sector delivered prices, Mountain

Dependent Variable: NGRCU_MTN-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:47

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.884700	0.186404	4.746139	0.0000
NGHHMCF-NGHHMCF(-1)	-1.113948	0.068452	-16.27348	0.0000
NGWG_WCON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	-0.000573	0.000544	-1.052284	0.2995
(ZWHD_MTN-ZWHN_MTN)/ZSAJQUS	-0.100665	0.017989	-5.596034	0.0000
(ZWHD_MTN(-1)-ZWHN_MTN(-1))/ZSAJQUS(-1)	0.021511	0.018462	1.165134	0.2514
D10	-0.267278	0.081130	-3.294428	0.0022
D1010	1.161061	0.232305	4.998006	0.0000
D1106	-0.693556	0.227214	-3.052431	0.0042
D1205	0.765787	0.243447	3.145605	0.0033
D1209	0.498304	0.217795	2.287947	0.0280
D1411	-0.541030	0.226928	-2.384150	0.0224
FEB	0.385201	0.128736	2.992168	0.0049
MAR	0.242911	0.130761	1.857682	0.0712
APR	0.448554	0.129418	3.465937	0.0014
MAY	1.005115	0.140106	7.173984	0.0000
JUN	2.294604	0.150570	15.23947	0.0000
JUL	2.135787	0.180488	11.83338	0.0000
AUG	1.360669	0.227159	5.989945	0.0000
SEP	-0.067784	0.251360	-0.269669	0.7889
OCT	-1.917692	0.227371	-8.434188	0.0000
NOV	-1.218152	0.157943	-7.712605	0.0000
DEC	-0.222459	0.128114	-1.736416	0.0908
NGRCU_MTN(-1)-NGHHMCF(-1)	0.823735	0.035631	23.11878	0.0000
R-squared	0.995636	Mean dependent var	6.738683	
Adjusted R-squared	0.993042	S.D. dependent var	2.319074	
S.E. of regression	0.193448	Akaike info criterion	-0.164374	
Sum squared resid	1.384621	Schwarz criterion	0.638458	
Log likelihood	27.93122	Hannan-Quinn criter.	0.149658	
F-statistic	383.7337	Durbin-Watson stat	2.068353	
Prob(F-statistic)	0.000000			

Table C18 - NGRCU_NEK, residential sector delivered prices, New England

Dependent Variable: NGRCU_NEK-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:50

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.985169	0.684484	5.822151	0.0000
NGHHMCF-NGHHMCF(-1)	-0.841966	0.121361	-6.937709	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	0.000702	0.000328	2.139809	0.0392
(ZWHD_NEK-ZWHN_NEK)/ZSAJQUS	-0.001665	0.023632	-0.070468	0.9442
(ZWHD_NEK(-1)-ZWHN_NEK(-1))/ZSAJQUS(-1)	0.035150	0.027128	1.295717	0.2033
D1005	1.128561	0.348722	3.236280	0.0026
D1008	-0.775696	0.338539	-2.291307	0.0279
D1104+D1105	-1.034297	0.250874	-4.122779	0.0002
D1110	-0.952934	0.344629	-2.765104	0.0089
D1201	0.985245	0.360300	2.734510	0.0096
D1304	-1.156376	0.357730	-3.232537	0.0026
D1406	1.020618	0.362332	2.816806	0.0078
FEB	0.240359	0.205241	1.171108	0.2492
MAR	0.719697	0.218241	3.297723	0.0022
APR	1.533008	0.246061	6.230204	0.0000
MAY	1.494825	0.246512	6.063900	0.0000
JUN	1.758447	0.247956	7.091786	0.0000
JUL	2.980821	0.276992	10.76141	0.0000
AUG	2.590568	0.376351	6.883380	0.0000
SEP	1.629857	0.393954	4.137171	0.0002
OCT	-0.272604	0.364517	-0.747850	0.4594
NOV	0.497116	0.236167	2.104932	0.0423
DEC	0.327320	0.217443	1.505315	0.1410
NGRCU_NEK(-1)-NGHHMCF(-1)	0.542933	0.072032	7.537340	0.0000
R-squared	0.981291	Mean dependent var	11.02460	
Adjusted R-squared	0.969337	S.D. dependent var	1.719932	
S.E. of regression	0.301173	Akaike info criterion	0.726908	
Sum squared resid	3.265378	Schwarz criterion	1.564646	
Log likelihood	2.192755	Hannan-Quinn criter.	1.054593	
F-statistic	82.09442	Durbin-Watson stat	2.020578	
Prob(F-statistic)	0.000000			

Table C19 - NGRCU_PAC, residential sector delivered prices, Pacific

Dependent Variable: NGRCU_PAC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:51

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.176226	0.358256	6.074503	0.0000
NGHHMCF-NGHHMCF(-1)	-0.920400	0.079311	-11.60496	0.0000
NGWG_WCON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)(ZWHD_PAC-ZWHN_PAC)/ZSAJQUS(ZWHD_PAC(-1)-ZWHN_PAC(-1))/ZSAJQUS(-1)@TREND(2009:12)-D12ON*@TREND(2011:12)	0.000876 -0.046018 -0.003947	0.000585 0.024400 0.025126	1.497140 -1.886018 -0.157108	0.1424 0.0668 0.8760
D1003	-1.328057	0.280423	-4.735909	0.0000
D1407	0.678318	0.251037	2.702062	0.0101
D1409	0.635699	0.248136	2.561892	0.0144
FEB	-0.214309	0.162997	-1.314803	0.1963
MAR	0.002645	0.155272	0.017034	0.9865
APR	0.150287	0.144262	1.041767	0.3039
MAY	0.685904	0.149317	4.593606	0.0000
JUN	0.468643	0.162865	2.877502	0.0065
JUL	0.287206	0.181936	1.578613	0.1225
AUG	0.399100	0.193566	2.061834	0.0459
SEP	0.032218	0.207649	0.155155	0.8775
OCT	0.072243	0.198413	0.364104	0.7177
NOV	-0.707169	0.185291	-3.816542	0.0005
DEC	0.023297	0.144970	0.160699	0.8732
NGRCU_PAC(-1)-NGHHMCF(-1)	0.623542	0.075151	8.297182	0.0000
R-squared	0.961459	Mean dependent var	6.676681	
Adjusted R-squared	0.941695	S.D. dependent var	0.895798	
S.E. of regression	0.216303	Akaike info criterion	0.044947	
Sum squared resid	1.824697	Schwarz criterion	0.777967	
Log likelihood	19.65160	Hannan-Quinn criter.	0.331671	
F-statistic	48.64597	Durbin-Watson stat	2.258084	
Prob(F-statistic)	0.000000			

Table C20 - NGRCU_SAC, residential sector delivered prices, South Atlantic

Dependent Variable: NGRCU_SAC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:51

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.489115	0.667749	6.722756	0.0000
NGHHMCF-NGHHMCF(-1)	-0.819370	0.128789	-6.362112	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	0.001837	0.000413	4.450195	0.0001
(ZWHD_SAC-ZWHN_SAC)/ZSAJQUS	-0.184613	0.023731	-7.779496	0.0000
(ZWHD_SAC(-1)-ZWHN_SAC(-1))/ZSAJQUS(-1)	0.013318	0.029207	0.455966	0.6513
D1004	1.315652	0.399259	3.295237	0.0023
D1008	1.484633	0.409713	3.623588	0.0009
D1110	-1.611911	0.410874	-3.923125	0.0004
D1111	1.036434	0.438370	2.364292	0.0239
D1207	-0.977758	0.419795	-2.329131	0.0259
D1209	-1.144037	0.411023	-2.783392	0.0087
D1406	1.470408	0.415366	3.540032	0.0012
D1408	1.113797	0.432891	2.572928	0.0146
D1410	1.439508	0.411027	3.502220	0.0013
FEB	0.147912	0.228038	0.648626	0.5209
MAR	0.722159	0.234364	3.081360	0.0041
APR	2.386789	0.253447	9.417300	0.0000
MAY	5.171934	0.329468	15.69786	0.0000
JUN	6.775638	0.566977	11.95047	0.0000
JUL	7.501324	0.830059	9.037100	0.0000
AUG	6.570124	0.928242	7.078028	0.0000
SEP	6.370292	1.018650	6.253662	0.0000
OCT	1.873603	0.911158	2.056287	0.0475
NOV	-0.972718	0.584154	-1.665173	0.1051
DEC	0.033923	0.263611	0.128684	0.8984
NGRCU_SAC(-1)-NGHHMCF(-1)	0.398687	0.083886	4.752728	0.0000
R-squared	0.996709	Mean dependent var	12.55544	
Adjusted R-squared	0.994289	S.D. dependent var	4.649845	
S.E. of regression	0.351400	Akaike info criterion	1.044902	
Sum squared resid	4.198397	Schwarz criterion	1.952451	
Log likelihood	-5.347056	Hannan-Quinn criter.	1.399894	
F-statistic	411.8630	Durbin-Watson stat	1.817269	
Prob(F-statistic)	0.000000			

Table C21 - NGRCU_WNC, residential sector delivered prices, West North Central

Dependent Variable: NGRCU_WNC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:53

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.425019	0.346283	4.115191	0.0002
NGHHMCF-NGHHMCF(-1)	-0.794958	0.150219	-5.292004	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	-0.001315	0.000353	-3.729294	0.0007
(ZWHD_WNC-ZWHN_WNC)/ZSAJQUS	-0.075573	0.020277	-3.727092	0.0007
(ZWHD_WNC(-1)-ZWHN_WNC(-1))/ZSAJQUS(-1)	-0.003850	0.024487	-0.157212	0.8760
D1003	-0.876836	0.378313	-2.317752	0.0264
D1006	-1.195471	0.375637	-3.182514	0.0031
D1010	1.225723	0.387524	3.162957	0.0032
D1110	1.015333	0.378885	2.679794	0.0112
D1204	1.316541	0.455674	2.889217	0.0066
D1205	1.614201	0.409566	3.941244	0.0004
D1208	1.157544	0.365434	3.167587	0.0032
D1404	-1.282189	0.400330	-3.202832	0.0029
FEB	0.471487	0.214485	2.198223	0.0346
MAR	0.832736	0.220833	3.770884	0.0006
APR	1.177552	0.233883	5.034800	0.0000
MAY	1.887405	0.237133	7.959255	0.0000
JUN	4.887897	0.308531	15.84250	0.0000
JUL	4.449240	0.495621	8.977109	0.0000
AUG	3.428152	0.650906	5.266742	0.0000
SEP	1.600801	0.689442	2.321880	0.0262
OCT	-1.393491	0.620881	-2.244378	0.0312
NOV	-1.165620	0.356355	-3.270952	0.0024
DEC	-0.579816	0.228743	-2.534793	0.0159
NGRCU_WNC(-1)-NGHHMCF(-1)	0.656298	0.068639	9.561566	0.0000
R-squared	0.995559	Mean dependent var	8.169951	
Adjusted R-squared	0.992514	S.D. dependent var	3.673285	
S.E. of regression	0.317815	Akaike info criterion	0.839645	
Sum squared resid	3.535234	Schwarz criterion	1.712289	
Log likelihood	-0.189358	Hannan-Quinn criter.	1.180984	
F-statistic	326.9392	Durbin-Watson stat	2.040672	
Prob(F-statistic)	0.000000			

Table C22 - NGRCU_WSC, residential sector delivered prices, West South Central

Dependent Variable: NGRCU_WSC-NGHHMCF

Method: Least Squares

Date: 04/28/15 Time: 14:55

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.275681	0.471675	2.704577	0.0102
NGHHMCF-NGHHMCF(-1)	-1.085397	0.184319	-5.888696	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-37))/3)	-0.001242	0.000461	-2.693499	0.0105
(ZWHD_WSC-ZWHN_WSC)/ZSAJQUS	-0.214312	0.045965	-4.662514	0.0000
(ZWHD_WSC(-1)-ZWHN_WSC(-1))/ZSAJQUS(-1)	-0.064036	0.056746	-1.128451	0.2662
D1001	1.652920	0.611091	2.704868	0.0102
D1301	-1.936961	0.618161	-3.133426	0.0033
D1305	-1.244253	0.589202	-2.111759	0.0413
D1306	2.049669	0.605033	3.387698	0.0017
D1307	1.280365	0.563901	2.270549	0.0289
FEB	0.519711	0.376415	1.380683	0.1754
MAR	1.000787	0.377982	2.647711	0.0117
APR	2.429387	0.383045	6.342306	0.0000
MAY	3.403683	0.467387	7.282365	0.0000
JUN	3.722169	0.574428	6.479780	0.0000
JUL	3.446979	0.675663	5.101624	0.0000
AUG	3.544216	0.773802	4.580265	0.0000
SEP	2.175217	0.844158	2.576789	0.0140
OCT	1.045863	0.797310	1.311739	0.1975
NOV	-2.727652	0.692758	-3.937380	0.0003
DEC	-1.599350	0.429830	-3.720891	0.0006
NGRCU_WSC(-1)-NGHHMCF(-1)	0.724465	0.072334	10.01562	0.0000
R-squared	0.991145	Mean dependent var	9.695766	
Adjusted R-squared	0.986251	S.D. dependent var	4.285127	
S.E. of regression	0.502457	Akaike info criterion	1.737961	
Sum squared resid	9.593593	Schwarz criterion	2.505888	
Log likelihood	-30.13884	Hannan-Quinn criter.	2.038340	
F-statistic	202.5347	Durbin-Watson stat	1.581109	
Prob(F-statistic)	0.000000			

Table C23 - NGCCU_ENC, commercial sector delivered prices, East North Central

Dependent Variable: NGCCU_ENC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:09

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.865227	0.270911	3.193765	0.0028
NGHHMCF-NGHHMCF(-1)	-0.994509	0.128883	-7.716392	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	0.000183	0.000375	0.488040	0.6283
(ZWHD_ENC-ZWHN_ENC)/ZSAJQUS	-0.005703	0.016756	-0.340375	0.7354
(ZWHD_ENC(-1)-ZWHN_ENC(-1))/ZSAJQUS(-1)	0.027067	0.018656	1.450829	0.1548
D1205	1.045894	0.395182	2.646617	0.0117
D1206	1.330704	0.387737	3.431975	0.0014
D1208	1.554729	0.364506	4.265298	0.0001
D1210	-0.874242	0.373211	-2.342487	0.0244
JAN	-0.074250	0.200383	-0.370540	0.7130
FEB	-0.010693	0.203947	-0.052432	0.9585
MAR	0.221743	0.207203	1.070171	0.2911
APR	0.427130	0.198929	2.147148	0.0381
MAY	0.738907	0.214568	3.443690	0.0014
JUN	0.729094	0.226950	3.212581	0.0026
JUL	0.684797	0.231150	2.962570	0.0052
AUG	0.265032	0.247153	1.072340	0.2902
SEP	-0.355928	0.253477	-1.404183	0.1682
OCT	-0.665436	0.224628	-2.962397	0.0052
NOV	-0.377375	0.203500	-1.854421	0.0713
NGCCU_ENC(-1)-NGHHMCF(-1)	0.774790	0.060433	12.82066	0.0000
R-squared	0.967264	Mean dependent var	4.706796	
Adjusted R-squared	0.950477	S.D. dependent var	1.372796	
S.E. of regression	0.305499	Akaike info criterion	0.735480	
Sum squared resid	3.639867	Schwarz criterion	1.468500	
Log likelihood	-1.064390	Hannan-Quinn criter.	1.022204	
F-statistic	57.61805	Durbin-Watson stat	1.744191	
Prob(F-statistic)	0.000000			

Table C24 - NGCCU_ESC, commercial sector delivered prices, East South Central

Dependent Variable: NGCCU_ESC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:09

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.946836	0.333084	2.842634	0.0069
NGHHMCF-NGHHMCF(-1)	-0.929327	0.079153	-11.74085	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-37))/3)	-0.000199	0.000187	-1.064031	0.2934
(ZWHD_ESC-ZWHN_ESC)/ZSAJQUS	-0.057911	0.012215	-4.741061	0.0000
(ZWHD_ESC(-1)-ZWHN_ESC(-1))/ZSAJQUS(-1)	0.009206	0.014134	0.651351	0.5184
D1306	0.686687	0.240410	2.856310	0.0066
JAN	0.206740	0.149491	1.382959	0.1740
FEB	0.431296	0.148345	2.907383	0.0058
MAR	0.504556	0.150664	3.348893	0.0017
APR	0.816145	0.140268	5.818473	0.0000
MAY	0.985600	0.140869	6.996567	0.0000
JUN	0.661520	0.147482	4.485435	0.0001
JUL	0.854419	0.139283	6.134397	0.0000
AUG	0.773072	0.144031	5.367385	0.0000
SEP	0.634843	0.145419	4.365608	0.0001
OCT	0.445119	0.144289	3.084908	0.0036
NOV	0.248020	0.143837	1.724313	0.0920
NGCCU_ESC(-1)-NGHHMCF(-1)	0.736713	0.055027	13.38822	0.0000
R-squared	0.968789	Mean dependent var	5.723513	
Adjusted R-squared	0.956156	S.D. dependent var	1.012694	
S.E. of regression	0.212046	Akaike info criterion	-0.020698	
Sum squared resid	1.888474	Schwarz criterion	0.607605	
Log likelihood	18.62095	Hannan-Quinn criter.	0.225066	
F-statistic	76.68797	Durbin-Watson stat	2.080761	
Prob(F-statistic)	0.000000			

Table C25 - NGCCU_MAC, commercial sector delivered prices, Middle Atlantic

Dependent Variable: NGCCU_MAC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:09

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.413782	0.382344	1.082224	0.2866
NGHHMCF-NGHHMCF(-1)	-0.807460	0.103426	-7.807142	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	9.14E-05	0.000309	0.295683	0.7692
(ZWHD_MAC-ZWHN_MAC)/ZSAJQUS	-0.027160	0.017720	-1.532728	0.1343
(ZWHD_MAC(-1)-ZWHN_MAC(-1))/ZSAJQUS	0.036022	0.019106	1.885373	0.0677
D1001	1.182514	0.312165	3.788099	0.0006
D1210	2.120306	0.319581	6.634653	0.0000
D1211	-1.139470	0.297639	-3.828358	0.0005
D1212	1.170297	0.303433	3.856857	0.0005
D1309	2.973681	0.291413	10.20436	0.0000
D1310	-2.504752	0.338480	-7.399990	0.0000
D1401	1.013388	0.329624	3.074378	0.0041
D1408	-0.601578	0.296510	-2.028865	0.0501
JAN	-0.482696	0.204674	-2.358365	0.0241
FEB	-0.018831	0.175631	-0.107221	0.9152
MAR	0.236313	0.181505	1.301963	0.2014
APR	-0.400976	0.180805	-2.217724	0.0332
MAY	-0.107201	0.176715	-0.606633	0.5480
JUN	-0.336572	0.182426	-1.844974	0.0735
JUL	-0.388065	0.179663	-2.159959	0.0377
AUG	0.083027	0.195483	0.424726	0.6736
SEP	-0.051989	0.187937	-0.276628	0.7837
OCT	0.102216	0.203363	0.502625	0.6184
NOV	0.106466	0.191934	0.554700	0.5826
NGCCU_MAC(-1)-NGHHMCF(-1)	0.919581	0.068255	13.47268	0.0000
R-squared	0.952252	Mean dependent var	5.071102	
Adjusted R-squared	0.919511	S.D. dependent var	0.909712	
S.E. of regression	0.258091	Akaike info criterion	0.423328	
Sum squared resid	2.331384	Schwarz criterion	1.295971	
Log likelihood	12.30016	Hannan-Quinn criter.	0.764667	
F-statistic	29.08407	Durbin-Watson stat	2.368550	
Prob(F-statistic)	0.000000			

Table C26 - NGCCU_MTN, commercial sector delivered prices, Mountain

Dependent Variable: NGCCU_MTN-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:10

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.535211	0.129246	4.141016	0.0002
NGHHMCF-NGHHMCF(-1)	-1.046179	0.036894	-28.35622	0.0000
NGWG_ECON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	-0.000289	9.83E-05	-2.937524	0.0055
(ZWHD_MTN-ZWHN_MTN)/ZSAJQUS	-0.053996	0.009767	-5.528427	0.0000
(ZWHD_MTN(-1)-ZWHN_MTN(-1))/ZSAJQUS(-1)	-0.019347	0.009481	-2.040669	0.0479
D1004	-0.494732	0.123176	-4.016445	0.0003
D1405	-0.432192	0.130185	-3.319832	0.0019
D1410	-0.526787	0.126390	-4.167939	0.0002
JAN	0.191666	0.070453	2.720467	0.0096
FEB	0.289602	0.084750	3.417147	0.0015
MAR	0.021464	0.107938	0.198853	0.8434
APR	0.032115	0.122552	0.262056	0.7946
MAY	0.290094	0.108807	2.666140	0.0110
JUN	0.448416	0.102829	4.360784	0.0001
JUL	0.502520	0.092621	5.425528	0.0000
AUG	0.199258	0.090035	2.213111	0.0327
SEP	0.065699	0.082358	0.797723	0.4297
OCT	-0.123542	0.075608	-1.633974	0.1101
NOV	-0.270044	0.068914	-3.918570	0.0003
NGCCU_MTN(-1)-NGHHMCF(-1)	0.919445	0.025609	35.90348	0.0000
R-squared	0.991125	Mean dependent var	4.222555	
Adjusted R-squared	0.986910	S.D. dependent var	0.933208	
S.E. of regression	0.106770	Akaike info criterion	-1.375080	
Sum squared resid	0.455993	Schwarz criterion	-0.676965	
Log likelihood	61.25239	Hannan-Quinn criter.	-1.102008	
F-statistic	235.1181	Durbin-Watson stat	2.265187	
Prob(F-statistic)	0.000000			

Table C27 - NGCCU_NEK, commercial sector delivered prices, New England

Dependent Variable: NGCCU_NEK-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:10

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.994184	0.446183	4.469434	0.0001
NGHHMCF-NGHHMCF(-1)	-0.813437	0.111729	-7.280460	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	-0.000631	0.000308	-2.048625	0.0473
(ZWHD_NEK-ZWHN_NEK)/ZSAJQUS	0.032192	0.022839	1.409479	0.1666
(ZWHD_NEK(-1)-ZWHN_NEK(-1))/ZSAJQUS(-1)	-0.098599	0.029410	-3.352517	0.0018
D1206	0.943579	0.335669	2.811037	0.0077
D1207	0.895761	0.334256	2.679866	0.0107
D1404	1.582320	0.380405	4.159562	0.0002
D1412	0.764413	0.335423	2.278951	0.0282
JAN	0.080533	0.186834	0.431043	0.6688
FEB	-0.078463	0.186601	-0.420485	0.6764
MAR	0.269467	0.195705	1.376906	0.1764
APR	-0.256058	0.210852	-1.214399	0.2319
MAY	-0.225261	0.188284	-1.196390	0.2388
JUN	-0.589851	0.208234	-2.832642	0.0073
JUL	-0.289567	0.203516	-1.422825	0.1627
AUG	-0.288398	0.192386	-1.499061	0.1419
SEP	-0.107497	0.186509	-0.576362	0.5677
OCT	-0.375747	0.187491	-2.004087	0.0520
NOV	0.061362	0.205968	0.297919	0.7673
NGCCU_NEK(-1)-NGHHMCF(-1)	0.712056	0.062277	11.43371	0.0000
R-squared	0.901154	Mean dependent var	6.871561	
Adjusted R-squared	0.850464	S.D. dependent var	0.707859	
S.E. of regression	0.273728	Akaike info criterion	0.515855	
Sum squared resid	2.922158	Schwarz criterion	1.248875	
Log likelihood	5.524354	Hannan-Quinn criter.	0.802580	
F-statistic	17.77770	Durbin-Watson stat	2.496939	
Prob(F-statistic)	0.000000			

Table C28 - NGCCU_PAC, commercial sector delivered prices, Pacific

Dependent Variable: NGCCU_PAC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:10

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.138459	0.301330	3.778111	0.0006
NGHHMCF-NGHHMCF(-1)	-0.930931	0.071271	-13.06176	0.0000
NGWG_ECON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	0.000729	0.000195	3.732423	0.0007
(ZWHD_PAC-ZWHN_PAC)/ZSAJQUS	-0.061419	0.023526	-2.610647	0.0131
(ZWHD_PAC(-1)-ZWHN_PAC(-1))/ZSAJQUS(-1)	0.007891	0.023616	0.334128	0.7402
D1003	-1.650745	0.227142	-7.267466	0.0000
D1004	0.921685	0.254241	3.625242	0.0009
D1005	-0.528950	0.228345	-2.316447	0.0263
D1009	-0.462208	0.225507	-2.049645	0.0477
D1104	0.766996	0.236883	3.237872	0.0026
D1308	0.589996	0.217179	2.716635	0.0101
D1407	0.735593	0.227039	3.239946	0.0026
JAN	-0.260074	0.134020	-1.940565	0.0602
FEB	-0.007148	0.164368	-0.043485	0.9656
MAR	0.539890	0.222013	2.431799	0.0201
APR	0.105459	0.248089	0.425083	0.6733
MAY	0.510260	0.224429	2.273594	0.0291
JUN	0.440854	0.192440	2.290863	0.0279
JUL	0.103660	0.164400	0.630532	0.5323
AUG	0.144015	0.156895	0.917907	0.3648
SEP	-0.262076	0.156525	-1.674337	0.1027
OCT	-0.205489	0.128931	-1.593792	0.1197
NOV	-0.465194	0.127619	-3.645176	0.0008
NGCCU_PAC(-1)-NGHHMCF(-1)	0.624186	0.061492	10.15074	0.0000
R-squared	0.936550	Mean dependent var	4.979765	
Adjusted R-squared	0.896012	S.D. dependent var	0.601092	
S.E. of regression	0.193835	Akaike info criterion	-0.154441	
Sum squared resid	1.352597	Schwarz criterion	0.683297	
Log likelihood	28.63323	Hannan-Quinn criter.	0.173244	
F-statistic	23.10314	Durbin-Watson stat	2.050589	
Prob(F-statistic)	0.000000			

Table C29 - NGCCU_SAC, commercial sector delivered prices, South Atlantic

Dependent Variable: NGCCU_SAC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:11

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.418925	0.406143	3.493658	0.0012
NGHHMCF-NGHHMCF(-1)	-0.900101	0.057451	-15.66740	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	0.000459	0.000199	2.309872	0.0260
(ZWHD_SAC-ZWHN_SAC)/ZSAJQUS	-0.072920	0.011095	-6.572622	0.0000
(ZWHD_SAC(-1)-ZWHN_SAC(-1))/ZSAJQUS(-1)	0.051225	0.012760	4.014448	0.0002
D1004+D1005	-0.473326	0.129897	-3.643866	0.0007
D1411	-0.622912	0.185410	-3.359641	0.0017
JAN	0.193758	0.111187	1.742631	0.0889
FEB	0.051319	0.106878	0.480164	0.6337
MAR	0.155597	0.111162	1.399741	0.1691
APR	0.637370	0.105424	6.045799	0.0000
MAY	0.753030	0.110670	6.804301	0.0000
JUN	0.786347	0.115290	6.820605	0.0000
JUL	0.543698	0.127337	4.269755	0.0001
AUG	0.311716	0.138713	2.247198	0.0301
SEP	0.353999	0.136028	2.602406	0.0128
OCT	-0.033342	0.129295	-0.257874	0.7978
NOV	-0.135497	0.118729	-1.141235	0.2604
NGCCU_SAC(-1)-NGHHMCF(-1)	0.723312	0.069178	10.45575	0.0000
R-squared	0.979169	Mean dependent var	6.126350	
Adjusted R-squared	0.970024	S.D. dependent var	0.926246	
S.E. of regression	0.160366	Akaike info criterion	-0.570160	
Sum squared resid	1.054403	Schwarz criterion	0.093050	
Log likelihood	36.10479	Hannan-Quinn criter.	-0.310742	
F-statistic	107.0700	Durbin-Watson stat	2.386231	
Prob(F-statistic)	0.000000			

Table C30 - NGCCU_WNC, commercial sector delivered prices, West North Central

Dependent Variable: NGCCU_WNC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:11

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.565290	0.468799	3.338937	0.0019
NGHHMCF-NGHHMCF(-1)	-0.698614	0.095852	-7.288430	0.0000
NGWG_ECON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	4.87E-05	0.000205	0.237501	0.8135
(ZWHD_WNC-ZWHN_WNC)/ZSAJQUS	-0.046463	0.011924	-3.896596	0.0004
(ZWHD_WNC(-1)-ZWHN_WNC(-1))/ZSAJQUS(-1)	0.010347	0.013322	0.776681	0.4422
D1003	-0.608081	0.241347	-2.519535	0.0161
D1006	-0.857818	0.231305	-3.708605	0.0007
D1106	-0.598633	0.220972	-2.709092	0.0101
D1403	1.096181	0.270549	4.051696	0.0002
D1409	0.898027	0.216593	4.146155	0.0002
JAN	-0.057516	0.135186	-0.425458	0.6729
FEB	0.191361	0.182289	1.049767	0.3005
MAR	0.214007	0.219000	0.977202	0.3346
APR	0.086537	0.247403	0.349780	0.7284
MAY	0.434205	0.236685	1.834530	0.0744
JUN	1.478362	0.221084	6.686883	0.0000
JUL	1.135832	0.170446	6.663887	0.0000
AUG	0.959738	0.163093	5.884621	0.0000
SEP	0.277879	0.162294	1.712193	0.0950
OCT	-0.333557	0.141927	-2.350200	0.0241
NOV	0.090526	0.123280	0.734315	0.4673
NGCCU_WNC(-1)-NGHHMCF(-1)	0.543606	0.064302	8.453893	0.0000
R-squared	0.975935	Mean dependent var	4.334854	
Adjusted R-squared	0.962636	S.D. dependent var	0.979084	
S.E. of regression	0.189254	Akaike info criterion	-0.214882	
Sum squared resid	1.361045	Schwarz criterion	0.553045	
Log likelihood	28.44645	Hannan-Quinn criter.	0.085496	
F-statistic	73.38462	Durbin-Watson stat	2.370406	
Prob(F-statistic)	0.000000			

Table C31 - NGCCU_WSC, commercial sector delivered prices, West South Central

Dependent Variable: NGCCU_WSC-NGHHMCF

Method: Least Squares

Date: 04/29/15 Time: 10:11

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.275945	0.229221	5.566433	0.0000
NGHHMCF-NGHHMCF(-1)	-1.063710	0.075957	-14.00405	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-37))/3)	-0.000116	0.000211	-0.546679	0.5877
(ZWHD_WSC-ZWHN_WSC)/ZSAJQUS	-0.035802	0.019918	-1.797459	0.0800
(ZWHD_WSC(-1)-ZWHN_WSC(-1))/ZSAJQUS(-1)	-0.008443	0.021714	-0.388813	0.6995
D1001	0.907622	0.248712	3.649287	0.0008
D1009	-0.552726	0.229426	-2.409171	0.0208
D12ON	0.152829	0.065682	2.326824	0.0253
D1201	0.684947	0.257210	2.662982	0.0112
JAN	-0.126319	0.157083	-0.804158	0.4262
FEB	0.243545	0.140065	1.738799	0.0900
MAR	0.192104	0.137359	1.398553	0.1698
APR	0.666410	0.128958	5.167639	0.0000
MAY	0.791399	0.131262	6.029131	0.0000
JUN	0.837585	0.130507	6.417928	0.0000
JUL	0.708156	0.131568	5.382428	0.0000
AUG	0.669528	0.134994	4.959672	0.0000
SEP	0.710849	0.143958	4.937901	0.0000
OCT	0.640435	0.133357	4.802407	0.0000
NOV	0.132055	0.136213	0.969480	0.3383
NGCCU_WSC(-1)-NGHHMCF(-1)	0.545603	0.053939	10.11518	0.0000
R-squared	0.963453	Mean dependent var	4.065406	
Adjusted R-squared	0.944711	S.D. dependent var	0.850598	
S.E. of regression	0.200006	Akaike info criterion	-0.111725	
Sum squared resid	1.560088	Schwarz criterion	0.621295	
Log likelihood	24.35176	Hannan-Quinn criter.	0.174999	
F-statistic	51.40637	Durbin-Watson stat	2.271588	
Prob(F-statistic)	0.000000			

Table C32 - NGICU_ENC, industrial sector delivered prices, East North Central

Dependent Variable: NGICU_ENC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:34

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.194914	0.231033	5.172060	0.0000
NGHHMCF-NGHHMCF(-1)	-0.788568	0.123351	-6.392862	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-25))+NGWG_ECON(-37))/3)	-0.000132	0.000326	-0.405516	0.6873
(ZWHD_ENC-ZWHN_ENC)/ZSAJQUS	-0.023557	0.016229	-1.451601	0.1544
(ZWHD_ENC(-1)-ZWHN_ENC(-1))/ZSAJQUS(-1)	0.012050	0.016506	0.730022	0.4696
D1403	1.924420	0.371459	5.180712	0.0000
D1405	1.093352	0.341860	3.198246	0.0027
D1406	-1.155319	0.352047	-3.281717	0.0021
JAN	-0.002804	0.175348	-0.015989	0.9873
FEB	-0.090086	0.179595	-0.501608	0.6187
MAR	-0.049557	0.187469	-0.264346	0.7929
APR	-0.197928	0.183272	-1.079968	0.2866
MAY	-0.490934	0.183111	-2.681068	0.0106
JUN	-0.077728	0.186099	-0.417671	0.6784
JUL	0.015445	0.173997	0.088766	0.9297
AUG	-0.140767	0.176590	-0.797143	0.4301
SEP	-0.653171	0.176320	-3.704475	0.0006
OCT	-0.526139	0.171959	-3.059672	0.0039
NOV	0.065290	0.176302	0.370328	0.7131
NGICU_ENC(-1)-NGHHMCF(-1)	0.637991	0.072345	8.818779	0.0000
R-squared	0.907360	Mean dependent var	2.907108	
Adjusted R-squared	0.863356	S.D. dependent var	0.723147	
S.E. of regression	0.267314	Akaike info criterion	0.460419	
Sum squared resid	2.858278	Schwarz criterion	1.158533	
Log likelihood	6.187444	Hannan-Quinn criter.	0.733490	
F-statistic	20.61988	Durbin-Watson stat	1.578045	
Prob(F-statistic)	0.000000			

Table C33 - NGICU_ESC, industrial sector delivered prices, East South Central

Dependent Variable: NGICU_ESC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:37

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.570391	0.133157	11.79353	0.0000
NGHHMCF-NGHHMCF(-1)	-0.698016	0.058833	-11.86433	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-37))/3)	0.000519	0.000140	3.696763	0.0006
(ZWHD_ESC-ZWHN_ESC)/ZSAJQUS	0.005904	0.008670	0.680919	0.4997
D1007	0.746221	0.171835	4.342650	0.0001
D1403	-1.068898	0.200143	-5.340659	0.0000
JAN	-0.039249	0.100095	-0.392116	0.6970
FEB	-0.131751	0.100747	-1.307735	0.1981
MAR	-0.232283	0.108992	-2.131193	0.0390
APR	-0.347799	0.098579	-3.528141	0.0010
MAY	-0.277346	0.096816	-2.864660	0.0065
JUN	-0.329872	0.096959	-3.402198	0.0015
JUL	-0.538822	0.103523	-5.204850	0.0000
AUG	-0.517854	0.098607	-5.251668	0.0000
SEP	-0.558298	0.097249	-5.740917	0.0000
OCT	-0.389355	0.098469	-3.954078	0.0003
NOV	-0.269936	0.099220	-2.720578	0.0094
NGICU_ESC(-1)-NGHHMCF(-1)	0.167223	0.077710	2.151886	0.0372
R-squared	0.885423	Mean dependent var	1.547199	
Adjusted R-squared	0.839047	S.D. dependent var	0.380419	
S.E. of regression	0.152620	Akaike info criterion	-0.678403	
Sum squared resid	0.978303	Schwarz criterion	-0.050100	
Log likelihood	38.35210	Hannan-Quinn criter.	-0.432639	
F-statistic	19.09210	Durbin-Watson stat	2.077525	
Prob(F-statistic)	0.000000			

Table C34 - NGICU_MAC, industrial sector delivered prices, Middle Atlantic

Dependent Variable: NGICU_MAC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:50

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.112692	0.303414	3.667247	0.0007
NGHHMCF-NGHHMCF(-1)	-0.859326	0.096260	-8.927135	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-37))/3)	0.000161	0.000203	0.794877	0.4312
(ZWHD_MAC-ZWHN_MAC)/ZSAJQUS	0.015066	0.016383	0.919655	0.3630
D1006	-1.023528	0.286259	-3.575533	0.0009
D1409	-0.946679	0.275848	-3.431887	0.0014
JAN	0.192483	0.160810	1.196963	0.2380
FEB	0.093931	0.158549	0.592438	0.5567
MAR	0.225938	0.161808	1.396338	0.1699
APR	-0.371500	0.156548	-2.373071	0.0223
MAY	-0.119870	0.156761	-0.764671	0.4487
JUN	0.125212	0.165414	0.756961	0.4533
JUL	-0.241793	0.159907	-1.512088	0.1380
AUG	-0.062654	0.161563	-0.387797	0.7001
SEP	0.154508	0.167891	0.920290	0.3627
OCT	0.354286	0.157694	2.246673	0.0300
NOV	0.190153	0.160458	1.185069	0.2427
NGICU_MAC(-1)-NGHHMCF(-1)	0.740193	0.061351	12.06488	0.0000
R-squared	0.906145	Mean dependent var	4.341027	
Adjusted R-squared	0.868156	S.D. dependent var	0.672987	
S.E. of regression	0.244364	Akaike info criterion	0.263011	
Sum squared resid	2.507982	Schwarz criterion	0.891314	
Log likelihood	10.10968	Hannan-Quinn criter.	0.508775	
F-statistic	23.85277	Durbin-Watson stat	2.005178	
Prob(F-statistic)	0.000000			

Table C35 - NGICU_MTN, industrial sector delivered prices, Mountain

Dependent Variable: NGICU_MTN-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:46

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.671659	0.137098	4.899129	0.0000
NGHHMCF-NGHHMCF(-1)	-0.866361	0.063986	-13.53981	0.0000
NGWG_WCON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	-5.28E-05	0.000469	-0.112390	0.9110
(ZWHD_MTN-ZWHN_MTN)/ZSAJQUS	-0.004137	0.016768	-0.246737	0.8063
JAN	-0.293219	0.119381	-2.456160	0.0181
FEB	-0.031122	0.125615	-0.247755	0.8055
MAR	-0.145333	0.123014	-1.181433	0.2438
APR	-0.500660	0.120558	-4.152873	0.0001
MAY	-0.324004	0.121912	-2.657689	0.0109
JUN	-0.174672	0.119709	-1.459143	0.1516
JUL	0.022788	0.120323	0.189388	0.8507
AUG	-0.183007	0.120331	-1.520857	0.1355
SEP	-0.252578	0.120008	-2.104673	0.0411
OCT	-0.077319	0.119615	-0.646398	0.5214
NOV	-0.370122	0.119989	-3.084640	0.0035
NGICU_MTN(-1)-NGHHMCF(-1)	0.788579	0.048139	16.38142	0.0000
R-squared	0.924471	Mean dependent var	2.313001	
Adjusted R-squared	0.898723	S.D. dependent var	0.590752	
S.E. of regression	0.188002	Akaike info criterion	-0.281554	
Sum squared resid	1.555163	Schwarz criterion	0.276938	
Log likelihood	24.44661	Hannan-Quinn criter.	-0.063097	
F-statistic	35.90389	Durbin-Watson stat	2.332651	
Prob(F-statistic)	0.000000			

Table C36 - NGICU_NEK, industrial sector delivered prices, New England

Dependent Variable: NGICU_NEK-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:50

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.822937	0.474564	5.948482	0.0000
NGHHMCF-NGHHMCF(-1)	-0.887787	0.110629	-8.024920	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-37))/3)	0.000640	0.000261	2.449162	0.0186
(ZWHD_NEK-ZWHN_NEK)/ZSAJQUS	0.053253	0.022500	2.366772	0.0226
D1201	1.558003	0.345262	4.512531	0.0001
D1209	1.125945	0.327723	3.435664	0.0013
JAN	-0.835782	0.200653	-4.165305	0.0002
FEB	-0.587680	0.185210	-3.173039	0.0028
MAR	-0.411769	0.190940	-2.156535	0.0368
APR	-0.572208	0.186678	-3.065206	0.0038
MAY	-1.010633	0.183597	-5.504627	0.0000
JUN	-1.266419	0.187983	-6.736888	0.0000
JUL	-1.112547	0.205753	-5.407199	0.0000
AUG	-1.132186	0.205718	-5.503590	0.0000
SEP	-1.124726	0.210884	-5.333391	0.0000
OCT	-0.862305	0.203487	-4.237636	0.0001
NOV	0.022091	0.199004	0.111006	0.9121
NGICU_NEK(-1)-NGHHMCF(-1)	0.587306	0.084749	6.929902	0.0000
R-squared	0.918603	Mean dependent var	5.036353	
Adjusted R-squared	0.885656	S.D. dependent var	0.854760	
S.E. of regression	0.289035	Akaike info criterion	0.598785	
Sum squared resid	3.508726	Schwarz criterion	1.227089	
Log likelihood	0.036438	Hannan-Quinn criter.	0.844549	
F-statistic	27.88169	Durbin-Watson stat	1.920543	
Prob(F-statistic)	0.000000			

Table C37 - NGICU_PAC, industrial sector delivered prices, Pacific

Dependent Variable: NGICU_PAC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:51

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.432367	0.216415	6.618600	0.0000
NGHHMCF-NGHHMCF(-1)	-0.948842	0.084535	-11.22428	0.0000
NGWG_WCON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	0.000299	0.000605	0.494812	0.6233
(ZWHD_PAC-ZWHN_PAC)/ZSAJQUS	-0.014319	0.022817	-0.627585	0.5336
D1003	-1.615286	0.271828	-5.942306	0.0000
JAN	-0.335625	0.150673	-2.227514	0.0312
FEB	-0.630204	0.150470	-4.188226	0.0001
MAR	-0.085328	0.159619	-0.534575	0.5957
APR	-0.517588	0.149650	-3.458657	0.0012
MAY	-0.595615	0.148678	-4.006072	0.0002
JUN	-0.370076	0.149159	-2.481084	0.0171
JUL	-0.412766	0.151087	-2.731979	0.0091
AUG	-0.513479	0.153704	-3.340701	0.0017
SEP	-0.714628	0.154425	-4.627684	0.0000
OCT	-0.533347	0.150975	-3.532686	0.0010
NOV	-0.362908	0.148203	-2.448725	0.0185
NGICU_PAC(-1)-NGHHMCF(-1)	0.673560	0.064478	10.44635	0.0000
R-squared	0.855295	Mean dependent var	3.026167	
Adjusted R-squared	0.801452	S.D. dependent var	0.525535	
S.E. of regression	0.234172	Akaike info criterion	0.167998	
Sum squared resid	2.357964	Schwarz criterion	0.761395	
Log likelihood	11.96006	Hannan-Quinn criter.	0.400108	
F-statistic	15.88481	Durbin-Watson stat	2.375741	
Prob(F-statistic)	0.000000			

Table C38 - NGICU_SAC, industrial sector delivered prices, South Atlantic

Dependent Variable: NGICU_SAC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:52

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.971799	0.138256	14.26195	0.0000
NGHHMCF-NGHHMCF(-1)	-0.732996	0.050555	-14.49902	0.0000
NGWG_ECON(-1)-((NGWG_ECON(-13)+NGWG_ECON(-37))/3)	0.000278	0.000104	2.658451	0.0110
(ZWHD_SAC-ZWHN_SAC)/ZSAJQUS	0.002381	0.009454	0.251855	0.8024
D1403	-0.798611	0.181251	-4.406111	0.0001
JAN	-0.121222	0.090088	-1.345592	0.1855
FEB	-0.198028	0.089597	-2.210198	0.0325
MAR	-0.318785	0.099627	-3.199797	0.0026
APR	-0.498543	0.089606	-5.563700	0.0000
MAY	-0.402464	0.087625	-4.593037	0.0000
JUN	-0.573430	0.087889	-6.524485	0.0000
JUL	-0.529764	0.090139	-5.877185	0.0000
AUG	-0.582343	0.089382	-6.515208	0.0000
SEP	-0.566604	0.088108	-6.430819	0.0000
OCT	-0.509069	0.088265	-5.767509	0.0000
NOV	-0.333897	0.090121	-3.704979	0.0006
NGICU_SAC(-1)-NGHHMCF(-1)	0.158247	0.066993	2.362152	0.0228
R-squared	0.897928	Mean dependent var	1.878000	
Adjusted R-squared	0.859948	S.D. dependent var	0.369814	
S.E. of regression	0.138397	Akaike info criterion	-0.883853	
Sum squared resid	0.823615	Schwarz criterion	-0.290455	
Log likelihood	43.51558	Hannan-Quinn criter.	-0.651742	
F-statistic	23.64206	Durbin-Watson stat	2.222650	
Prob(F-statistic)	0.000000			

Table C39 - NGICU_WNC, industrial sector delivered prices, West North Central

Dependent Variable: NGICU_WNC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:53

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.205563	0.181513	6.641754	0.0000
NGHHMCF-NGHHMCF(-1)	-0.630317	0.102985	-6.120483	0.0000
NGWG_WCON(-1)-((NGWG_WCON(-13)+NGWG_WCON(-25)+NGWG_WCON(-37))/3)	-0.001527	0.000655	-2.330511	0.0247
(ZWHD_WNC-ZWHN_WNC)/ZSAJQUS	-0.028945	0.013169	-2.197907	0.0335
D1403	1.974814	0.300884	6.563379	0.0000
D1404	-1.417059	0.318298	-4.451985	0.0001
JAN	-0.289245	0.143504	-2.015585	0.0503
FEB	-0.122444	0.147620	-0.829450	0.4115
MAR	-0.378873	0.155719	-2.433046	0.0193
APR	-0.517962	0.154281	-3.357265	0.0017
MAY	-0.696165	0.144043	-4.833017	0.0000
JUN	-0.643909	0.149804	-4.298349	0.0001
JUL	-0.637991	0.151577	-4.209030	0.0001
AUG	-0.598183	0.150288	-3.980238	0.0003
SEP	-0.487722	0.146622	-3.326399	0.0018
OCT	-0.432898	0.146015	-2.964750	0.0050
NOV	-0.120686	0.143631	-0.840246	0.4055
NGICU_WNC(-1)-NGHHMCF(-1)	0.531679	0.082203	6.467864	0.0000
R-squared	0.907029	Mean dependent var	1.646731	
Adjusted R-squared	0.869399	S.D. dependent var	0.624801	
S.E. of regression	0.225796	Akaike info criterion	0.104953	
Sum squared resid	2.141315	Schwarz criterion	0.733256	
Log likelihood	14.85142	Hannan-Quinn criter.	0.350717	
F-statistic	24.10331	Durbin-Watson stat	1.710313	
Prob(F-statistic)	0.000000			

Table C40 - NGICU_WSC, industrial sector delivered prices, West South Central

Dependent Variable: NGICU_WSC-NGHHMCF

Method: Least Squares

Date: 04/07/15 Time: 11:55

Sample: 2010M01 2014M12

Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.281292	0.061561	4.569295	0.0000
NGHHMCF-NGHHMCF(-1)	-0.523596	0.050894	-10.28787	0.0000
NGWG_PROD(-1)-((NGWG_PROD(-13)+NGWG_PROD(-37))/3)	-0.000260	0.000115	-2.266916	0.0285
(ZWHD_WSC-ZWHN_WSC)/ZSAJQUS	-0.036523	0.011694	-3.123153	0.0032
D1403	-0.676785	0.179702	-3.766158	0.0005
JAN	-0.073113	0.088004	-0.830786	0.4107
FEB	-0.057117	0.091826	-0.622012	0.5372
MAR	-0.225204	0.095550	-2.356914	0.0231
APR	-0.196037	0.087428	-2.242269	0.0302
MAY	-0.102784	0.087423	-1.175714	0.2462
JUN	-0.169630	0.087846	-1.930990	0.0601
JUL	-0.153701	0.087264	-1.761322	0.0853
AUG	-0.024738	0.089426	-0.276637	0.7834
SEP	-0.164735	0.091934	-1.791879	0.0802
OCT	-0.133903	0.087285	-1.534081	0.1323
NOV	-0.176223	0.089746	-1.963578	0.0561
NGICU_WSC(-1)-NGHHMCF(-1)	-0.195347	0.084330	-2.316441	0.0254
R-squared	0.802484	Mean dependent var	0.135046	
Adjusted R-squared	0.728990	S.D. dependent var	0.262936	
S.E. of regression	0.136881	Akaike info criterion	-0.905894	
Sum squared resid	0.805661	Schwarz criterion	-0.312496	
Log likelihood	44.17681	Hannan-Quinn criter.	-0.673783	
F-statistic	10.91902	Durbin-Watson stat	1.818912	
Prob(F-statistic)	0.000000			