

# **The Oil and Gas Production Industry in the Illinois Economy**

## **March 2016 Update to the March 2009 Report**

**Prepared for the  
Illinois Oil and Gas  
Association**

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# **Executive Summary**

## **Oil and Gas Production in Illinois (Chapter 2)**

Oil production in Illinois has been a significant contributor to the Illinois economy since the early 1900s and continues to support important economic activity in the southeastern part of the state. Oil production in Illinois has remained very stable since the time of the previous report, reporting 9.4 million barrels in 2008, and 9.6 million barrels in 2015 based on data provided by Illinois Petroleum Resources Board (IRPB).

The geographic concentration of oil production has remained relatively stable since 2008. In 2008, 43 of the 102 counties of Illinois reported oil production, and in 2015, 45 counties reported production.

Drilling activity is reflected in several indicators, including the number of active drill rigs, average weekly drilling permits issued, and annual Scout Ticket counts. The number of active rigs remained stable until the second-half of 2015 when a noticeable reduction occurred. The average number of weekly drilling permits issued also declined in 2015. The number of reported Scout Ticket counts did not decline in 2015, but this may be a result of a lag in reported data. Overall, these indicators point to a decline in drilling activity in the industry starting in 2015.

Illinois was the 16<sup>th</sup> largest oil producing state in the United States in 2015, the most recent year for which state data are available. This is a slightly lower ranking than in the 2009 report, due largely to increased unconventional production methods including high-volume hydraulic fracturing occurring in other states.

## **Oil Producing Formations, Well Drilling, and Extraction in Illinois (Chapter 3)**

Illinois has various conventional and unconventional geologic formations. Historically, most oil produced in Illinois has come from the Post-New Albany Play. Illinois also contains unconventional plays including the New Albany Shale Gas Play which demonstrates significant potential for growth in Illinois. Beginning in 2010, interest increased in development of shale formations in Illinois, especially the New Albany Shale. However, with declining oil prices and with the passage of strict regulations on high-volume hydraulic fracturing in 2014, activity related to the possible development of the New Albany Shale appears to have been put on hold.

Most industry representatives reported that they continue to drill vertical wells. In 2009, the average number of dry holes cited by industry representatives for every

completed well in a new field was about ten. In 2015, several survey respondents suggested that the average has dropped to between five and seven. Horizontal wells are occasionally drilled but are very expensive. High-volume hydraulic fracturing wells are not being utilized in Illinois at the time of the writing of this report.

Illinois producers continue to use water flooding as a secondary recovery technique but usage of enhanced oil recovery (EOR) has been limited. As of 2015, little or no EOR using carbon dioxide has taken place by oil producers in Illinois. However, since the 2009 report, the Midwest Geological Sequestration Consortium's (MGSC) has had several successful small-scale EOR projects that used carbon dioxide in the region.

## **Ownership, Employment, and Economic Impact (Chapter 4)**

Oil and gas production in Illinois continues to be an important driver of employment and revenue for the Illinois economy. Through the ups and downs in oil prices, employment in these industries has remained very stable. This is a great testament to the commitment of local firms engaged in oil production activities, and the stability of those firms in times of plenty and of want.

Total employment in the oil and gas production industry increased from approximately 4,200 in 2006 to approximately 4,600 in 2013, based on data from the U.S. Census Bureau. According to industry representatives, employment also increased in 2014. More recent information along with feedback from industry representatives in 2015 suggests that employment has since decreased and may be at approximately the same levels as were seen in 2008.

The geographic distribution of employment has also remained relatively stable since the time of the last report. Employment remains concentrated in the southeastern portion of Illinois where production is the strongest.

Wages for many of the field occupations such as derrick operators, rotary drill operators, service unit operators and roustabouts increased since the 2009 report to an average of over \$18 per hour in 2014. Wages for petroleum engineers and technicians in Illinois have displayed volatility which could be due partly to the low numbers of employees in these occupations, retirements, and migration of higher skilled employees to locations in the U.S. with higher demand and higher wages.

Illinois has grown as a transportation hub for oil and gas produced across the country. The majority of crude oil shipped by rail throughout the U.S. now passes through the Midwest. After the 2009 report, oil production in the U.S. has increased,

resulting in more than 1 million barrels per day of crude oil being moved by train across the U.S. in 2014, a large increase since the last study. Much of the crude-by-rail comes from the Bakken Field in North Dakota to refineries located on the East Coast, resulting in large volumes of crude oil moving through the Midwest region.

Royalty payments to leaseholders and residents owning mineral rights continue to provide economic value and income in Illinois. The number of people receiving royalty payments from oil produced in Illinois is estimated to be over 30,000. During the 2010 to 2012 period, developers began seeking leases related to unconventional shale resource plays. Expenditures associated with leasing activity in Illinois exceeded \$300 million dollars, according to industry representatives. Future leasing activity and any further development of shale gas resources in Illinois currently remains uncertain due to depressed oil prices and the retarding influence of strict and costly regulations.

Estimates from the previous report are used here to demonstrate the continued and steady economic importance of the industry to the state of Illinois. Illinois oil and gas employment in the previous report was found to be approximately 4,200. Because of multiplier effects, an additional 9,800 jobs are estimated to have been created throughout rest of the state, accounting for approximately 14,000 total jobs. Among the additional jobs, the indirect employment effects from purchases by gas and oil firms from firms outside the industry were felt most strongly in professional scientific and technical services, followed by mining itself and administrative and waste services; the induced employment impacts from payments to the households working in these firms had the greatest impact in health and social services, followed closely by retail trade, and more distantly in accommodation and food services, all sectors where households spend a good deal of their income. Income impacts are substantial and include a direct impact of \$769 million and a total impact of \$1.29 billion on income with multiplier effects. The oil and gas industry also accounted for \$3.04 billion within the industry in direct output impact and \$4.81 billion taking account of multiplier effects. Approximately \$106 million in Illinois state sales and income tax revenues came from the oil and gas industry's workers. The industry and its suppliers paid \$330 million in state taxes, 72 percent of which were in the form of indirect business taxes, and \$383 million in federal taxes, for a total of \$713 million.

## **Factors Affecting Revenues and Costs (Chapter 5)**

The price received by Illinois oil producers is less than the published spot market price due to transportation and handling charges and other adjustments. However, the price received by Illinois oil producers follows that of the WTI oil price because of

similar physical and chemical characteristics. As of late 2015, there were six first purchasers in Illinois, up from three in the previous report.

From 2007 to 2009, the real spread between the WTI spot price and the posted price for Illinois sweet crude often exceeded approximately \$9 a barrel. The spread has generally declined and stood at approximately \$7 a barrel in 2015.

Ad valorem taxes received by the state of Illinois are calculated based on the average price over two years. In 2013, \$9.6 million in tax revenue was collected for oil production in Illinois (in 2015 dollars). The amount of tax revenue collected for 2007 production, the year following the previous study, was \$7.7 million (in 2015 dollars).

Interview respondents asked about well drilling costs described similar drilling costs in 2015 as were experienced at the time of the last study. Some interview respondents noted that labor costs, and insurance costs in particular, had increased at rates higher than inflation over the 2009 to 2014 time frame.

Well operations costs are a combination of well-specific characteristics, and labor and materials costs, which can vary independently of each other. High and steady oil prices from 2011 to 2014 were cited by some industry representatives during interviews conducted in 2015 as a key determinant to attracting new and qualified people into the industry. Some industry representatives described cutbacks in personnel and/or wages associated with lower prices and activity in recent months. However, the industry has not faced the same or similar materials-related challenges which were encountered and detailed in the 2009 report.

Another benchmark for operating costs is the IHS Upstream Operating Cost Index (UOCI) which measures changes in costs related to oil and gas field operations. Although this index reflects movements in underlying global data, it can serve as a useful comparison to information gained from industry representatives in Illinois. As of the third quarter of 2015, the UOCI index was at approximately the same level as the time of the last study, which is consistent with the trends cited by industry representatives.

As crude oil production in the U.S. has risen, roughly 90 percent of the growth between 2011 and 2014 consisted of light sweet crude oil. The growth in domestic production resulted in a decline in imports of similar quality. However, as light and medium crude imports have declined, heavy imports have remained steady.

## **Current and Recent Developments (Chapter 6)**

Industry representatives interviewed for this report described significant activity in Illinois related to shale gas plays from 2010 to 2012, including leasing and research for use in potential shale gas extraction. Industry representatives estimated that over \$300 million was invested in Illinois on leases and related expenditures in preparation for fracking; landowners were receiving upwards of \$300 per acre. However, the situation has now changed. Given the introduction of a strict regulatory environment and the decline in oil prices since 2014, the future of leasing activity and investment in shale gas development in Illinois has become uncertain. Industry representatives have described the new fracking regulations as excessive and burdensome. Some companies have pursued fracking and horizontal drilling opportunities in nearby states, in areas with similar geological attributes as those found in Illinois, spurred by the relatively lower regulatory burdens in those other states.

The unknown future course of oil prices is a major source of uncertainty facing the oil and gas production industry. Since June 2014, with the exception of a temporary small rebound in 2015, oil prices have been on a steady decline. At the time of this writing, the most recent WTI spot price published was \$30.31 per barrel on January 25, 2016. The forecast for oil prices is extremely uncertain at this point.

Oil production in Illinois declined slowly but steadily from 2000 to 2009, and did not seem to be strongly influenced by changes in prices. Total annual production was over 12.2 million barrels in 2000 compared to 9.1 million barrels in 2009. Production remained steady from 2009 to 2012 before increasing slightly in 2015 to \$9.6 million barrels per year. In the period of large decreases in oil prices between June 2014 and the most recently available data for December 2015, oil production in Illinois has not slowed down. This may be due to the highly variable operating costs of marginal wells. Industry representatives in Illinois who were interviewed noted that some marginal or stripper wells could be shut down at low prices. However, these operators can also change operations to reduce costs and attempt to preserve mineral rights and wells. One industry representative described the small, family-owned businesses that operate stripper wells in Illinois as “resilient” because they often elect cost-cutting measures to avoid halting production.

Drilling activity for oil and gas wells in the Illinois Basin has very pronounced seasonal fluctuations that can make it difficult to discern other influences. Still, looking past the seasonal effects, there was a reduction in the typical level of active drill rigs



starting in 2015 which is likely to be a result of the recent low oil prices and uncertainty over the future of oil prices.

There are three main employment categories for the oil and gas production industry presented in this report. These include Oil and Gas Extraction (NAICS 21111), Drilling Oil and Gas Wells (NAICS 213111), and Support Activities for Oil and Gas Operations (NAICS 213112). The most recent monthly data, showing employment levels as of June 2015, from the U.S. Bureau of Labor Statistics Quarter Census of Employment and Wages (QCEW), are available for employees who work for firms (does not include independent contractors). Employment in the Oil and Gas Extraction (NAICS 21111) and Support Activities for Oil and Gas Operations (NAICS 213112) sectors appear to be less affected by oil prices than employment in the Drilling Oil and Gas Wells (NAICS 213111) sector. The decline in oil price since 2014 does seem to have had an effect on the number of active drilling rigs through the middle of 2015, falling below where would be expected even on a seasonal basis. Employment in all three sectors did decline after the oil price decline in the second half of 2014. However, employment levels for all three sectors increased when oil prices rebounded slightly in the second quarter of 2015. Data from the second-half of 2015, not available at the time of this report, will allow for an improved understanding of the recent low oil price environment and employment in the oil and gas industry in Illinois.

However, information gathered within the past few months indicates that low oil prices are having a negative effect on employment in the oil production industry in Illinois. While official published industry data have a long lag before publication, the most recent accounts from producers indicate there have been employment reductions in the hundreds during the past year and that financial trouble may be ahead for firms in Illinois if prices stay so low. These descriptions are consistent with what would be expected after the large decline in oil prices.

But overall, according to other industry representatives, employment has been at very high levels in the past two years, and even layoffs in the hundreds may only serve to bring employment back to historical averages. Given the continued uncertainty regarding future oil prices and the influences of the international oil market, it remains to be seen if there will be any permanent effects from recent price declines on the traditional oil production industry in Illinois.

In terms of future development of shale gas resources in Illinois, the confluence of low prices and a difficult and expensive regulatory environment does seem to have negatively affected prospects for development using HVHF at a time when the state is deeply in need of new sources of employment and revenue.

# 1. Introduction

This report – ***The Oil and Gas Production Industry In the Illinois Economy – March 2016 Update to the March 2009 Report*** serves as an update to its predecessor report – *The Oil and Gas Industry In the Illinois Economy* – which was prepared in 2008 and 2009, and released in March 2009. The 2016 report incorporates updated data, new information from recent interviews with industry representatives, and offers a comprehensive look at oil production in Illinois and the importance of this activity to the state.

Results from this 2016 report indicate that the industry continues to be an important driver of employment and economic activity throughout a large portion of Illinois at approximately the same levels as were quantified in the 2009 report. While the major focus is Illinois upstream oil production, some discussion has also been provided of downstream marketing and refining of Illinois oil. Both the 2009 and 2015 reports focus primarily on crude oil production because natural gas production in Illinois is still limited and is in large part a residual by-product of oil production.

The source of much of the industry information described in this report was obtained through interviews with industry representatives. A total of 17 industry representatives were interviewed for the 2015 report, compared to 14 industry representatives interviewed for the 2009 report.<sup>1</sup> Respondents represented a wide variety of business types including drillers, producers, resource players and leasers, first purchasers, and other industry representatives.

Table 1-1 shows the number of people interviewed by company type.<sup>2</sup> For the 2009 report, the interviews were conducted in early 2009. For the 2016 report, the interviews were conducted primarily in May, July, and October of 2015. Several of the 2015 interview respondents were contacted multiple times for follow-up conversations but were counted only once in Table 1-1. Repeated communications with the same interview respondents over several months were helpful for understanding ways in which the industry has evolved over a condensed period of time. Additionally, seven interview respondents participated in both 2009 and 2015 which provided a unique perspective for making valuable comparisons across the two distinct time periods.

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<sup>1</sup> Interviews were conducted by telephone and/or by response to emailed questions.

<sup>2</sup> In addition to the number of interviews represented here, additional information was obtained by telephone and email communications with industry experts.

**Table 1-1. Number of Interviews of Industry Representatives by Company Type**

| Company type                   | Number of Respondents |           |
|--------------------------------|-----------------------|-----------|
|                                | 2009                  | 2015      |
| Resource Player                | 0                     | 3         |
| Drilling Contractor            | 2                     | 1         |
| Multiple Services <sup>3</sup> | 2                     | 2         |
| Producer                       | 3                     | 8         |
| First Purchaser                | 2                     | 2         |
| Other <sup>4</sup>             | 5                     | 1         |
| <b>Total</b>                   | <b>14</b>             | <b>17</b> |

Chapter 2 presents an overview of the oil and gas production industry in Illinois. Topics include the history and geographic distribution of production in Illinois, updates of recent annual oil production, information on oil producing wells, drilling activity, and the relative position of Illinois in national oil production.

Chapter 3 discusses oil and gas formations in the state, characteristics of well drilling in Illinois and oil well drilling methods, and enhanced recovery technologies.

Chapter 4 describes the structure of the firms, the types of employment and number of employees in the industry, firm size, occupations and wages, and a review of the contribution of the oil and gas production industry to the Illinois economy which was quantified in the 2009 study. Updated employment estimates are presented for upstream production and support, along with a discussion of downstream activities. Recipients of royalty income from oil and gas production are also discussed.

Chapter 5 presents information on selected factors affecting revenues and costs. Influences on the price of oil received by Illinois oil producers is discussed, as well as, ad valorem taxes, changes in well drilling and operating costs, and changing qualities of crude oil supply in the U.S.

Chapter 6 describes recent developments in the oil and gas industry including a discussion of activities and regulations regarding potential shale gas production, recent

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<sup>3</sup> Some companies have both production and service companies under one umbrella.

<sup>4</sup> Includes representatives of trucking companies, government agencies, industry groups, and other industry representatives.

oil price trends compared to oil production, well drilling, and employment in oil production activities in Illinois.

## **2. Oil and Gas Production in Illinois**

The focus of this report is on oil and gas production in Illinois. Overall oil and gas industry activity consists of upstream oil and gas activities leading to production of oil and gas, and post-production or downstream activities including marketing, transportation and refining, as well as distribution and retailing of refined products. The downstream activities result from upstream production not only in Illinois but outside of Illinois from products shipped into the state. The majority of this activity is in oil. Natural gas production in Illinois is extremely limited and is frequently a residual by-product of oil production.

This chapter discusses oil production in Illinois. Section 2.1 offers an overview of the oil producing regions in Illinois and the Illinois Basin. Section 2.2 presents historical oil production data. Section 2.3 discusses recent oil production in Illinois, presenting data at both the state and county levels. Section 2.4 details Illinois Basin drilling activity. Section 2.5 describes the Illinois oil and gas industry in a national perspective.

### **2015 Report Highlights**

Oil production in Illinois has been a significant contributor to the Illinois economy since the early 1900s and continues to support important economic activity in the southeastern part of the state. Oil production in Illinois has remained very stable since the time of the previous report, with 9.4 million barrels in 2008, and 9.6 million barrels in 2015.

The geographic concentration of oil production has also remained stable. In 2008, 43 of the 102 counties of Illinois reported oil production, and in 2015, 45 counties reported production.

Drilling activity is reflected in several indicators, including the number of active drill rigs, average weekly drilling permits issued, and annual Scout Ticket counts. The number of active rigs remained stable until the second half of 2015 when a noticeable reduction occurred. The average number of weekly drilling permits issued also declined in 2015. The number of reported Scout Ticket counts did not decline in 2015, but this may be a result of a lag in reported data. Overall, these indicators point to a decline in drilling activity in the industry starting in 2015.

Illinois was the 16<sup>th</sup> largest oil producing state in the United States in 2015, the most recent year for which state data are available. This is a slightly lower ranking

than in the 2009 report, due largely to increased unconventional production methods including high-volume hydraulic fracturing occurring in other states.

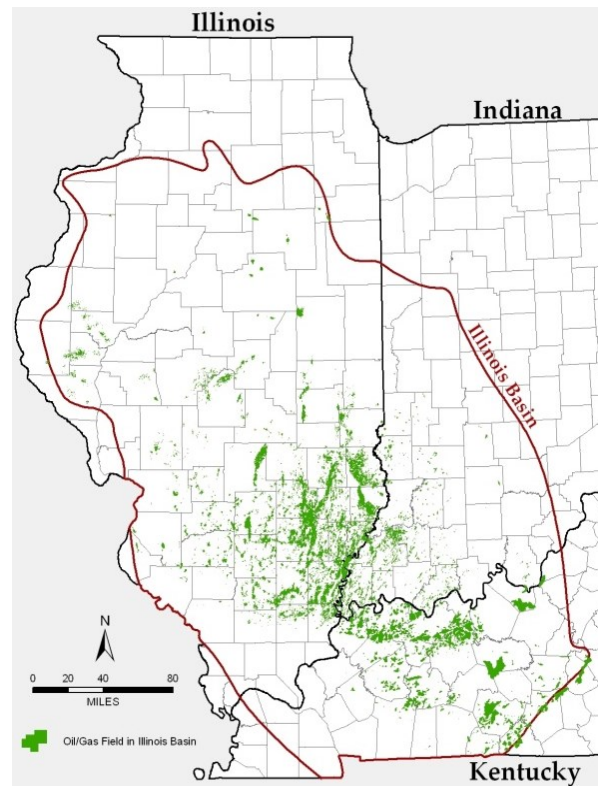
## 2.1 Oil Production and the Illinois Basin

As can be seen in Figure 2-1 obtained from the Illinois State Geologic Survey (ISGS), the oil producing region of Illinois is concentrated in the southern half of the state, and is part of a three-state oil producing geologic region called the Illinois Basin. The major part of the oil producing area of the Illinois Basin is located in Illinois, with some extension into adjacent areas in Indiana and Kentucky. With cumulative oil production for the Illinois Basin of about 4.2 billion barrels, nearly 10 billion barrels of oil remains, primarily as unrecovered resources in known fields.<sup>5</sup>

Production of oil in Illinois is done by a mix of many small businesses and independent firms, and a few large companies. Although Illinois has four large refineries, most of the oil produced in Illinois is exported to other states for refining.

The majority of the Illinois Basin's oil producing activities, businesses, employees, and reserves are located in Illinois.<sup>6</sup> As a result, the viability of production in Illinois is important to the oil and gas industries of the entire Illinois Basin area. The industry in Illinois is located primarily in rural areas, playing an important economic role in these areas.

Figure 2-1. Map of the Illinois Basin from Illinois State Geological Survey



## 2.2 Historical Perspective

Oil production in Illinois has been a significant contributor to the Illinois economy since the early 1900s when oil production began in the southern part of the state.

<sup>5</sup> RCF communication with ISGS, January 2016. In addition, see Midwest Geological Sequestration Consortium. "Enhanced Oil Recovery," <http://sequestration.org/science/enhancedoilrecovery.html> (Accessed January 20, 2016).

<sup>6</sup> RCF interviews with industry representatives (2009, 2015).

Figure 2-2 shows Illinois oil production since 1905. Since its inception, Illinois has enjoyed good production from relatively shallow wells in the 3,500-foot depth range.<sup>7</sup> An early peak occurred around 1910 when annual production was approximately 33 million barrels.<sup>8</sup> A second peak occurred at the time of World War II when seismic exploration techniques were introduced and production rose to 147 million barrels annually. A third peak in production, although not in discovery, occurred in the mid-1950s with the general application of fracking and water-flood secondary recovery techniques.<sup>9</sup> During the 1940s and 1950s, Illinois was one of the nation's leading oil producers.<sup>10</sup> Production dropped by approximately 75 percent through the 1960s and 1970s. A small rise in production occurred in the early 1980s as a result of intensified exploration spurred by high oil prices. At that time many of the major oil companies had operations in Illinois. When crude oil prices fell in the late 1980s, the majority of the major companies left Illinois to pursue exploration and production elsewhere.

The legacy assets and oil fields developed by the large oil companies are now operated by a few large companies. In addition to the few large fields developed by the major oil companies, Illinois production comes from many small fields.

Natural gas is much less abundant than crude oil in Illinois. Generally, natural gas in Illinois is a by-product that bubbles out of the oil when the oil is brought to the surface. Natural gas may be separated in a gas separator and/or prepared for a gas pipeline. Sometimes, the gas is flared at the site to safely dispose of the gas. Some oil wells make use of the natural gas to power the pump motor.<sup>11</sup>

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<sup>7</sup> RCF interviews with industry representatives (2009, 2015).

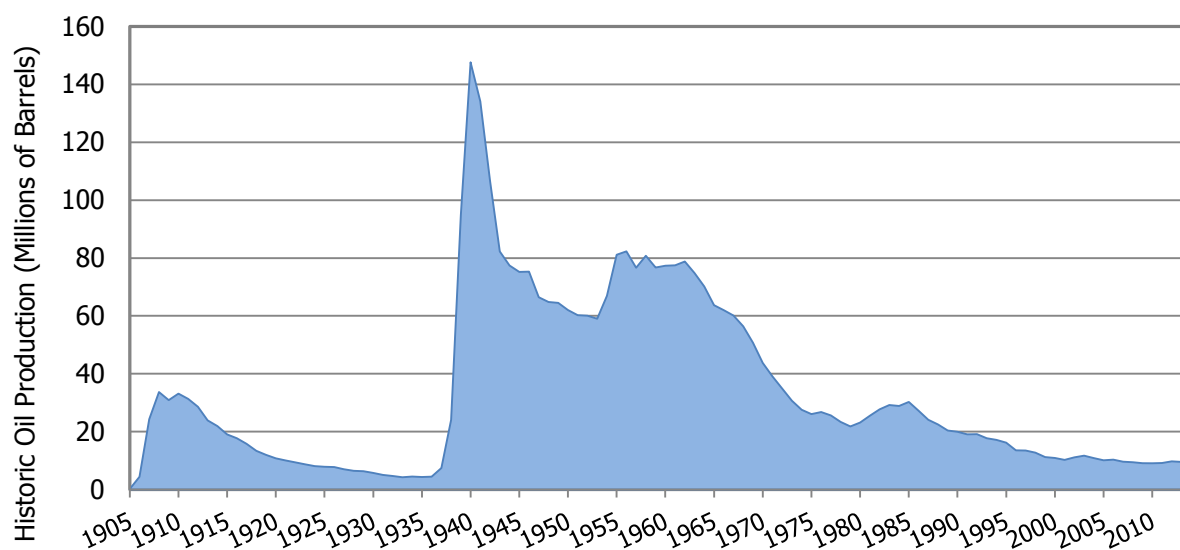
<sup>8</sup> Illinois State Geologic Survey (ISGS), History of Oil Production in Illinois, <https://www.isgs.illinois.edu/outreach/geology-resources/history-oil-and-gas-production-illinois>. (Accessed January 29, 2016).

<sup>9</sup> Macke, D. L. (1995). Illinois Basin Province (064), in Gautier, D. L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., ed., 1995 National assessment of United States oil and gas resources--Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS-30, Release 2, one CD-ROM.

<sup>10</sup> Illinois State Geologic Survey (ISGS), [www.isgs.uiuc.edu/maps-data-pub/publications/geobits/geobit9.shtml](http://www.isgs.uiuc.edu/maps-data-pub/publications/geobits/geobit9.shtml), (Accessed December 2008).

<sup>11</sup> ISGS, [www.isgs.uiuc.edu/maps-data-pub/publications/geobits/geobit9.shtml](http://www.isgs.uiuc.edu/maps-data-pub/publications/geobits/geobit9.shtml), (Accessed December 2008).

**Figure 2-2. Illinois Oil Production, 1905 to 2014**



Source: Illinois State Geologic Survey (ISGS).<sup>12</sup>

## 2.3 Recent Oil Production in Illinois

Oil production in Illinois is considered mature. Exploration and development in the state is ongoing, but the majority of oil produced in Illinois comes from older wells producing 1 to 2 barrels per day.<sup>13</sup> Nonetheless, Illinois has good reserves located at relatively shallow depths, which makes long-term oil production in Illinois a possibility.

### 2.3.1 Oil Production Trends

Estimates of monthly oil production were obtained from the U.S. Energy Information Association (EIA) and are illustrated in Figure 2-3. Oil production in Illinois demonstrates some degree of seasonality with lower levels of production generally occurring in January and February and higher levels of production occurring during the other months of the year as shown in Figure 2-3. From 2007 through 2015, production fluctuated between approximately 650,000 and 850,000 barrels per month but has remained relatively stable on an annual basis. EIA estimates that Illinois produced 9.4 million barrels of crude oil in 2008 and 9.5 million barrels of crude oil in 2015.<sup>14</sup>

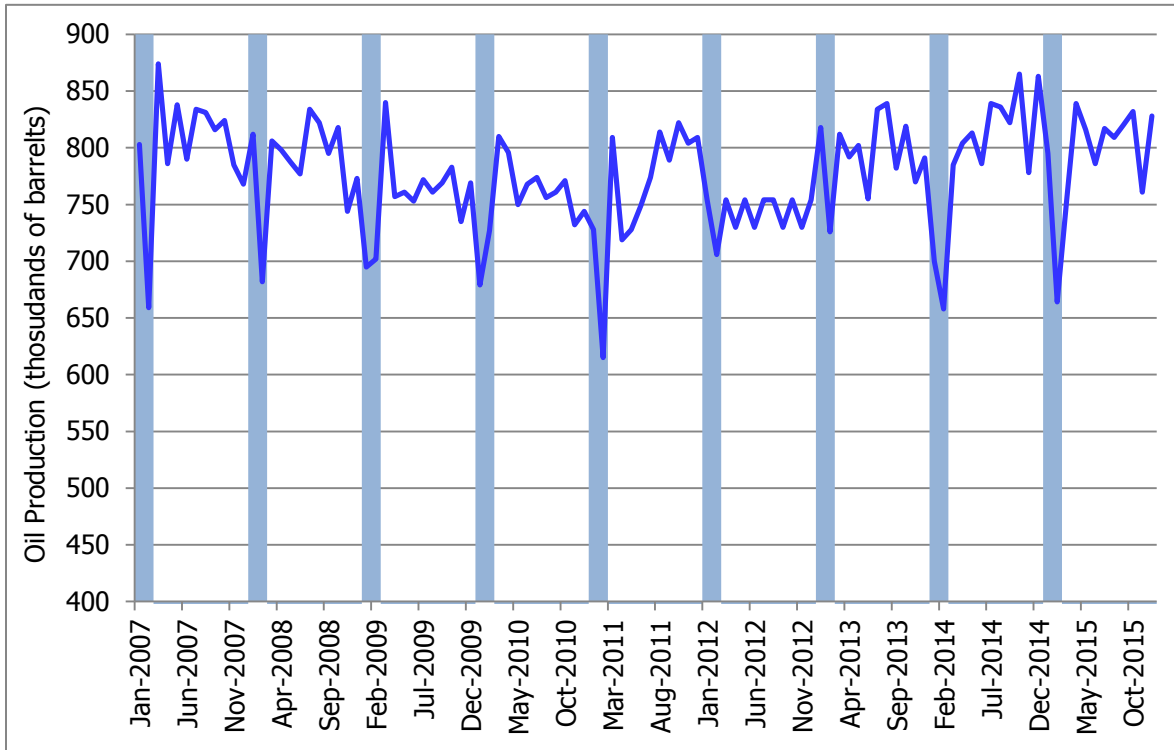
<sup>12</sup> Data provided to RCF from ISGS via email on May 18, 2015.

<sup>13</sup> RCF interviews with industry representatives (2009, 2015).

<sup>14</sup> U.S. Energy Information Association (EIA). "Illinois Field Production of Crude Oil," [https://www.eia.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbbbl\\_m.htm](https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbbl_m.htm) (Accessed March 16, 2016).



**Figure 2-3. Illinois Monthly Oil Production,  
January 2007 through December 2015**



Source: U.S. Energy Information Association (EIA).<sup>15</sup>

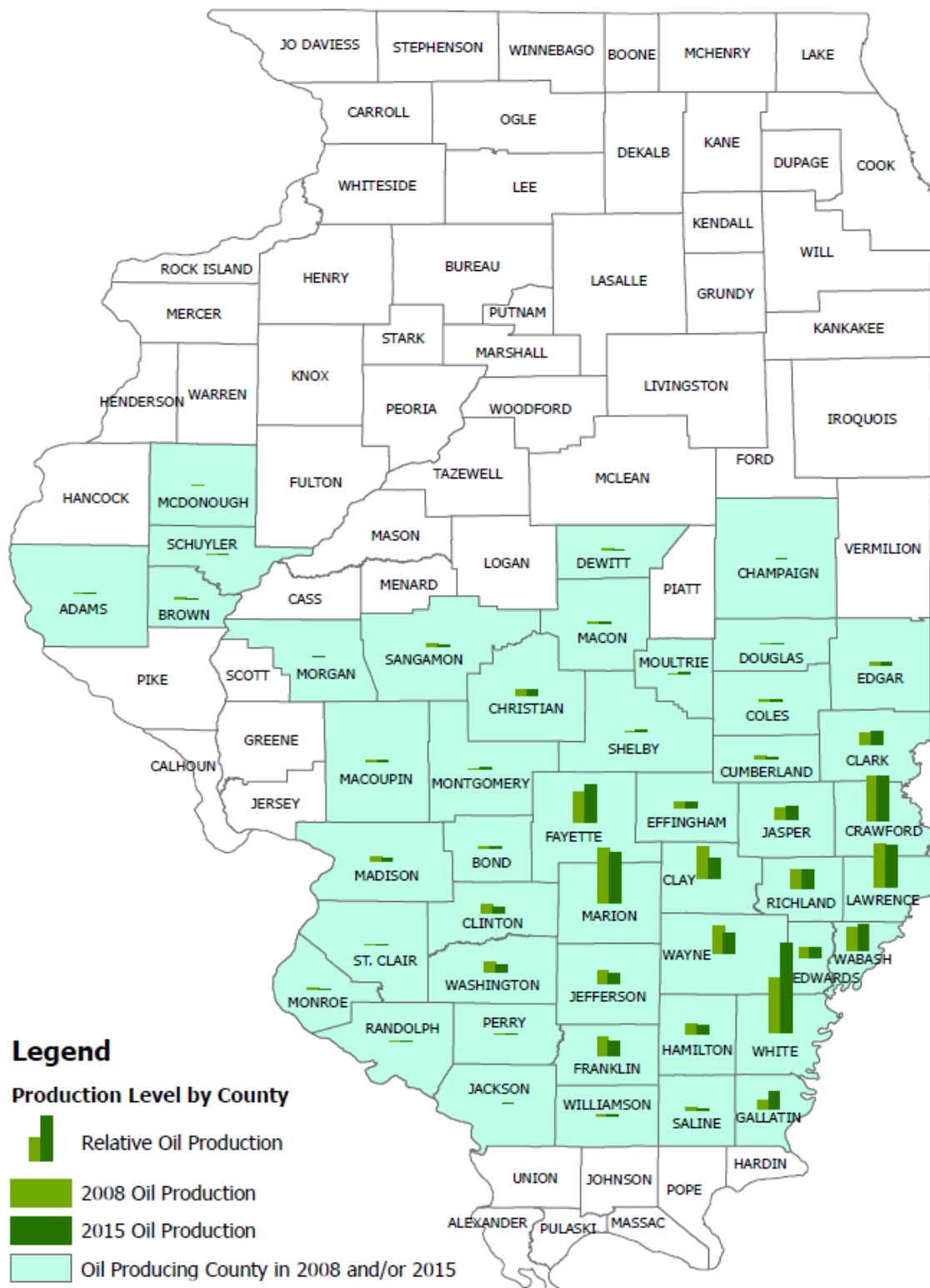
### 2.3.2 Geographic Distribution of Oil Production

Production data by county were obtained from the Illinois Petroleum Resource Board (IRPB). Oil production in Illinois took place in 43 of 102 counties in 2008 and 45 counties in 2015, as shown in Figure 2-4 and Table 2-1.<sup>16</sup> The counties with the largest production are located in the southeastern section of the state. This is shown in the geographic distribution of oil production in Illinois is shown in Figure 2-4; the production levels for 2008 and 2015 are depicted by vertical bars. Specific production levels are reported in Table 2-1 for both years by county. As shown in Figure 2-4 and Table 2-1, production remained relatively stable across counties between 2008 and 2015.

<sup>15</sup> *Ibid.*

<sup>16</sup> Data provided to RCF from Illinois Petroleum Resources Board (IPRB), March 14, 2016.

**Figure 2-4. Illinois Oil Production by County, 2008 and 2015**



<sup>17</sup> Data provided by the Illinois Petroleum Resources Board (IPRB) on August 28, 2015 and March 14, 2016.

**Table 2-1. Illinois Oil Production by County, 2008 and 2015**

| <b>County</b> | <b>2008<br/>(1,000<br/>barrels)</b> | <b>2015<br/>(1,000<br/>barrels)</b> | <b>County</b> | <b>2008<br/>(1,000<br/>barrels)</b> | <b>2015<br/>(1,000<br/>barrels)</b> |
|---------------|-------------------------------------|-------------------------------------|---------------|-------------------------------------|-------------------------------------|
| Adams         | 1.1                                 | 1.5                                 | Macon         | 18.0                                | 31.5                                |
| Bond          | 31.0                                | 18.6                                | Macoupin      | 10.2                                | 9.5                                 |
| Brown         | 35.5                                | 17.2                                | Madison       | 78.5                                | 70.3                                |
| Christian     | 115.0                               | 112.2                               | Marion        | 1,097.9                             | 1015.5                              |
| Clark         | 221.6                               | 283.5                               | McDonough     | 1.0                                 | 0                                   |
| Clay          | 643.3                               | 399.9                               | Monroe        | 11.0                                | 4.8                                 |
| Clinton       | 159.3                               | 112.3                               | Montgomery    | 2.1                                 | 9.2                                 |
| Coles         | 42.7                                | 33.2                                | Morgan        | 0                                   | 0.3                                 |
| Crawford      | 903.3                               | 917.1                               | Moultrie      | 5.0                                 | 9.8                                 |
| Cumberland    | 44.0                                | 23.9                                | Perry         | 8.6                                 | 5.5                                 |
| DeWitt        | 21.8                                | 14.9                                | Randolph      | 18.0                                | 11.1                                |
| Douglas       | 0.9                                 | 0.5                                 | Richland      | 381.0                               | 368.4                               |
| Edgar         | 68.3                                | 42.0                                | Saline        | 49.3                                | 33.9                                |
| Edwards       | 192.2                               | 193.6                               | Sangamon      | 43.4                                | 21.5                                |
| Effingham     | 117.0                               | 125.2                               | Schuyler      | 2.1                                 | 1.8                                 |
| Fayette       | 604.8                               | 737.3                               | Shelby        | 14.7                                | 18.1                                |
| Franklin      | 357.1                               | 284.1                               | St. Clair     | 8.8                                 | 7.7                                 |
| Gallatin      | 170.8                               | 331.0                               | Wabash        | 465.2                               | 497.8                               |
| Hamilton      | 218.8                               | 171.2                               | Washington    | 190.7                               | 145.9                               |
| Jackson       | 0                                   | 2.2                                 | Wayne         | 562.2                               | 403.7                               |
| Jasper        | 226.9                               | 264.2                               | White         | 1,109.8                             | 1797.5                              |
| Jefferson     | 265.3                               | 196.0                               | Williamson    | 32.6                                | 30.3                                |
| Lawrence      | 869.6                               | 833.6                               | <b>Total</b>  | <b>9,421</b>                        | <b>9,609</b>                        |

Source: Illinois Petroleum Resources Board.<sup>18</sup>

Notes: Champaign County, which is not included in the table above, reported 0 barrels in 2008 and 5 barrels in 2015.

<sup>18</sup> *Ibid.*

### 2.3.3 Oil Producing Wells

There are approximately 14,000 oil producing wells in Illinois.<sup>19</sup> The majority of these wells are characterized as marginal wells. As of 2012, the Interstate Oil & Gas Compact Commission (IOGCC) estimated that all of the oil produced in Illinois came from marginal wells.<sup>20</sup> Marginal oil wells, according to IOGCC, are defined as producing wells that require a higher price per barrel of oil to be worth producing, due to low production rates and/or high production costs.<sup>21</sup> Many marginal wells in Illinois are also categorized as stripper wells. Stripper wells are oil wells whose daily average oil production does not exceed 10 barrels per day in any 12 month period.<sup>22</sup> Many older wells in Illinois produce on average between 1 and 2 barrels of oil per day.<sup>23</sup>

The percentage of Illinois oil production coming from marginal wells increased from 92 percent to approximately 100 percent from 2006 to 2012.<sup>24, 25</sup> Figure 2-5 presents data on the percentage of oil produced in each state from marginal wells. Recent interviews with industry representatives confirmed that nearly all producing wells in Illinois during 2015 fit the definition of marginal wells; however, newly drilled wells are likely to produce more oil than marginal wells for the first few years of production.<sup>26</sup>

Production of oil from marginal wells occurs throughout the majority of oil producing states. As shown in Figure 2-5, some states experienced a large decline in the percentage of oil produced from marginal wells between 2006 and 2012, primarily due to an overall increase in production from unconventional methods in those states, such as Oklahoma and Texas. Some states, such as Nevada and Tennessee exhibited large percentage changes in oil production between 2006 and 2012. However, these states produce relatively small amounts of oil; therefore, small volume changes result in a large percentage change.

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<sup>19</sup> RCF communication with Illinois State Geologic Survey (ISGS), January 2016.

<sup>20</sup> Interstate Oil & Gas Compact Commission. 2012 Marginal Wells Report, <http://iogcc.myshopify.com>, (Accessed January 22, 2016).

<sup>21</sup> Interstate Oil & Gas Compact Commission. 2010 Marginal Well Report, <http://iogcc.myshopify.com>, (Accessed January 22, 2016).

<sup>22</sup> *Ibid.*

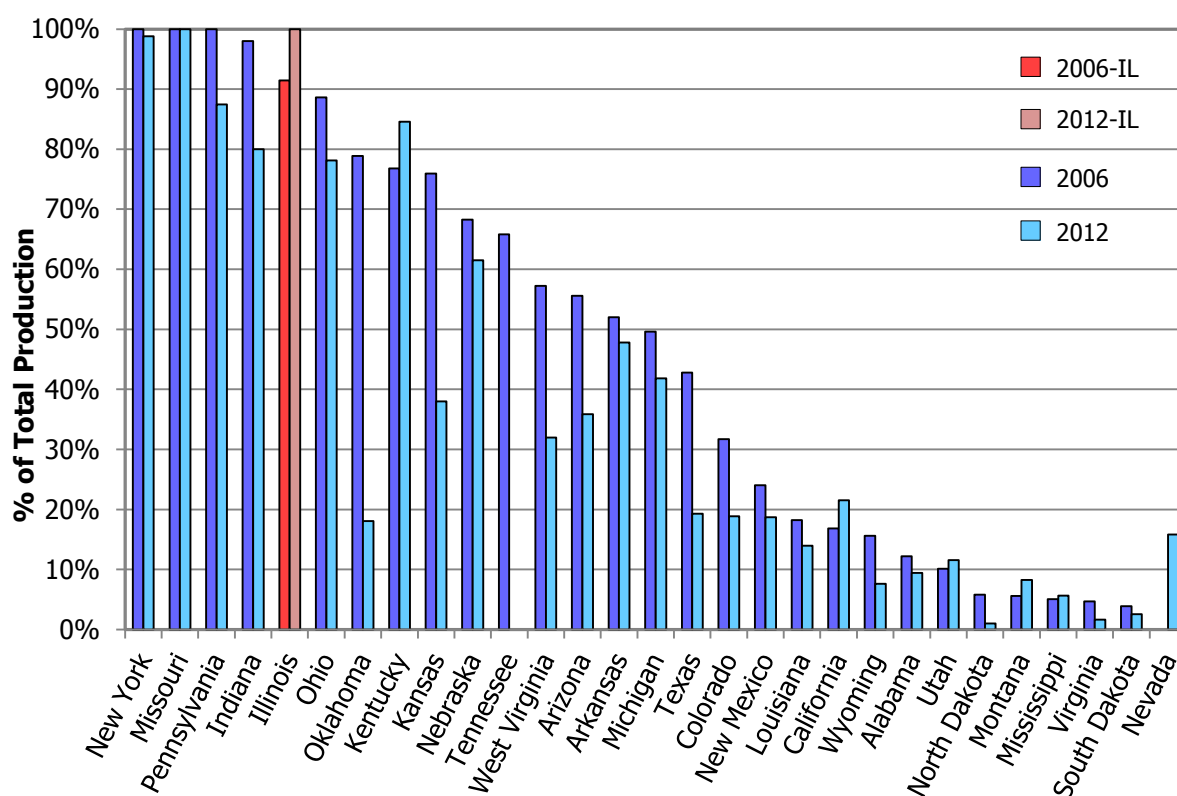
<sup>23</sup> RCF interviews with industry representatives. (2015).

<sup>24</sup> Interstate Oil & Gas Compact Commission. 2007 Marginal Well Report, <http://iogcc.myshopify.com>, (Accessed January 22, 2016).

<sup>25</sup> Interstate Oil & Gas Compact Commission. 2012 Marginal Wells Report, <http://iogcc.myshopify.com>, (Accessed January 22, 2016).

<sup>26</sup> RCF interviews with industry representatives (2015).

**Figure 2-5. Marginal Oil Well Production as a Percent of Total Oil Production by State, 2006 and 2012**



Source: IOGCC, Marginal Wells: 2007 Report and IOGCC, Marginal Wells: 2012 Report.

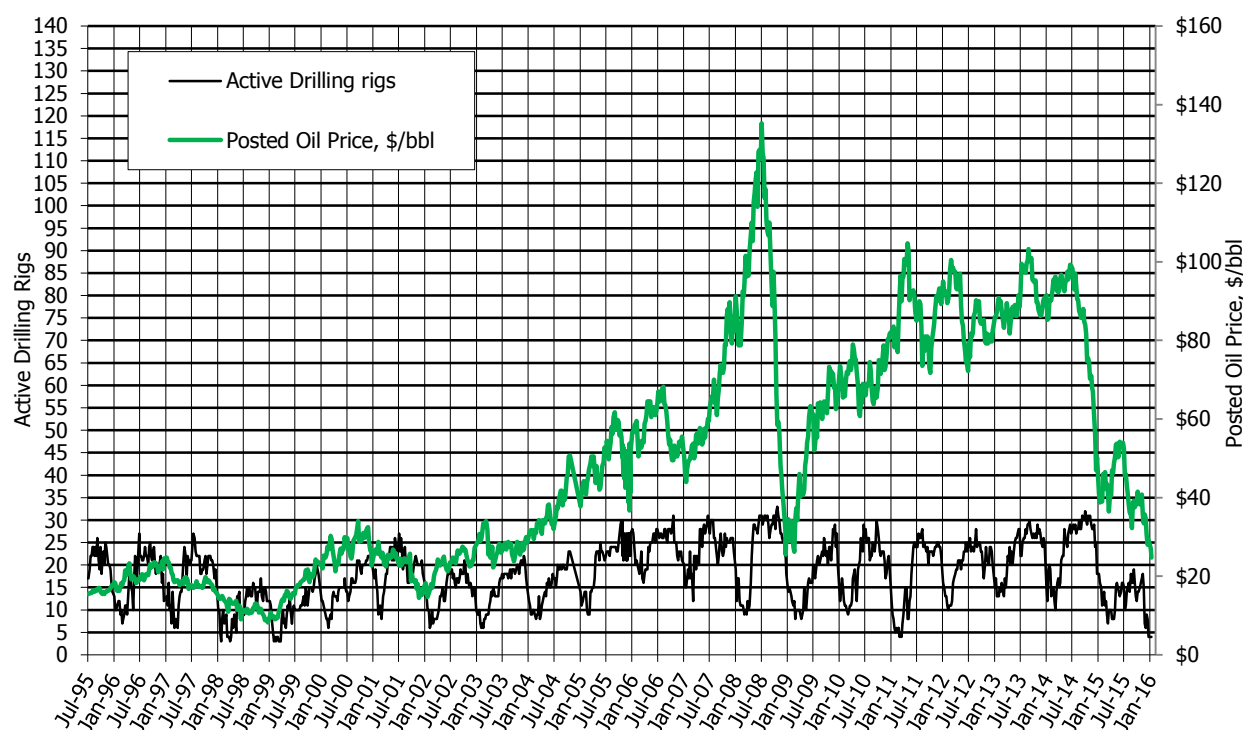
## 2.4 Illinois Basin Drilling Activity

Figure 2-6 provides a look at drilling activity in the Illinois Basin from 1995 to 2015 in relation to posted prices for Illinois Basin Crude.<sup>27</sup> The number of active drilling rigs can be influenced by prices and seasonal weather conditions. According to industry representatives, there are approximately 30 to 35 drilling rigs available at any given time in the Illinois Basin. Figure 2-6 provides a look at drilling activity and demonstrates that there is a high degree of seasonality in the number of active drilling rigs operating at any one time. This phenomenon is partially due to “Frost Laws” which limit the load weight on township roads during the period January 15 to April 15 and, in effect, restrict the ability to move rigs over the same time period. A noticeable annual dip in the rig count occurs every winter even when oil prices are favorable. In 2008, there was a large price decrease, but prices recovered quickly. During the second-half of 2015, there was a decrease in the number of active rigs which may be due to

<sup>27</sup> Oil price and active drilling rig data provided to RCF from Scout Check on January 12, 2016, via email Scout Check’s active drilling rig data is accompanied by posted oil prices from CountryMark and/or Bi-Petro.

continued low price conditions and uncertainty. According to industry experts, if the current trend in oil prices continues, they would anticipate fewer new wells drilled in 2016.<sup>28</sup> Additional discussion on recent industry activities and oil prices is presented in Chapter 6 of this report.

**Figure 2-6. Illinois Basin Active Drilling Rigs vs. Weekly Oil Price (Nominal \$)**



Source: Scout Check.<sup>29</sup>

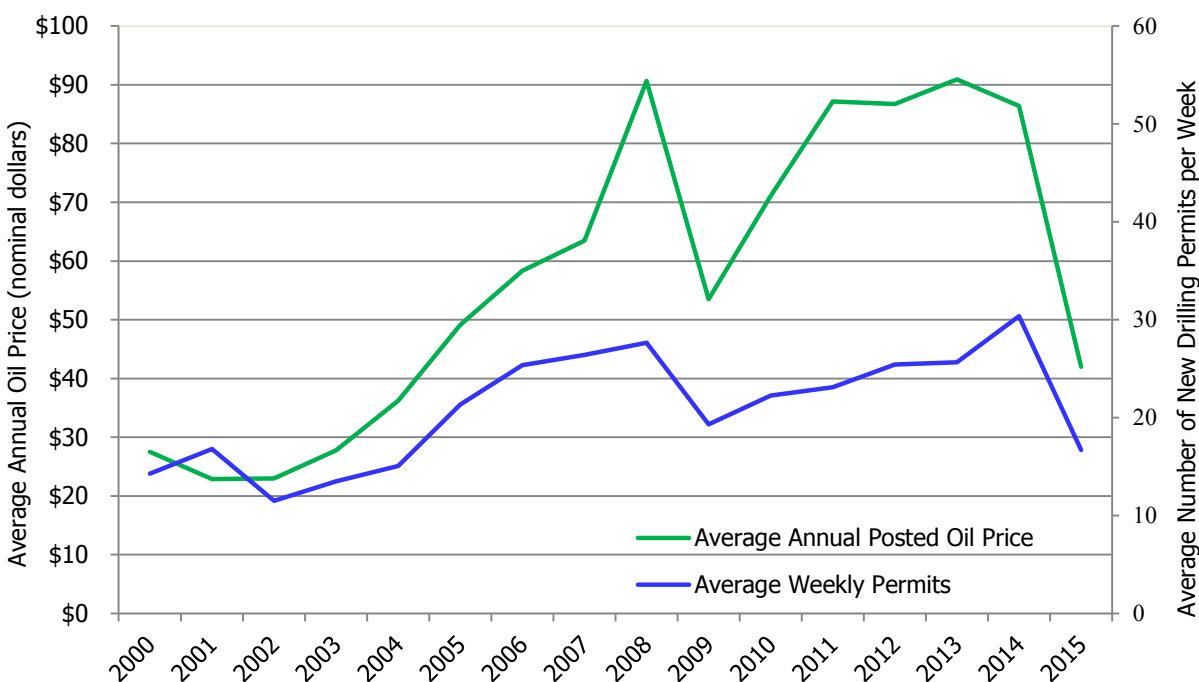
In order to drill a new well, producers must first receive a permit. Figure 2-7 summarizes the average number of new drilling permits each week from 2000 to 2015. As shown in Figure 2-7, the average number of weekly permits and the average annual posted price of oil follow a similar trend. Between 2008 and 2009, oil prices declined as did the average number of permits each week. In addition, the average number of weekly drilling permits did exhibit a decline beginning in 2015. Drilling permits expire after one year. While not all permits end up as drilled wells, it was noted by an industry expert that this is one of the best activity indicators because it shows intent to drill at a point in time.<sup>30</sup>

<sup>28</sup> RCF interviews with industry representatives (2015).

<sup>29</sup> Oil price and active drilling rig data provided to RCF from Scout Check on January 12, 2016, via email. Scout Check's active drilling rig data is accompanied by posted oil prices from CountryMark and/or Bi-Petro.

<sup>30</sup> RCF interviews with industry representatives (2015).

**Figure 2-7. Average Weekly Well Drilling Permits and Annual Oil Price  
Illinois Basin, 2000-2015**



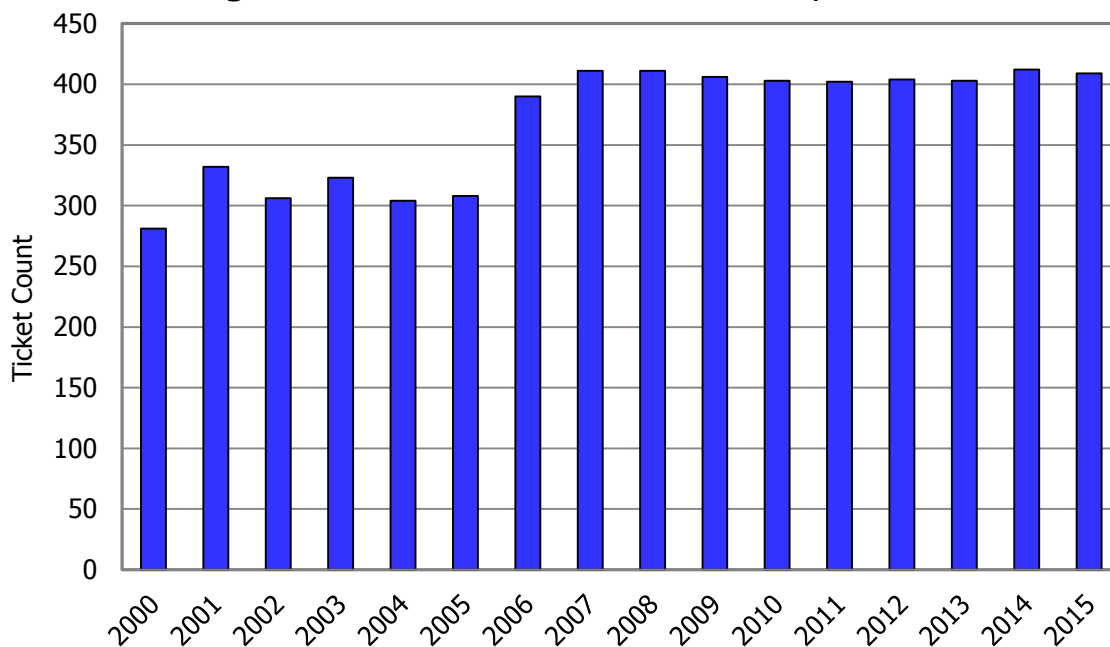
Source: Scout Check.<sup>31</sup>

Another indicator of drilling activity in Illinois is the number of wells being drilled, which can be different from the number of permit applications, and is indicated by Scout Tickets. Scout Tickets are brief reports about a well from the time it is permitted through drilling and completion. Figure 2-8 provides data on the number of Scout Tickets issued each year in Illinois for 2000 to 2015. Operators have the option to have their well data kept confidential for up to two years by the Illinois State Geological Survey (ISGS). According to Scout Check, because of this option, Scout Tickets do not exactly represent the number of wells drilled or completed during any particular year.<sup>32</sup> However, the overall trend does provide insight into the relative steadiness of drilling activity in Illinois since 2006 despite large swings in the price of oil.

<sup>31</sup> Data and chart on weekly price and active drilling rig data provided to RCF from Scout Check on January 12, 2016, via email.

<sup>32</sup> RCF interviews with industry representatives (2015).

**Figure 2-8. Illinois Scout Ticket Count, 2000-2015**



Source: Scout Check <sup>33</sup>

In 2009, industry representatives were generally optimistic about opportunities for new development in Illinois.<sup>34</sup> As of 2015, some industry representatives continue to describe the development opportunities in Illinois positively.<sup>35</sup> However, low oil prices since late 2014 and future uncertainty regarding world oil prices may affect development.

## **2.5 Illinois Oil and Gas Production in National Perspective**

As of 2015, Illinois is the 16<sup>th</sup> largest oil producing state in the U.S., excluding off-shore production.<sup>36</sup> This ranking has remained relatively stable since 2007 despite large increases in production observed in other states.<sup>37</sup> Most notably, Texas and North Dakota have experienced a boom in oil production since 2007 due to improved technology and unconventional extraction methods such as fracking. Overall, thirty-one states in the U.S. have land-based oil production. Off-shore oil production is located in Texas, Alaska, California, and Louisiana.

<sup>33</sup> Includes total tickets issued by Scout Check for dry holes and completed wells.

<sup>34</sup> RCF interviews with industry representatives (2009).

<sup>35</sup> RCF interviews with industry representatives (2015).

<sup>36</sup> U.S. Energy Information Administration. Petroleum and Other Liquids. Crude Oil Production, [http://www.eia.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbbbl\\_a.htm](http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbbl_a.htm), (Accessed March 16, 2016).

<sup>37</sup> *Ibid.*



### **3. Oil Producing Formations, Well Drilling, and Extraction in Illinois**

This chapter discusses methods of extracting oil and gas in Illinois. Section 3.1 discusses oil and gas formations in the state, for both conventional and unconventional plays. Section 3.2 discusses the characteristics of well drilling in Illinois. Finally, Section 3.3 describes enhanced oil recovery techniques.

#### **2015 Report Highlights**

Illinois has various conventional and unconventional geologic formations. Historically, most oil produced in Illinois has come from the Post-New Albany Play. Illinois also contains unconventional plays including the New Albany Shale Gas Play which demonstrates significant potential for growth in Illinois. Beginning in 2010, interest increased in development of shale formations in Illinois, especially the New Albany Shale. However, with declining oil prices and with the passage of strict regulations on high-volume hydraulic fracturing in 2014, activity related to the possible development of the New Albany Shale appears to have been put on hold.

Most industry representatives reported that they continue to drill vertical wells. In 2009, the average number of dry holes cited by industry representatives for every completed well in a new field was about ten. In 2015, several survey respondents suggested that the average has dropped to between five and seven. Horizontal wells are occasionally drilled but are very expensive. High-volume hydraulic fracturing wells are not being utilized in Illinois at the time of the writing of this report.

Illinois producers continue to use water flooding as a secondary recovery technique but usage of enhanced oil recovery (EOR) has been limited. As of 2015, little or no EOR using carbon dioxide has taken place by oil producers in Illinois. However, since the 2009 report, the Midwest Geological Sequestration Consortium's (MGSC) has had several successful small-scale EOR projects that used carbon dioxide in the region.

#### **3.1 Oil and Gas Formations in Illinois**

Oil production in Illinois is concentrated in the southeastern part of the state which, geologically, is part of the large Illinois Basin Province (Chapter 2, Section 2.3.2,

Figure 2-4).<sup>38</sup> Within the Illinois Basin, Illinois has a variety of hydrocarbon-producing formations, including both conventional and unconventional plays.<sup>39</sup> Conventional plays are more porous and often allow for conventional oil drilling and production processes where a well is drilled and the oil rises to the surface due to reservoir pressure or is pumped by a pumpjack.<sup>40</sup> Unconventional plays – such as shale or tight oil plays – have low permeability and often require horizontal drilling and/or hydraulic fracturing to make extracting hydrocarbons technically feasible and economically viable.<sup>41</sup>

By far the largest conventional play in the Illinois Basin is the Post-New Albany Play, which accounts for more than 95 percent of the hydrocarbon production in the basin. It is primarily an oil play, with its most productive oil fields in Marion and Effingham counties in Illinois. Other relatively mature, conventional oil plays include the Hunton Play, Silurian Reef Play, and Middle and Upper Ordovician Play. These plays produce oil and gas in Effingham, Clinton, Madison, and Washington counties, among others. Several other potential conventional plays in the Mississippi Embayment could produce both oil and gas.<sup>42</sup>

Illinois also contains unconventional plays including the New Albany Shale Gas Play which demonstrates significant potential for growth in Illinois. Since 2009 there has been ongoing and increased interest in shale formations in Illinois, especially the New Albany Shale. Over the last few years, however, activity related to the development of the New Albany Shale has stopped. Some industry representatives interviewed in 2015 cited the uncertainty that surrounded the drafting of the Hydraulic Fracturing Regulatory Act (HFRA) and the eventual regulatory language as impediments to the development on the New Albany Shale. The passing of HFRA also coincided with a decline in oil prices which has continued. Taken together these two developments seem to have resulted in a halt to development of the New Albany Shale Gas Play in

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<sup>38</sup> Illinois Department of Natural Resources. "About Oil And Gas In Illinois,"

<http://www.dnr.illinois.gov/OilandGas/Pages/AboutOilAndGasInIllinois.aspx> (Accessed January 27, 2016).

<sup>39</sup> Macke, D. L. (1995). Illinois Basin Province (064), *in* Gautier, D. L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., ed., 1995 National assessment of United States oil and gas resources--Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS-30, Release 2, one CD-ROM.

Available at: <http://certmapper.cr.usgs.gov/data/noga95/prov64/text/prov64.pdf>.

<sup>40</sup> American Oil and Gas Historical Society. (n.d.) "All Pumped Up – Oilfield Technology," <http://aoghs.org/technology/oil-well-pump/> (Accessed January 27, 2016).

<sup>41</sup> Bauer, R. (2014). "Hydraulic Fracturing, Horizontal Wells & Unconventional Oil/Gas Resources," Illinois State Geological Survey, <http://www.midamericacph.com/wp-content/uploads/2014/03/Bauer-Hydrofracturing-3-12-2014.pdf> (Accessed January 24, 2016).

<sup>42</sup> Macke, D. L. (1995). Illinois Basin Province (064), *in* Gautier, D. L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., ed., 1995 National assessment of United States oil and gas resources--Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS-30, Release 2, one CD-ROM.

Available at: <http://certmapper.cr.usgs.gov/data/noga95/prov64/text/prov64.pdf>.

Illinois.<sup>43</sup> Several industry representatives interviewed, however, remained optimistic about the New Albany Shale's potential, with one respondent comparing the situation in Illinois to successful plays in Oklahoma and North Dakota.<sup>44</sup>

## **3.2 Characteristics of Well Drilling in Illinois**

### **3.2.1 Conventional Well Drilling**

The addition of new wells in Illinois can occur for two main reasons. First, wells may be drilled to search for new, undiscovered oil fields. The second, and more common reason, is that new drilling can occur to expand and enhance fields with existing production. Finding new producing wells is a high-risk endeavor requiring significant amounts of capital with no guarantee of return. To reduce risk, wells are drilled in existing fields where oil is already being produced. Some industry representatives reported that when drilling in existing fields, it is usual to drill on average 2 or 3 dry holes before finding one that can be completed. Finding oil in a new field entails more risk than an existing field. Some industry representatives reported in 2009 that the average number of dry holes for every completed well in a new field is about 10. However, several respondents from the 2015 interviews suggested that the average has dropped to between 5 and 7.<sup>45</sup> Additionally, it is common practice for producers to partner with others and work with investors to minimize risk when drilling new wells. Partners can help with various stages of the production process, including exploration, development, and the sharing of drilling costs.

The average well depth reported by industry representatives in 2009 was approximately 2,500 to 3,500 feet in Illinois.<sup>46</sup> Currently, some wells are being drilled into portions of the Illinois Basin that require a greater depth of 4,000 feet.<sup>47</sup>

### **3.2.2 Horizontal Drilling and Hydraulic Fracturing**

Horizontal drilling can be used for traditional wells and for high-volume hydraulic fracturing in tight geologic formations. Historically, vertical wells have been the most commonly drilled well type in Illinois. However, with improved horizontal drilling technology in the 1980s, the use of horizontal drilling has increased across the country

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<sup>43</sup> Illinois Farmer Today. (December 24, 2015). Illinois Fracking on hold average leases signed, [http://www.illinoisfarmertoday.com/news/regional/illinois-fracking-on-hold-after-leases-signed/article\\_e10e1576-a81d-11e5-9c7b-47d08044ae93.html](http://www.illinoisfarmertoday.com/news/regional/illinois-fracking-on-hold-after-leases-signed/article_e10e1576-a81d-11e5-9c7b-47d08044ae93.html) (Accessed January 30, 2016).

<sup>44</sup> RCF interviews with industry representatives (2015).

<sup>45</sup> *Ibid.*

<sup>46</sup> RCF interviews with industry representatives (2009).

<sup>47</sup> RCF interviews with industry representatives (2015).

and has been used in Illinois. Horizontal drilling involves drilling down and then permeating a layer along a horizontal line, which is sometimes miles long.<sup>48</sup>

Obtaining a horizontal drilling permit for a traditional well in Illinois can take months – much longer than in other states, according to an industry representative. Further, while horizontal drilling for traditional wells continues to hold promise, the cost compared to vertical wells remains high and is another impediment to widespread adoption.

There has been much interest in the potential for high-volume hydraulic fracturing (HVHF) to extract oil and natural gas from the various formations in Illinois. The Illinois Hydraulic Fracturing Regulatory Act (HFRA), which was passed by the Illinois General Assembly in June 2013, with implementing regulations approved in November 2014, defines HVHF in Illinois as using more than 80,000 gallons per stage or more than 300,000 gallons total of hydraulic fracturing fluid.<sup>49</sup>

Under HFRA, companies are now required to register with the Illinois Department of Natural Resources and apply for a permit prior to undertaking any HVHF projects. Since the passing of HFRA, only two companies have registered with the Illinois Department of Natural Resources for HVHF.<sup>50</sup> However, no companies hold a permit for an HVHF well in Illinois. Additional discussion of HFRA and recent developments related to hydraulic fracturing in Illinois can be found in Chapter 6 of this report.

### **3.3 Enhanced Oil Recovery Methods**

There are typically three phases of oil production: primary, secondary, and enhanced oil recovery. During primary recovery, the natural pressure of the reservoir combined with pumping techniques brings the oil to the surface. Only approximately 10 percent of the available oil is captured during primary recovery.<sup>51</sup> Producers in Illinois have historically used the secondary recovery method of water flooding. This method involves injecting water back into the oil producing formation and can often yield an

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<sup>48</sup> Woolsey Companies. "Horizontal Drilling and Hydraulic Fracturing Practices," <http://www.woolseyenergy.com/media/files/WOC-Drilling-Brochure.pdf> (Accessed January 14, 2016).

<sup>49</sup> The complete text of the Illinois Hydraulic Fracturing Regulatory Act can be found at <http://www.ilga.gov/legislation/98/SB/PDF/09800SB1715lv.pdf>

<sup>50</sup> Illinois Department of Natural Resources. Oil and Gas, Approved Registrations, <https://www.dnr.illinois.gov/OilandGas/Pages/ApprovedRegistrations.aspx> (Accessed January 30, 2016).

<sup>51</sup> U.S. Department of Energy. (n.d.). "Enhanced Oil Recovery," <http://energy.gov/fe/science-innovation/oil-gas-research/enhanced-oil-recovery> (Accessed January 24, 2016).

additional 10 percent to 30 percent of available oil. A majority of producers interviewed in 2015 reported continued use of the water flooding method.<sup>52</sup>

Enhanced oil recovery (EOR), also known as tertiary recovery, may be performed to improve oil recovery in mature wells. EOR relies on changing the nature of water and oil which impacts the way it flows through the oil field while retaining the underlying structure of the rock in place.<sup>53</sup> Examples of EOR technologies include: chemical injection such as alkaline-surfactant-polymer flooding (ASP), thermal recovery using steam, and injection of gases such as carbon dioxide.<sup>54</sup>

As of the 2009, EOR techniques had not been widely used in Illinois, according to industry representatives, due to their significantly higher costs. In 2009, several industry representatives expressed interest in EOR using carbon dioxide. However, availability of carbon dioxide and the logistics of delivering it to wells were cited as impediments at the time. A producer interviewed had tried to source carbon dioxide from a local company. Nevertheless, due the inability to transport the carbon dioxide across the small gravel roads used in most Illinois oil fields, the producer was unable to use carbon dioxide method.<sup>55</sup>

As of 2015, little or no EOR using carbon dioxide has taken place by oil producers in Illinois.<sup>56</sup> However, since the 2009 report, the Midwest Geological Sequestration Consortium's (MGSC) has had several successful small-scale projects that used carbon dioxide in the region.<sup>57</sup> In addition to carbon dioxide, methods using nitrogen and chemical injection were cited as holding promise by some industry representatives.<sup>58</sup>

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<sup>52</sup> RCF interviews with industry representatives (2015).

<sup>53</sup> Envirofluid. (2014). "Oil Recovery Techniques - The need for Enhanced Oil Recovery," <https://envirofluid.com/info-library/eor-oil-recover-techniques> (Accessed January 27, 2016).

<sup>54</sup> U.S. Department of Energy. (n.d.). "Enhanced Oil Recovery," <http://energy.gov/fe/science-innovation/oil-gas-research/enhanced-oil-recovery> (Accessed January 24, 2016).

<sup>55</sup> RCF interviews with industry representatives (2009).

<sup>56</sup> RCF interviews with industry representatives (2015).

<sup>57</sup> Frailey, S., Finley, R., & Rupp, J. (2013). "Illinois basin, Midwest carbon dioxide EOR challenges may be surmountable", *Oil and Gas Journal*, <http://www.ogj.com/articles/print/volume-111/issue-1/drilling-production/illinois-basin-midwest-carbon-dioxide.html> (Accessed January 11, 2016).

<sup>58</sup> RCF interviews with industry representatives (2009, 2015).

## **4. Ownership, Employment, and Economic Impact**

This chapter discusses the structure of the oil and gas production industry in Illinois, including trends in employment and wages, and the economic importance of the industry to Illinois. Section 4.1 provides a brief overview of the structure of the oil and gas industry. Section 4.2 presents estimates of employment in oil and gas production (i.e., upstream employment). Section 4.3 presents the geographic distribution of upstream employment by county in Illinois. Section 4.4 discusses firm structure and occupations in oil and gas production. Section 4.5 discusses recent trends in wages by occupations within the oil and gas industry. Section 4.6 presents a discussion of selected downstream activities including: refineries, first purchasers, and transportation of crude oil. Section 4.7 provides figures on mineral lease holders receiving royalty payments in Illinois. Section 4.8 presents estimates of the economic importance of the oil and gas production industry to the Illinois economy.

### **2015 Report Highlights**

Total employment in the oil and gas production industry increased from 4,209 in 2006 to 4,599 in 2013, based on data from the U.S. Census Bureau. According to industry representatives, employment also increased in 2014. However, information from another U.S. Census survey, the Quarterly Census of Employment and Wages, along with recent feedback from industry representatives for 2015 suggests that employment has since decreased. However, we estimate that direct employment in the oil and gas production industry in Illinois remains approximately the same as it was at the time of the last report, approximately 4,200-4,500.

The geographic distribution of employment has also remained relatively stable since the time of the last report. Employment remains concentrated in the southeastern portion of Illinois where production is the strongest. Based on 2013 employment data from U.S. Census Bureau, the oil and gas industry represents an impressive 11 percent of total employment in Lawrence County, 9 percent of total employment in Wayne County, 7 percent of total employment in White County, and approximately 6 percent of total employment in both Jasper and Wabash counties.

Wages for many of the field occupations such as derrick operators, rotary drill operators, service unit operators and roustabouts increased since the 2009 report to an average of over \$18 per hour in 2014. Wages for petroleum engineers and technicians in Illinois have displayed volatility which could be due partly to the low numbers of

employees in these occupations, retirements, and migration of higher skilled employees to locations in the U.S. with higher demand and higher wages.

Illinois has grown as a transportation hub for oil and gas produced across the country. The majority of crude oil shipped by rail throughout the U.S. now passes through the Midwest. After the 2009 report, oil production in the U.S. has increased, resulting in more than 1 million barrels per day of crude oil being moved by train across the U.S. in 2014, a large increase since the last study. Much of the crude-by-rail comes from the Bakken Field in North Dakota to refineries located on the East Coast, resulting in large volumes of crude oil moving through the Midwest region.

Royalty payments to leaseholders and residents owning mineral rights continue to provide economic value and income in Illinois. The number people of receiving royalty payments from oil produced in Illinois is estimated to be over 30,000. During the 2010 to 2012 period, developers began seeking leases related to unconventional shale resource plays. Land leases were secured for over \$300 million, according to industry representatives. The future of these leases and any further development of shale gas resources in Illinois currently remains uncertain due to depressed oil prices and the retarding influence of strict and costly regulations.

Oil and gas production in Illinois continues to be an important driver of employment and revenue for the Illinois economy. Through the ups and downs in oil prices, employment in these industries has remained very stable. This is a great testament to the commitment of local firms engaged in oil production activities, and the stability of those firms in times of plenty and of want.

Estimates from the previous report are used here to demonstrate the continued and steady economic importance of the industry to the state of Illinois. Illinois oil and gas employment in the previous report was found to be 4,209 workers. Because of multiplier effects, an additional 9,843 jobs are estimated to have been created throughout rest of the state, giving a total of 14,052 jobs. Among the additional jobs, the indirect employment effects from purchases by gas and oil firms from firms outside the industry were felt most strongly in professional scientific and technical services, followed by mining itself and administrative and waste services; the induced employment impacts from payments to the to the households working in these firms had the greatest impact in health and social services, followed closely by retail trade, and more distantly in accommodation and food services, all sectors where households spend a good deal of their income. Income impacts are substantial and include a direct impact of \$769 million and a total impact of \$1.29 billion on income with multiplier

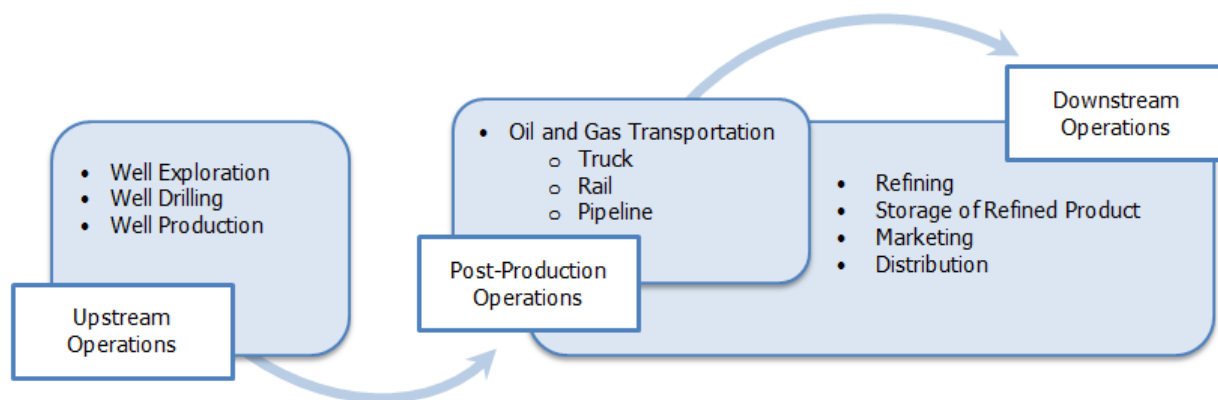
effects. The oil and gas industry also accounted for \$3.04 billion within the industry in direct output impact and \$4.81 billion taking account of multiplier effects.

Approximately \$106 million in Illinois state sales and income tax revenues came from the oil and gas industry's workers. The industry and its suppliers paid \$330 million in state taxes, 72 percent of which were in the form of indirect business taxes, and \$383 million in federal taxes, for a total of \$713 million.

## 4.1 Structure of the Oil and Gas Industry Structure

Activities in the oil and gas industry fall into two categories: upstream and downstream, as shown in Figure 4-1. Upstream activities include oil and gas extraction and directly related support services. Downstream activities include transporting oil from the point of extraction to a refinery by pipeline or tanker truck, plus refining, marketing, and distribution. In addition, owners of mineral rights receive income in the form of royalty payments.

**Figure 4-1. Structure of the Oil and Gas Industry**



## 4.2 Employment Data

Employment data are classified according to the North American Industry Classification System (NAICS), which is used for all industries in the U.S. The industry categories used in both this report and the 2009 report include: Oil and Gas Extraction (NAICS 21111), Drilling Oil and Gas Wells (NAICS 213111), and Support Activities for Oil and Gas Operations (NAICS 213112). These industries represent the upstream sectors (Figure 4-1 above) of oil and gas production and refer to the activities of crude oil and gas producers plus support activities required for production. The definition of each



industry sector was obtained from the U.S. Census Bureau and is described in more detail below.<sup>59</sup>

Three sources of data classified by the NAICS categories mentioned in the preceding paragraph were used in this report and the 2009 report. The first two sources are available from the U.S. Census Bureau and provide annual information on: (1) employees who work for firms, plus (2) independent contractors who do not work for firms. These two sources together provide a complete picture of direct employment annually, but the release of these data is delayed by two years. A second source, available from the U.S. Bureau of Labor Statistics (BLS), provides a more recent estimate of employment and is a source of monthly employment data; however, these data only cover employees who work for firms, excluding independent contractors which account for approximately half of the people working in the industry. The BLS data are used to gain an understanding of seasonal fluctuations based on monthly data and more recent trends over time for employment in the oil and gas production industry in general.

#### NAICS 21111 Oil and Gas Extraction

This industry consists of establishments primarily engaged in operating and/or developing oil and gas field properties and establishments primarily engaged in recovering liquid hydrocarbons from oil and gas field gases. Such activities may include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operation of separators, emulsion breakers, desilting equipment, and field gathering lines for crude petroleum and natural gas; and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. This industry includes the production of crude petroleum, the mining and extraction of oil from oil shale and oil sands, the production of natural gas, sulfur recovery from natural gas, and the recovery of hydrocarbon liquids from oil and gas field gases. Establishments in this industry operate oil and gas wells on their own account or for others on a contract or fee basis.

#### NAICS 213111 Drilling Oil and Gas Wells

This industry consists of establishments primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding in, drilling in, redrilling, and directional drilling.

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<sup>59</sup> U.S. Census Bureau North American Industry Classification System, 2012 Definitions. <http://www.census.gov/eos/www/naics/>. (Accessed January 29, 2016).

## NAICS 213112 Support Activities for Oil and Gas Operations

This industry consists of establishments primarily engaged in performing support activities on a contract or fee basis for oil and gas operations (except site preparation and related construction activities). Services included are exploration (except geophysical surveying and mapping); excavating slush pits and cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; acidizing and chemically treating wells; and cleaning out, bailing, and swabbing wells.

### **4.2.1 U.S. Census Bureau: County Business Patterns (CBP) Survey and Nonemployer Statistics Data**

The first two sources of employment data, from the U.S. Census Bureau, include the County Business Patterns (CBP) survey<sup>60</sup> and Nonemployer Statistics<sup>61</sup> data. These sources gather data on employees who work for firms, and also employees who work for themselves, or independent contractors, on an annual basis. The most recent data available for both sources are 2013, as shown in Figure 4-2. The CBP survey presents employment counts as of March 12<sup>th</sup> of each year, which means that seasonal variations in employment present in the oil and gas production industry are not captured. The Nonemployer Statistics data series uses information from tax returns. Unfortunately, there is a two-year lag in the release of data for both of these data sources.

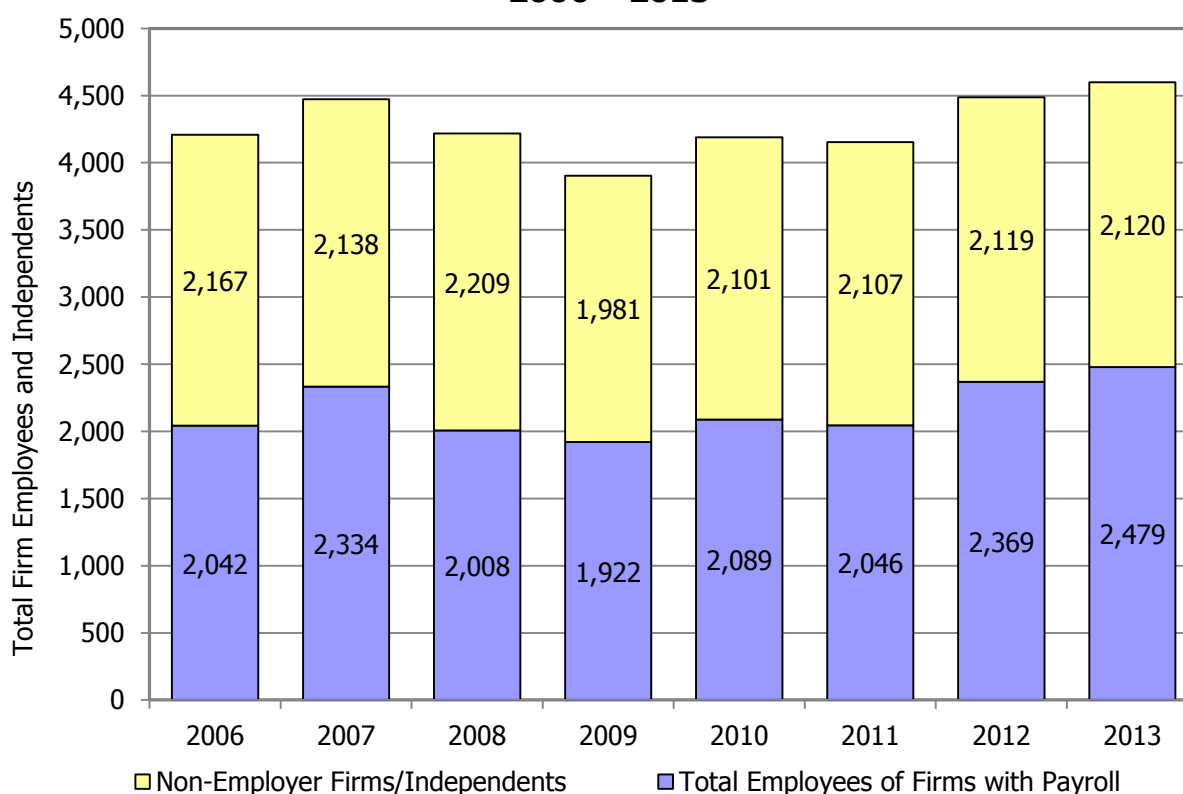
CBP employment data for 2006 through 2013 are presented below in Figure 4-2. In 2013, there were 349 firms in the oil and gas production industries reporting employment of 2,479 workers in Illinois. An additional 2,120 workers were engaged in oil and gas production as independent contractors. Together, the total estimated employment in 2013 was 4,599. At the time of the 2009 report, the most recent year of employment data available at the county level in Illinois was 2006. In 2006 there were 342 firms reporting employment of 2,042 workers in Illinois oil and gas production, with an additional group of 2,167 independent contractors resulting in a total of 4,209 individuals working in the oil and gas industry. As shown in Figure 4-2, approximately 50 percent of oil and gas production employment occurs in the category consisting of independent contractors over the period 2006 to 2013.

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<sup>60</sup> U.S. Census Bureau. County Business Patterns. <http://www.census.gov/econ/cbp>. and U.S. Census Bureau. Nonemployer Statistics. <http://www.census.gov/econ/nonemployer/> (Accessed January 29, 2016).

<sup>61</sup> Nonemployer Statistics is an annual data series for businesses that have no paid employees and are subject to federal income tax. Most nonemployers are self-employed individuals operating unincorporated businesses (known as sole proprietorships). For more information see <http://www.census.gov/econ/nonemployer/>.

**Figure 4-2. Total Firm Employees (blue) and Independent Contractors (yellow) Working in Oil and Gas Production in Illinois  
2006 – 2013**



Source: U.S. Census Bureau. County Business Patterns and Nonemployer Statistics.<sup>62</sup>

#### **4.2.2 U.S. Bureau of Labor Statistics: Quarterly Census of Employment and Wages**

The third data source is the Quarterly Census of Employment and Wages (QCEW)<sup>63</sup> report from the U.S. Bureau of Labor Statistics (BLS) which publishes data on quarterly and annual averages for employees who work for firms. The most recent QCEW data, published as of June 2015, are presented in Figure 4-3. Although the QCEW report is updated more frequently, it does not present a complete picture of the industry because information is not available on employment by independent contractors. This is a problem because independent contractors make up approximately 50 percent of employment in the oil and gas production industry in Illinois.

<sup>62</sup> U.S. Census Bureau. County Business Patterns. <http://www.census.gov/econ/cbp>; U.S. Census Bureau. Nonemployer Statistics. <http://www.census.gov/econ/nonemployer/>. (Accessed January 29, 2016).

<sup>63</sup> QCEW is a national database of business establishment data submitted quarterly from Unemployment Insurance (UI) tax files and includes information on monthly employment. QCEW monthly employment data represent the number of covered workers who worked during, or received pay for, the pay period that included the 12th day of the month.

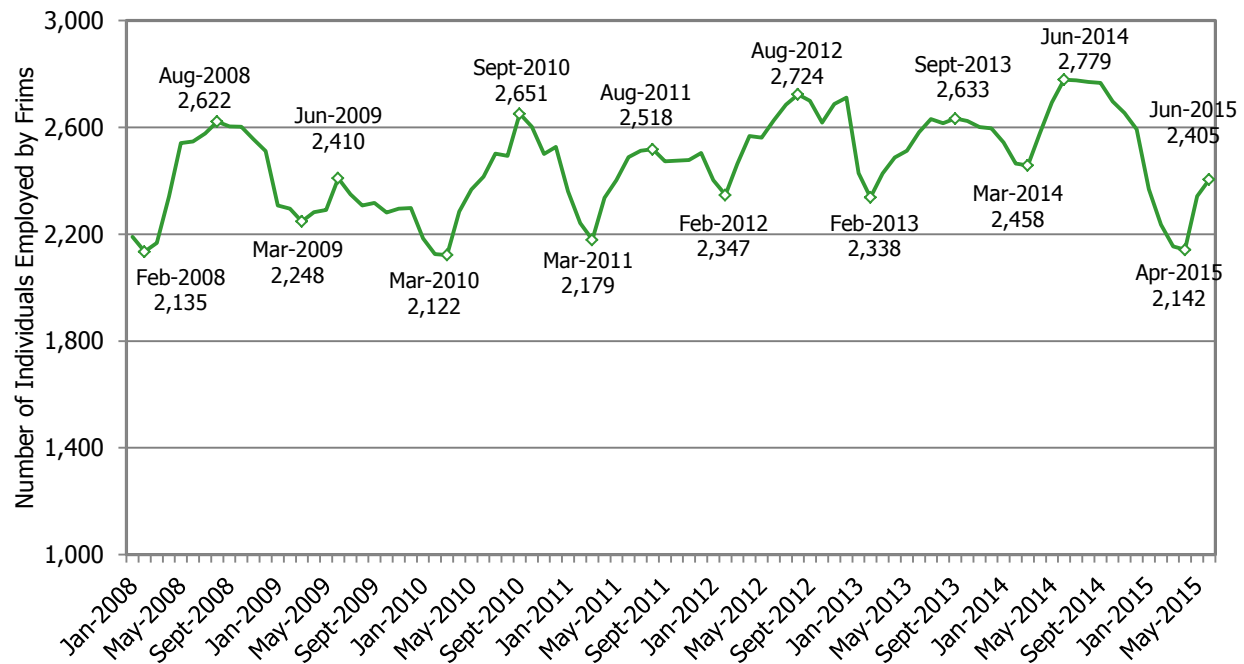
However, QCEW data are useful in understanding seasonal fluctuations and more recent trends over time for employment in the oil and gas production industry. The monthly data reveal a seasonal trend with dips typically occurring in February and March and peaks typically occurring in summer months. Minimum employment and maximum employment are denoted for each year in Figure 4-3. Over the time period presented, monthly employment peaked at 2,779 in June 2014. The minimum occurred at 2,135 in February 2008.

Employment generally trended upwards from 2010 to 2014. However, beginning in early 2015, the trend appears to have reversed. This finding is consistent with comments obtained in 2015 interviews of industry representatives who noted that employment in 2015 might be closer to 2009 levels due to the downward trend in oil prices.<sup>64</sup> The same result can be seen in Figure 4-3 where June of 2009 and June of 2015 are within 5 jobs of each other. Given the drop in oil prices from approximately \$107 per barrel in June 2014 to approximately \$59 per barrel in June 2015, employment appears to have held up very well through the last available data as of June 2015.

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<sup>64</sup> RCF interviews with industry representatives (2015).

**Figure 4-3. Monthly Firm Employees in Illinois Oil and Gas Production  
2008 – June 2015**



Source: Bureau of Labor Statistics. Quarterly Census of Employment and Wages.<sup>65</sup>

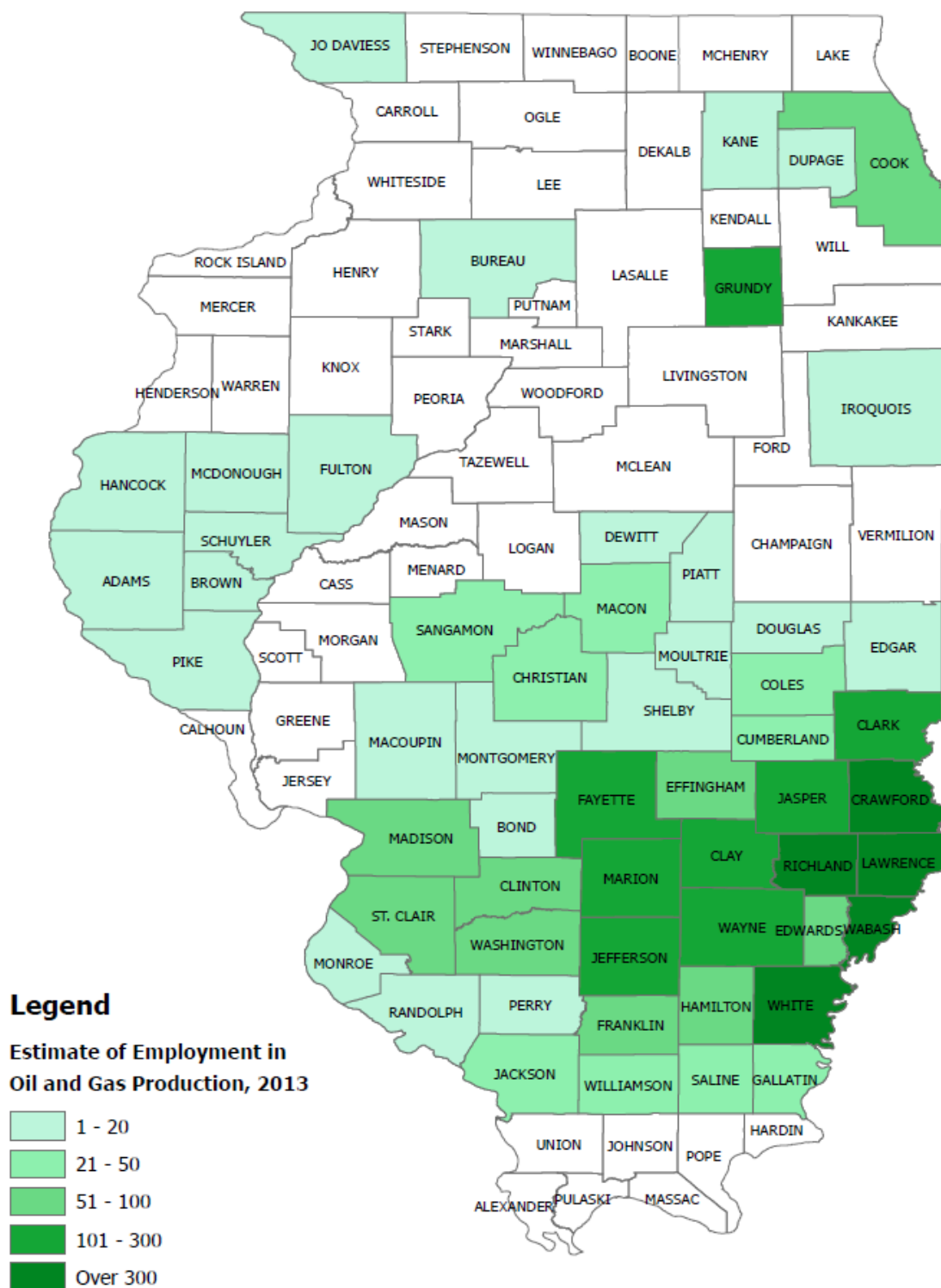
### 4.3 Geographic Distribution of Upstream Employment

Employment in oil and gas production in Illinois occurs throughout the entire state, and direct employment in Illinois oil production, including drilling and support services, is not limited to the counties where oil is extracted. Figure 4-4 shows total employment by county (firm employees plus independents) in oil and gas production for 2013.<sup>66</sup> As shown in Figure 4-4, the majority of those employed in oil and gas production live in the southeastern portion of the state where most of the oil production in Illinois occurs.

<sup>65</sup> U.S. Bureau of Labor Statistics. Quarterly Census of Employment and Wages. <http://www.bls.gov/cew/data.htm>. (Accessed January 29, 2015).

<sup>66</sup> County level employment data was obtained from County Business Patterns and Nonemployer Statistics for three NAICS sectors: 21111, 213111, 213112. For some sectors and counties, the source data is suppressed. In these instances, ranges were calculated for each county-sector based on the number of firms and firm size. The sectors were then aggregated and, when necessary, the midpoint of the aggregated ranges was used to generate the data underlying Figures 4-4 and 4-5.

**Figure 4-4. Firm Employees Plus Independents in Oil and Gas Production  
In Illinois Counties, 2013**



Sources: U.S. Census Bureau. County Business Patterns and Nonemployer Statistics.<sup>67</sup>

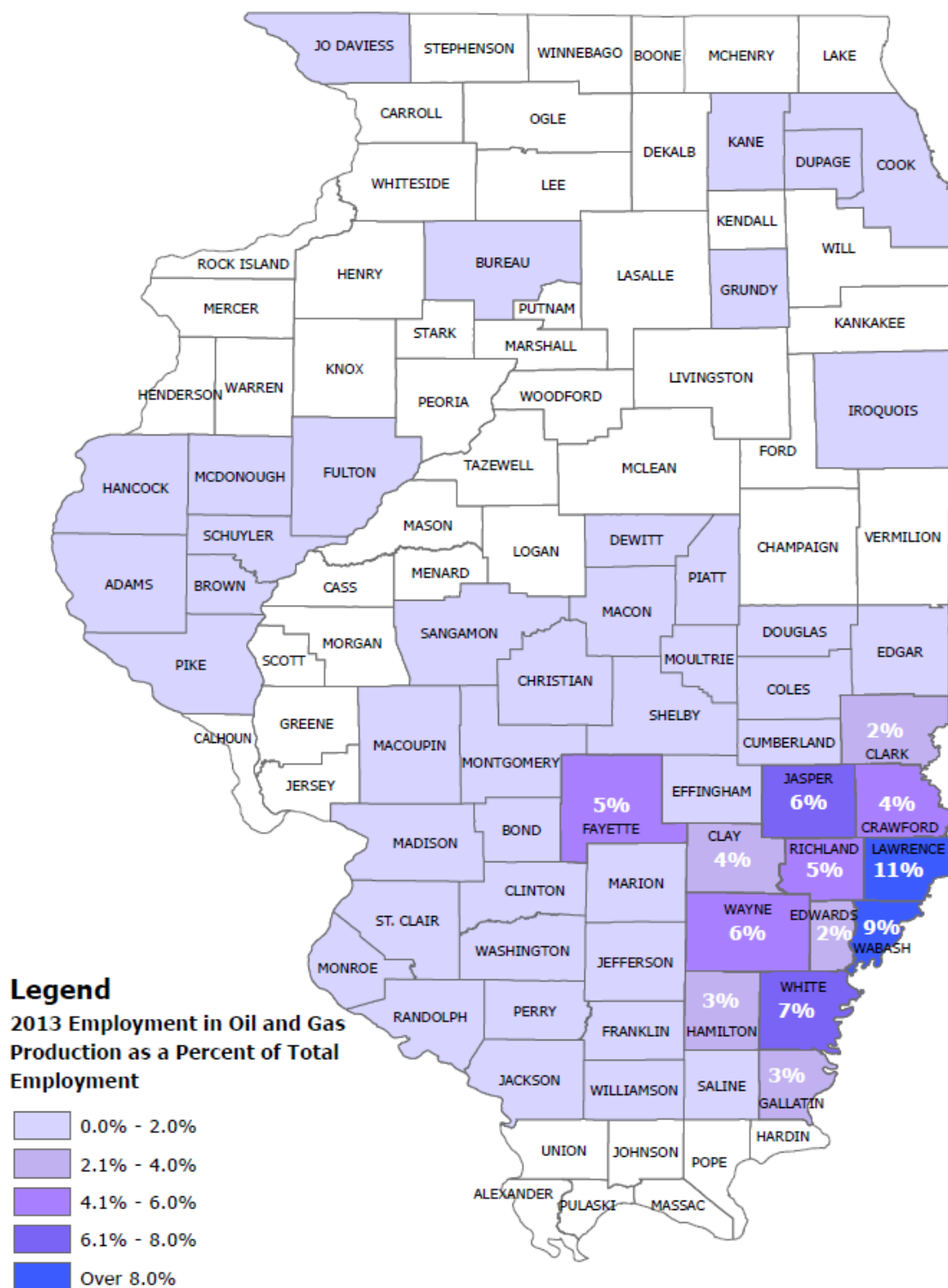
<sup>67</sup> U.S. Census Bureau. County Business Patterns. <http://www.census.gov/econ/cbp/>; U.S. Census Bureau. Nonemployer Statistics. <http://www.census.gov/econ/nonemployer/>. (Accessed January 29, 2016).

Employment in the oil and gas production industry plays an especially important role in several counties in Illinois. As shown in Figure 4-5, employment in oil and gas production is most prominent in Lawrence County where oil and gas production industry is estimated to represent 11 percent of total employment. This is followed closely by Wabash County where the oil and gas production industry is estimated to represent 9 percent of total employment. Finally, the estimated share of total employment that is in oil and gas production for White County, Jasper County, and Wayne County is 7 percent, 6 percent, and 6 percent, respectively.<sup>68</sup>

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<sup>68</sup> County level employment data was obtained from County Business Patterns and Nonemployer Statistics for three NAICS sectors: 21111, 213111, 213112. For some sectors and counties, the source data is suppressed. In these instances, ranges were calculated for each county-sector based on the number of firms and firm size. The sectors were then aggregated and, when necessary, the midpoint of the aggregated ranges was used to generate the data underlying Figures 4-4 and 4-5.

**Figure 4-5. Firm Employees plus Independents in Oil and Gas Production as a Percentage of Total Employment for Counties with Oil Production, 2013**



Sources: U.S. Census Bureau. County Business Patterns and Nonemployer Statistics.<sup>69</sup>

<sup>69</sup> U.S. Census Bureau. County Business Patterns. <http://www.census.gov/econ/cbp/>; U.S. Census Bureau. Nonemployer Statistics. <http://www.census.gov/econ/nonemployer/>. (Accessed January 29, 2016).

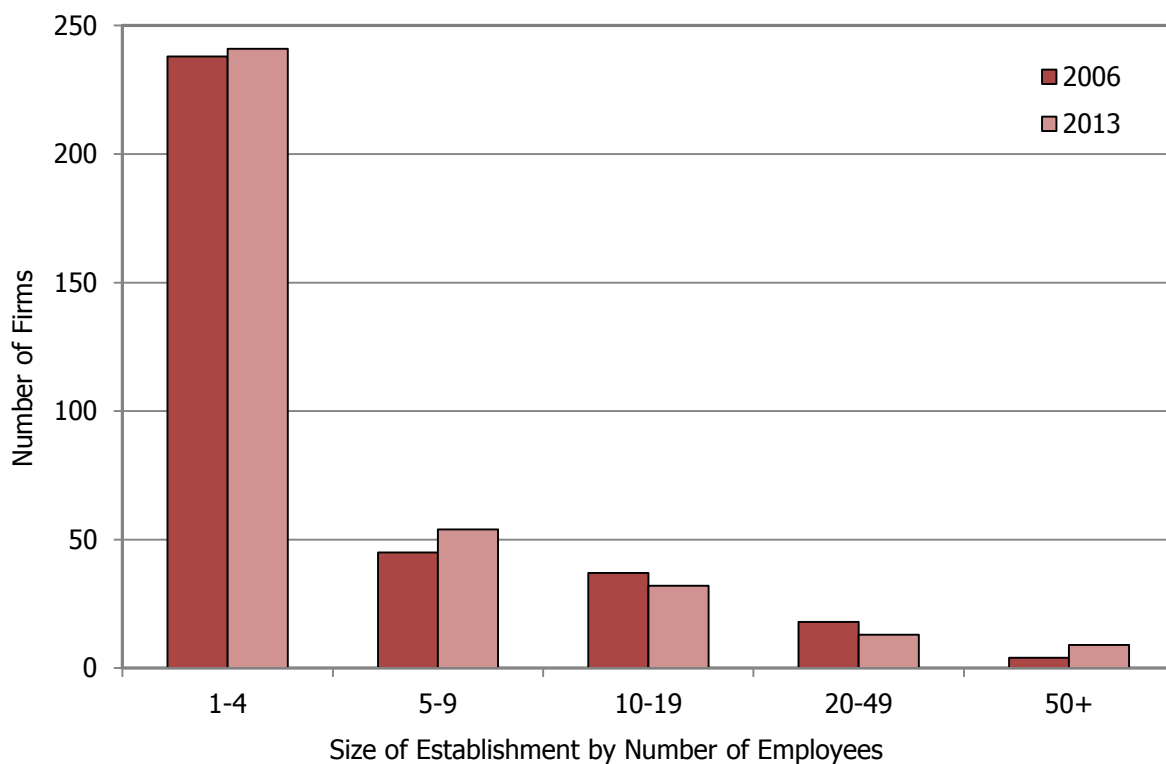


## 4.4 Firm Structure and Occupations

### 4.4.1 Employment by Firms

Data on the number of people employed by the size of the firm for 2006 and 2013 is presented below in Figure 4-6.<sup>70</sup> Firms engaged in oil and gas production in Illinois are primarily small businesses, with a few mid-sized to larger companies. In addition, nearly one-half of workers in the oil and gas industry are independent owner/operators or independent contractors, which are not represented in Figure 4-6. In Illinois, many of the small businesses involved in the oil and gas production industry have long histories and have been family-operated for several generations.<sup>71</sup> Overall, the distribution of employment by firm size remained similar between 2006 and 2013.

**Figure 4-6. Illinois Oil and Gas Production Employment by Firm Size, 2006 and 2013**



Source: U.S. Census Bureau. County Business Patterns.

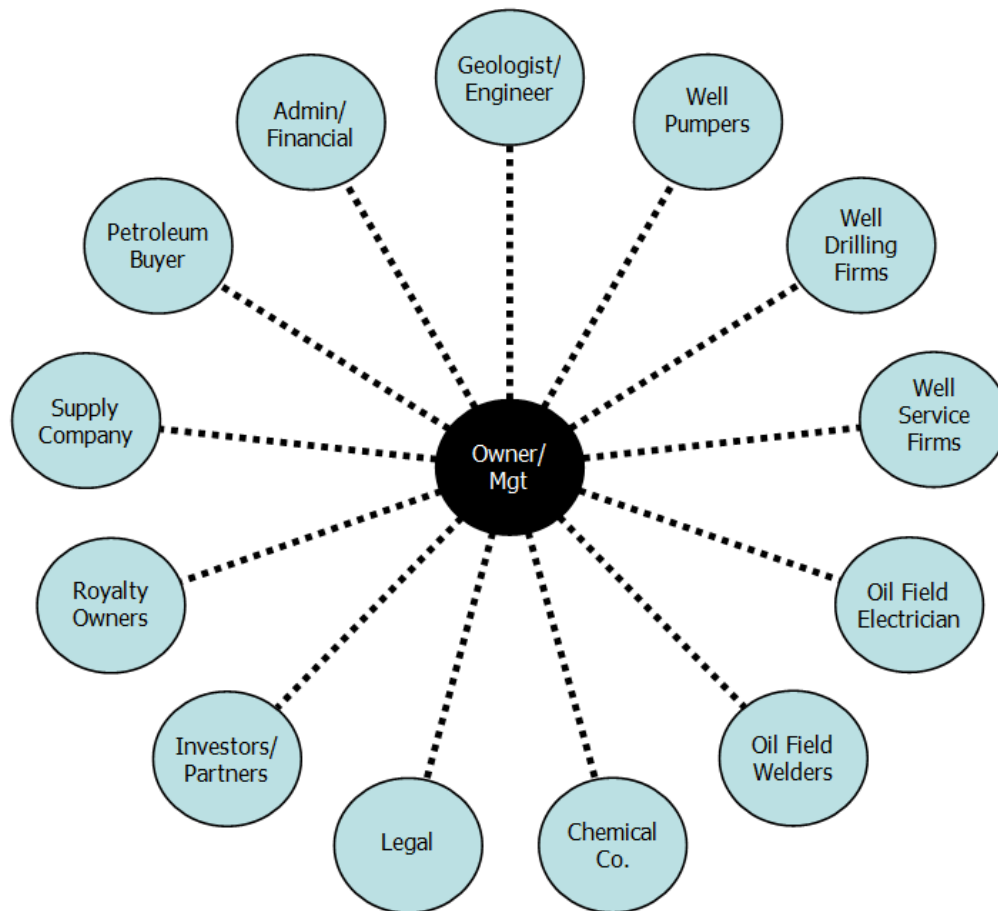
<sup>70</sup> U.S. Census Bureau. County Business Patterns. <http://www.census.gov/econ/cbp> (Accessed January 29, 2016).

<sup>71</sup> RCF interviews with industry representatives (2009).

#### 4.4.2 Occupational Distribution

While the majority of exploration and production companies in Illinois are small, the types of occupations and functions needed are similar, regardless of firm size. According to industry interviews, larger firms generally have greater numbers of in-house employees, but do tend to hire outside companies for various tasks.<sup>72</sup> Smaller production firms may have a very limited staff of a few administrative and accounting employees who may or may not be full-time. These small production firms hire most assistance on an as-needed basis. Figure 4-7 shows typical job functions utilized by firms in the oil and gas production industry.<sup>73</sup>

**Figure 4-7. Individuals and Companies Involved in Oil Production**



Source: RCF interviews with industry representatives (2009, 2015).

<sup>72</sup> RCF interviews with industry representatives (2009).

<sup>73</sup> *Ibid.*

Drilling, well completion, and pumpers are an integral part of the exploration and production of oil and natural gas in Illinois. Drilling companies are used to drill the wells, and a well completion company finishes the well once a producing well is located. Drilling companies typically have a few administrative and office workers, with the majority of employees in the field. Specific truck-mounted rigs are used for drilling wells, and different truck mounted rigs called “spudder rigs” are used for finishing and servicing wells later. All equipment is mobile and requires specialized maintenance to keep it operational.

Once a well is operational, well pumpers are needed to check each well on a daily basis. These pumpers may be full-time employees or independent contractors. If a well needs servicing that the pumpers cannot perform themselves, then service and repair companies are hired on an as-needed basis. In general, the mid-sized and larger companies may have a few pumpers who work full time, and they also may hire part-time contract pumpers to service wells that are located farther away from their main locations. Small firms and independent producers typically have several contract pumpers who are paid on a per-well-per-month basis to perform the daily activities needed for each well. Some small independent producers act as pumpers for their own wells. Examples of some of the service companies used from time to time include oil field welders, chemical companies, oil field electricians, and well pump mechanics, to name a few.

Contract geologists and engineers may be hired when new wells are drilled. Geologists or petroleum engineers are often independent contractors who work for different clients rather than being employed full-time by one company. Well owners and firms involved in production also purchase supplies from outside supply companies.<sup>74</sup>

#### **4.4.3 Education and Training**

Occupations and training requirements vary widely for workers in oil and gas exploration and production, and in the businesses that support the production industry. Owners and employees at the management level typically have college degrees in geology, engineering, or business. For the majority of workers in the exploration and production business, training occurs on the job. Drillers typically start working as a “helper” and move up in drilling crew ranks over time. Field supervisors and pumpers are usually workers who have been in the business for several years.

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<sup>74</sup> RCF Interviews with industry representatives (2009, 2015).

#### 4.4.4 Generational Gap in Labor

The age distribution of workers in exploration and production is complex, and has been influenced significantly over time by variations in the price of oil and major changes in the structure of the industry in Illinois. Prior to the late 1980s, many of the major national oil companies had significant operations in Illinois. This provided good opportunities for skilled labor and support service companies. In the 1980s, the combination of downward directions of both oil prices and oil production, in tandem with the exiting of major oil companies in the late 1980s resulted in a decline in demand for skilled labor and decreased opportunities for some service companies. Many workers left the industry for more stable positions, and few new workers entered the industry. Oil prices stayed low through the 1980s, and when prices dipped again in the late 1990s, many workers exited the industry permanently.<sup>75</sup>

As prices and demand increased in the early 2000s, there was a shortage of workers with experience in the industry. As a result, it was reported during the 2009 interviews that the average age of those who remained in leadership and skilled labor positions was advancing and that in some cases individuals involved were preparing to retire. After retirement, many people remain active through partnering and investing in new wells or through previous investments with mineral rights ownership that generate royalty income. The 2009 interviews also noted that relatively young workers were being employed by larger firms; however, the same was not true for small and mid-sized companies which reported having a difficult time finding relatively young workers.<sup>76</sup>

Since 2009, crude oil prices generally rose from early 2009 to mid-2011 before settling between \$85 and \$110 between mid-2011 and late 2014 (see Section 5.1, Figure 5-1 for more discussion on oil prices). During the 2015 interviews, some industry representatives reported that the increase in crude oil prices attracted younger employees to the industry and employers could afford to hire and train them. Because of this, some industry representatives noted that average age may have come down. In addition, some workers are starting to retire which reduces the overall average age. Nonetheless, the generational gap is still present as noted by some industry representatives.<sup>77</sup>

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<sup>75</sup> RCF interviews with industry representatives (2009).

<sup>76</sup> *Ibid.*

<sup>77</sup> RCF Interviews with industry representatives (2015).

## 4.5 Wages by Occupation

Wage data were collected from U.S. Department of Labor Occupational Employment Statistics (OES) Survey. The OES survey is conducted through a semi-annual mail survey designed to produce estimates of employment and wages for specific occupations. Data from self-employed persons are not collected and are not included in OES survey estimates. The OES survey benchmarks employment data to an average of the May and November employment levels. All wage data presented below were converted to 2015 dollars using unadjusted All Urban Consumers CPI data collected from the U.S. Bureau of Labor Statistics.<sup>78</sup>

For oil and gas production, data were collected for Illinois for the following occupational codes: 47-5011 Derrick operators, oil and gas, 47-5012 Rotary drill operators, oil and gas, 47-5013 Service unit operators, oil, gas, and mining, and 47-5071 Roustabouts, oil and gas. Figure 4-8 presents average real wage data in the oil and gas production industry from 2007 through 2014.<sup>79</sup> The average wage is weighted by the number employed in each occupation. As shown in Figure 4-8, the average real wage reached a minimum in 2011 at \$15.94 per hour. During this time, the economy was still in the midst of the Great Recession and the national unemployment rate was over 9 percent.<sup>80</sup> In the general economy there was a large labor supply but not an abundance of jobs which dampened wages overall. The average real wage has since recovered and stood at \$18.35 per hour in 2014.

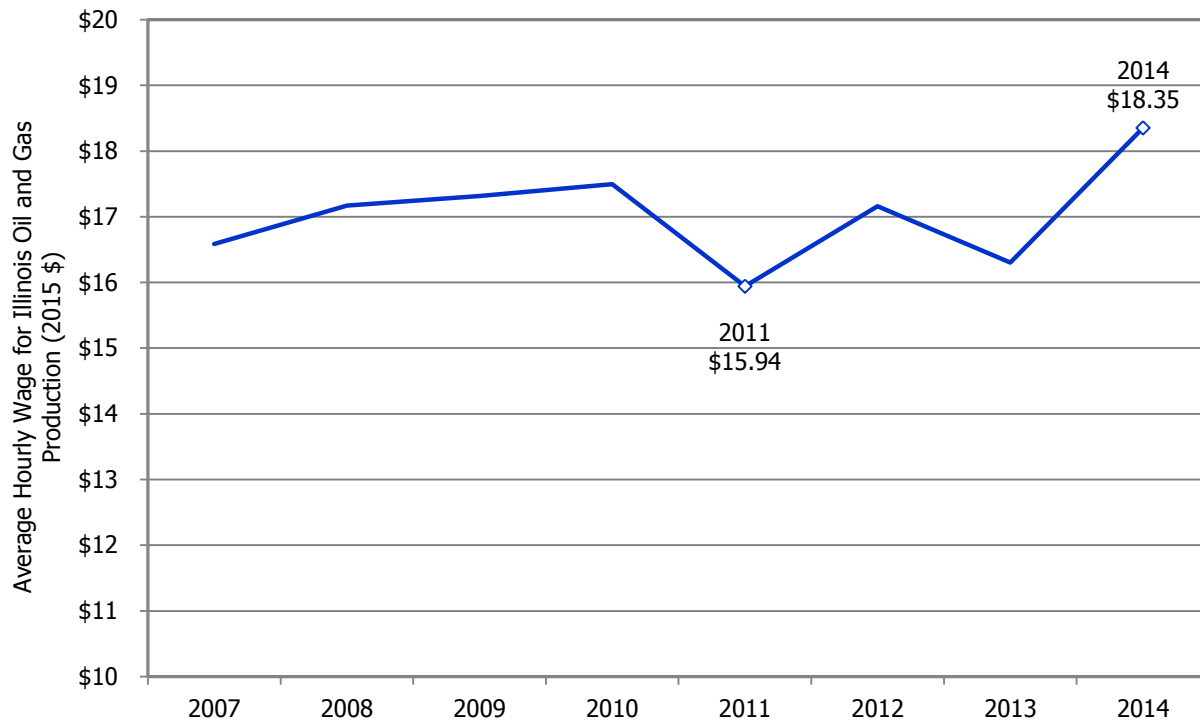
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<sup>78</sup> U.S. Department of Labor, Bureau of Labor Statistics. Databases, Tables, & Calculations by Subject. <http://www.bls.gov/data/> (Accessed January 29, 2016).

<sup>79</sup> U.S. Department of Labor, Bureau of Labor Statistics, Occupational and Employment Statistics. <http://www.bls.gov/oes/tables.htm> (Accessed January 29, 2016).

<sup>80</sup> U.S. Department of Labor, Bureau of Labor Statistics. Labor Force Statistics from the Current Population Survey. Databases, Tables & Calculations by Subject. <http://data.bls.gov/timeseries/LNS14000000>. (Accessed January 13, 2016).

**Figure 4-8. Average Hourly Wage for Occupations in Illinois Oil and Gas Production (2015 dollars)<sup>81</sup>**



Source: U.S. Department of Labor, Bureau of Labor Statistics, Occupational and Employment Statistics.

Wages for petroleum engineers and technicians in Illinois demonstrated volatility since the 2009 report. While this was true for professionals in Illinois, the nation as a whole was experiencing high demand for these positions due to the increase use of unconventional drilling methods as well as offshore drilling. By 2012, the oil boom and increased use of unconventional methods used for oil extraction led to a shortage of petroleum engineers in the national economy. This shortage placed a premium on industry veterans who had more experience managing drilling projects.<sup>82</sup> In general, the relatively high crude oil price led to an increased demand for more skilled engineers.<sup>83</sup> Average wages for petroleum engineers and technicians in Illinois have displayed volatility which could be due to the low numbers of employees in these occupations, retirements and/or migration of higher skilled employees to locations in the U.S. with higher demand and higher wages.

<sup>81</sup> 47-5011 Derrick operators, oil and gas, 47-5012 Rotary drill operators, oil and gas, 47-5013 Service unit operators, oil, gas, and mining, and 47-5071 Roustabouts, oil and gas.

<sup>82</sup> Reuters. In oil boom, petroleum engineers hottest commodity. Published Jan 18, 2012. <http://www.reuters.com/article/us-energy-jobs-idUSTRE80H1GQ20120118>. (Accessed January 13, 2016).

<sup>83</sup> Bureau of Labor Statistics. Occupational Outlook Handbook. Petroleum Engineers. <http://www.bls.gov/ooh/architecture-and-engineering/petroleum-engineers.htm>. (Accessed January 13, 2016).

## 4.6 A Discussion of Selected Downstream Activities

Although the downstream employment in the oil and gas industry in Illinois is outside the scope of this study, they are interdependent on oil and gas production. Downstream activities include refiners, first-purchasers, and pipelines and transportation. A brief discussion of oil and gas downstream activities in Illinois is provided below.

### 4.6.1 Refiners

Illinois has the largest crude oil refining capacity in the Midwest and is fourth in the nation after Texas, Louisiana, and California. However, the majority of oil refined in Illinois is from other parts of the country. With regard to refining, Illinois has four refineries with a total capacity of 962,540 barrels per day (bpd) as of 2015,<sup>84</sup> which is much larger than the roughly 26,000 bpd of crude oil currently produced in Illinois. The largest refinery in Illinois is the Wood River refinery in southwestern Illinois near St. Louis, Missouri.<sup>85</sup> Illinois refineries process domestic crude oil as well as Canadian and other foreign crude oils.<sup>86</sup> The largest refiner of oil produced in Illinois is CountryMark, which is a cooperative-owned refinery in Indiana.<sup>87</sup>

### 4.6.2 First Purchasers

There are currently six petroleum marketers, or first purchasers of Illinois crude oil. A first purchaser is anyone who buys crude oil or Illinois gas from a producer. A first purchaser can be a refiner or an intermediary purchaser of oil and gas from the field who transports to a refiner. First purchasers issue payments to producers and mineral rights owners, as well as send gross revenue tax funds to the state. The number of first purchasers of oil produced in Illinois has declined since the 1980s, when there were approximately fifteen first purchasers.<sup>88</sup> One of the major first purchasers in Illinois is CountryMark which takes approximately two-thirds of all crude oil produced in Illinois, and 80 percent of all oil produced in the tri-state Illinois Basin.<sup>89</sup>

### 4.6.3 Transportation and Pipelines

Crude oil produced in Illinois is primarily transported by truck to a refinery but some is also transported by pipeline. Truck drivers move between oil fields in Illinois, picking up oil and transporting it to a refinery. Some refineries and first purchasers employ people to transport oil from oil fields to refiners. For example, being a first

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<sup>84</sup> U.S. Energy Information Administration. Petroleum and Other Liquids. Number and Capacity of Petroleum Refineries. [http://www.eia.gov/dnav/pet/pet\\_pnp\\_cap1\\_dcu\\_SIL\\_a.htm](http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_SIL_a.htm). (Accessed January 29, 2016).

<sup>85</sup> U.S. Energy Information Administration. Illinois State Energy Profile. <https://www.eia.gov/state/print.cfm?sid=IL>. (Accessed January 29, 2016).

<sup>86</sup> *Ibid.*

<sup>87</sup> RCF interviews with industry representatives (2009, 2015).

<sup>88</sup> Illinois Oil and Gas Association. Illinois. State Profile and Energy Estimates. <https://www.eia.gov/state/analysis.cfm?sid=IL>. (Accessed January 25, 2016).

<sup>89</sup> RCF interviews with industry representatives (2009).

purchaser, CountryMark also has employees that live and work in Illinois, performing duties related to pipelines or drive trucks to pick up oil.

Illinois is also a key transportation hub in the national network of both pipeline and rail transport of crude oil and natural gas moving throughout North America. Table 4-1 reports data on Illinois pipeline mileage by commodity transported.<sup>90</sup> Overall, pipeline mileage increased between 2009 and 2014. In both years the majority of the pipelines in Illinois transported natural gas, followed by refined products. Approximately 15 percent of Illinois pipelines carried crude oil in 2014, only a small fraction of which is produced in Illinois.

**Table 4-1. Illinois Pipeline Statistics**

| Commodity  | 2009 Transmission Mileage by Commodity |             | 2014 Transmission Mileage by Commodity |                  |
|--|--|-------------|--|------------------|
|  | Mileage                                | Percent     | Mileage                                | Percent          |
| Crude Oil  | 1,808                                  | 11%         | 2,577                                  | 15%              |
| Natural Gas  | 9,060                                  | 55%         | 9,422                                  | 55%              |
| Refined Products   | 3,326                                  | 20%         | 3,702                                  | 22%              |
| Highly Volatile Liquids (HVL), Flammable, and Toxic Liquids <sup>a</sup> | 1,586                                  | 10%         | 1,387                                  | 8%               |
| Nitrogen   | 225                                    | 1%          | N/A <sup>b</sup>                       | N/A <sup>b</sup> |
| Empty Liquid   | 404                                    | 2%          | N/A <sup>b</sup>                       | N/A <sup>b</sup> |
| <b>Total</b>   | <b>16,409</b>                          | <b>100%</b> | <b>17,088</b>                          | <b>100%</b>      |

Source: U.S. DOT, Office of Pipeline Safety.

<sup>a</sup> Includes anhydrous ammonia, liquid petroleum gas, and natural gas liquids

<sup>b</sup> Nitrogen and empty liquid indicate that the pipeline is idle. These two categories are not reported separately for 2014 but are included under the commodity group the pipeline most recently transported.

In addition to transportation of oil by pipeline, the majority of crude oil shipped by rail throughout the U.S. now passes through the Midwest.<sup>91</sup> Since the 2009 report, oil production in the U.S. has increased resulting in more than 1 million barrels of crude oil being moved by train across the U.S. every day in 2014.<sup>92</sup> Figure 4-9 illustrates the change in the regional distribution of crude-by-rail movements between 2010 and 2014.<sup>93</sup> Much of the crude-by-rail is from the Bakken field in North Dakota to refineries

<sup>90</sup> U.S. DOT, Office of Pipeline Safety, <https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages> (Accessed January 26, 2016).

<sup>91</sup> Chicago Tribune. Chicago at heart of crude oil shipments data show. <http://www.chicagotribune.com/news/local/ct-oil-train-new-data-met-20150403-story.html> (Accessed January 25, 2016).

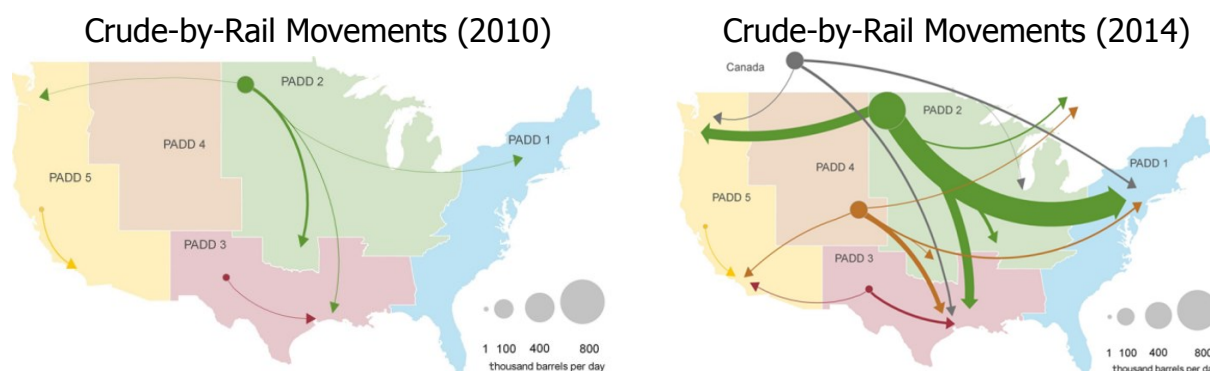
<sup>92</sup> U.S. Energy Information Administration. Today in Energy. New EIA monthly data track crude oil movements by rail. [https://www.eia.gov/todayinenergy/detail.cfm?id=20592#tabs\\_Slider-5](https://www.eia.gov/todayinenergy/detail.cfm?id=20592#tabs_Slider-5). (Accessed January 25, 2016).

<sup>93</sup> *Ibid.*



located on the East Coast, resulting in large volumes of crude oil moving through the Midwest region.

**Figure 4-9. Crude-by-Rail Movements 2010 and 2014**



Source: U.S. Energy Information Administration.

## 4.7 Leaseholders and Illinois Residents Receiving Royalty Income

When minerals are extracted from the earth by entities other than the owner of the mineral rights, a royalty payment is given in exchange for the mineral extracted. Often, the property owner is the mineral rights owner. However, in Illinois, regulations exist that allow the severing of mineral rights ownership from property ownership. Because property and mineral rights are transferable and inheritable, the number of people receiving leasehold and royalty income from oil and gas extraction in Illinois is significant. While the number of direct employees in extraction and production activities was 4,599 in 2013 based on U.S. Census data, the number of people receiving annual leasehold and royalty income payments in Illinois was estimated to be over 30,000.<sup>94</sup> Leaseholder and royalty income payments are also issued to people living outside of Illinois. Leaseholder and royalty payments, both for Illinois residents and for those living outside of Illinois can be an important source of income. Leaseholder and royalty payments are also an important source of government income tax revenue.

During 2010 to 2012, resource players began seeking leases related to the development of unconventional resource plays. Land leases were secured for over \$300 million according to industry representatives.<sup>95</sup> The future of these land leases and any further development of shale gas resources in Illinois remains uncertain. As discussed further in Chapter 6, the fall in oil prices and the implementation of regulations on shale gas development have resulted in many of these leases currently going unused by oil and gas producers.

<sup>94</sup> RCF interviews with industry representatives. (2009).

<sup>95</sup> RCF interviews with industry representatives. (2015).

## **4.8 Contribution of Oil and Gas Production to the Illinois Economy**

The oil and gas production industry in Illinois continues to be an important driver of employment and revenue for the Illinois economy. Through the ups and downs in oil prices, employment in these industries has remained very stable. This is a great testament to the commitment of local firms engaged in oil production activities, and the stability of those firms in times of plenty and of want.

The economic impact of the oil and gas industry in Illinois was last quantified in the predecessor 2009 report. In view of stability of employment level, a new impact analysis was not conducted for this report. Instead, estimates from the previous report are used to demonstrate the importance of the industry in Illinois. For more details, the reader is referred to the 2009 report.<sup>96</sup>

### **4.8.1 Overview of Economic Impact Methodology**

Spending by the oil and gas industry in Illinois affects the state's economy initially through the direct purchases of materials, payments for labor services and rentals of equipment for use in the industry. The suppliers of these goods and services to the oil and gas industry spend money paid them by the oil and gas industry in a first round of supply chain spending, generating indirect impacts in other industries. After the first round, the industries paid in the first round make payments to a second round of industries as they increase their production with their own particular needs from other industries, which leads to a third round, and then a fourth round. And so forth on to a point where the rounds become infinitesimal. Besides these indirect effects, households receive additional income from all the direct and indirect expenditures and spend a fraction of this income in Illinois, called induced spending. The industry's total impact on the state is the sum of the direct, indirect and induced spending. At each round, some of the spending leaks out through purchases made out-of-state (imports at the state level), payment of taxes, and savings. When the spending rounds are completed, there is a total multiplier or ripple effect of direct spending in the oil and gas industry on the Illinois economy. The effects operate on employment, total output, and income (measured as value added).

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<sup>96</sup> RCF Economic & Financial Consulting, Inc., & Real Economic Applications Laboratory (REAL), University of Illinois at Urbana-Champaign, "The Oil and Gas Industry in the Illinois Economy – Prepared for the Illinois Oil and Gas Association under a grant from the Illinois Petroleum Resources Board" (March 4, 2009).

#### **4.8.2 Economic Impacts on Employment, Income and Output from the 2009 Report**

Employment. Illinois oil and gas employment used in the 2009 analysis consisted of direct employment of 2,042 workers in firms and 2,167 independent operators, for a total of 4,209 workers. Because of the multiplier effects in other parts of the Illinois economy an additional an estimated 9,843 jobs were created throughout the state, giving a total of 14,052 jobs altogether, as reported in the 2009 report. The indirect employment effects from purchases by oil and gas firms from firms outside the industry were felt most strongly in professional scientific and technical services, followed by mining itself and administrative and waste services. The induced employment impacts from payments to the households working in these firms had the greatest impact in health and social services, followed closely by retail trade, and more distantly in accommodation and food services, all sectors where households spend a good deal of their income.

Income. The oil and gas industry had a direct impact of \$769 million on income in the state, and because of the multiplier effects, had an estimated total impact of \$1.29 billion. The sectoral distribution of the multiplier impacts was similar to that of the employment impacts.

Output. The oil and gas industry accounted for \$3.04 billion within the industry in direct output impact and an estimated \$4.81 billion in total output when taking account of multiplier effects.

Taxes. Approximately \$106 million in Illinois state sales and income tax revenues came from the oil and gas industry's workers. The industry and its suppliers paid \$330 million in state taxes, 72 percent of which were in the form of indirect business taxes, and \$383 million in federal taxes, for a total of \$713 million.

## **5. Factors Affecting Revenues and Costs**

This chapter discusses factors affecting the revenues and costs of the Illinois oil and gas production industry. Section 5.1 discusses influences on the pricing of Illinois crude oil, presents historical price data, and discusses some of the changes over time. Section 5.2 presents information on taxes on oil and gas production in Illinois. Section 5.3 reviews costs for well drilling and operating. Section 5.4 discusses the changing mix of crude oils in the U.S. oil market.

### **2015 Report Highlights**

The price received by Illinois oil producers is less than the published spot market prices due to transportation and handling charges and other adjustments. However, it tends to follow that of the West Texas Intermediate (WTI) oil price because of similar physical and chemical characteristics. As of late 2015, there were six first purchasers in Illinois, up from three in the previous report.

From 2007 to 2009, the real spread between the WTI spot price and the posted price for Illinois sweet crude often exceeded \$9 per barrel. The spread has generally declined since then and was approximately \$7 per barrel in 2015.

Ad valorem taxes received by the state of Illinois are calculated based on the average price over two years. In 2013, \$9.6 million in revenue was collected for oil production in Illinois (in 2015 dollars). The amount of revenue collected for 2007 production, the year following the previous study, was \$7.7 million (in 2015 dollars).

Interview respondents asked about well drilling costs described similar drilling costs in 2015 as were experienced at the time of the last report. Some interview respondents noted that labor costs, and insurance costs in particular, had increased at rates higher than inflation over the 2009 to 2014 time frame.

Well operations costs are a combination of well-specific characteristics and labor and materials costs, which can vary independently of each other. High and steady oil prices from 2011 to 2014 were cited by some industry representatives during interviews conducted in 2015 as a key determinant to attracting new and qualified people into the industry. Some industry representatives described cutbacks in personnel and/or wages associated with lower prices and activity in recent months. However, the industry has not faced the same or similar materials-related challenges to those which were encountered and detailed in the 2009 report.

Another benchmark for operating costs is the IHS Upstream Operating Cost Index (UOCI) which measures changes in costs related to oil and gas field operations.

Although this index reflects movements in underlying global data, it can serve as a useful comparison to information gained from industry representatives in Illinois. As of the third quarter of 2015, the UOCI index was at approximately the same level as the time of the last study, which is consistent with the trends cited by industry representatives.

As crude oil production in the U.S. has risen, roughly 90 percent of the growth between 2011 and 2014 consisted of light sweet crude oil. The growth in domestic production resulted in a decline in imports of similar quality. However, as light and medium crude imports have declined, heavy imports have remained steady.

## **5.1 Influences on the Price Received for Oil in Illinois**

### **5.1.1 Market for Illinois Oil**

The price obtained for a specific variety of crude oil depends, in part, on its physical and chemical properties. The physical and chemical properties of the oil produced depend on the location and characteristics of the reservoir where the oil was generated. Illinois produces a high quality, light, sweet crude oil which is attractive to refiners. The price of Illinois crude oil follows that of West Texas Intermediate (WTI) oil price because of similar physical and chemical characteristics of the underlying commodities. WTI is considered a high quality light sweet crude oil with an American Petroleum Institute (API) gravity of 39.6 degrees containing only 0.24 percent sulfur.<sup>97</sup> The location of production can also affect the marketing options of crude oil. Some crude oils are extracted near to low-cost, long-distance transportation such as pipelines which provide economical access to a wide number of refineries; however, others are not so fortunate. Illinois crude oil has good transportation options to nearby refineries.

As of late 2015, there were six first purchasers in Illinois, up from three as of the previous report. In the early 1980s there were many more buyers, at times as many as fifteen. CountryMark, a farmer-owned cooperative refinery in nearby Mt. Vernon, Indiana, buys approximately two-thirds of the oil produced in Illinois. Bi-Petro, Lincoln, and the remaining first purchasers buy the remaining Illinois produced oil.<sup>98</sup>

### **5.1.2 Illinois Oil First Purchaser Price**

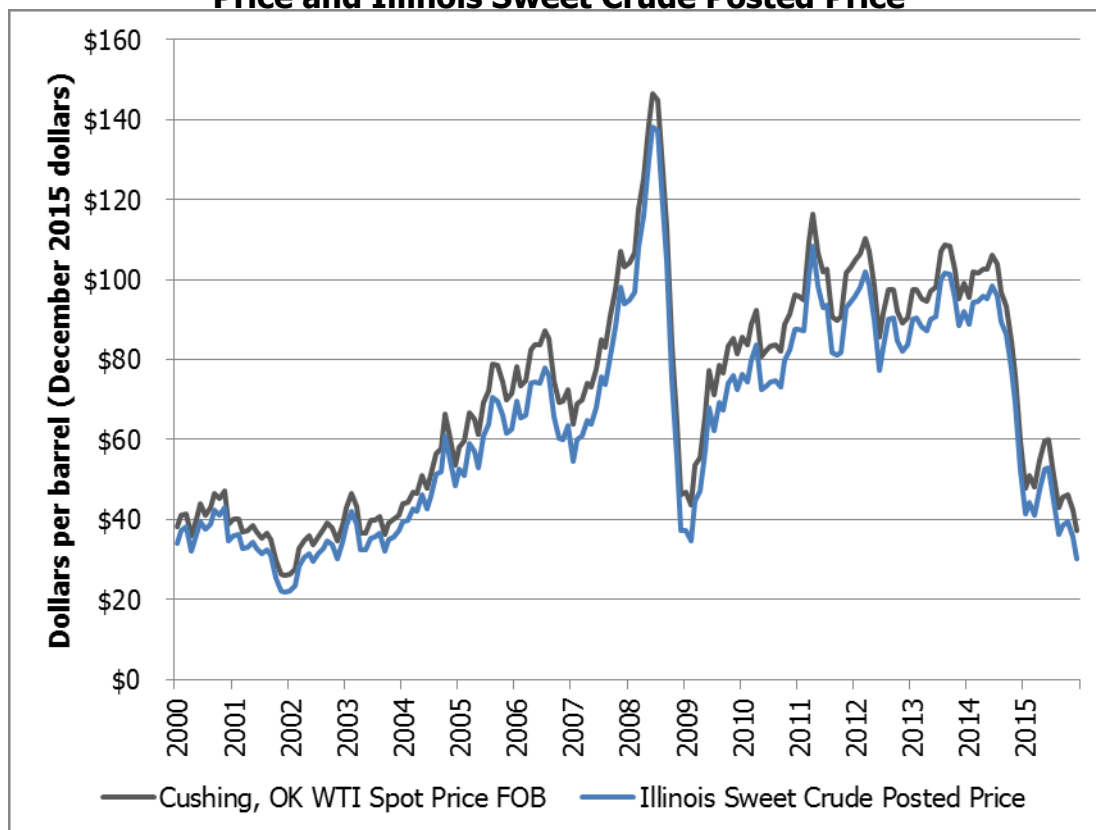
The price received by Illinois producers is based primarily on the WTI spot price minus transportation and related fees as well as quality adjustments. Figure 5-1 presents a comparison of the average monthly WTI spot price and the average monthly posted price for Illinois sweet crude from 2000 to 2015.

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<sup>97</sup> Oilprice. (2009). "A Detailed Guide on the Many Different Types of Crude Oil," <http://oilprice.com/Energy/Crude-Oil/A-Detailed-Guide-On-The-Many-Different-Types-Of-Crude-Oil.html> (Accessed January 27, 2016).

<sup>98</sup> *Ibid.*

**Figure 5-1. Real Average Monthly Crude Oil Prices – Cushing, OK WTI Spot Price and Illinois Sweet Crude Posted Price**



Source: U.S. Energy Information Administration;<sup>99</sup> Plains Marketing, L.P.<sup>100</sup>

As mentioned above, Illinois Basin crude oil is of high quality and its characteristics are generally desirable to refiners. It does, however, refine into a slightly lower proportion of high-valued gasoline than WTI, offering about a 2 percentage-point smaller refining cut of gasoline.<sup>101</sup> This difference, combined with transportation and marketing costs are incorporated into the ultimate price received by producers of oil.

The difference between the average monthly WTI spot price and the average monthly posted price for Illinois sweet crude is shown in Figure 5-2. From 2000 through 2005, the real spread between the WTI spot price and the Illinois sweet crude posted price was typically below \$6 per barrel (in December 2015 dollars). By 2007, as oil prices climbed rapidly, the spread often exceeded \$9 per barrel before generally declining towards approximately \$7 per barrel in 2015.

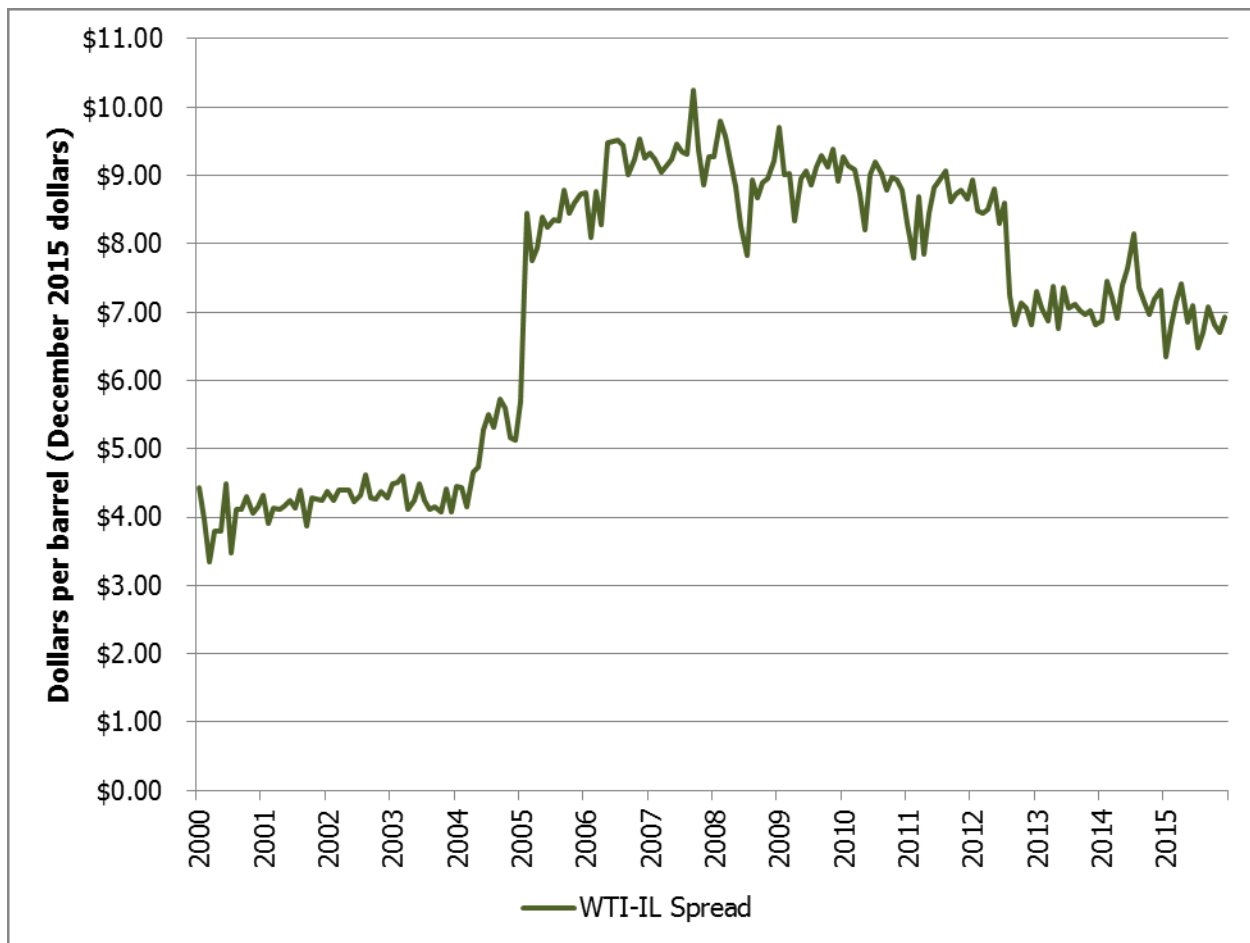
<sup>99</sup> U.S. Energy Information Administration. Cushing, OK WTI Spot Price FOB.

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D> (Accessed June 1, 2016).

<sup>100</sup> Plains Marketing, L.P. Monthly average price per barrel for Illinois sweet crude. Monthly price bulletins can be accessed at <https://www.plainsallamerican.com/customer-center/crude-oil-bulletins/historical/plains-marketing,-l-p>.

<sup>101</sup> Tomich, J. (2005). "Price Gap Hurts Producers in Illinois Basin," *St. Louis Post-Dispatch*. <https://www.highbeam.com/doc/1G1-134125021.html> (Accessed February 10, 2016).

**Figure 5-2. Price Spread between Average Monthly WTI Spot Price and Illinois Sweet Crude Posted Price (December 2015 Dollars)**



Source: U.S. Energy Information Administration;<sup>102</sup> Plains Marketing, L.P.<sup>103</sup>

## 5.2 Taxes on Oil and Gas in Illinois

An ad valorem tax on oil and gas production in Illinois exists for minerals including coal and oil. The per-well tax assessment system is complex, with the tax rates varying depending on the age of a well and the rate of production. The tax is not based on the price of oil at the time of production, but rather on the average price over the two-year period prior to the assessment date. This system helps smooth tax obligations during periods of price run-ups such as ones which occurred in 2007 and 2008, but it also produces a lengthy burden following periods of price declines, such as those which occurred in the second-half of 2008 and during the time period from late

<sup>102</sup> U.S. Energy Information Administration. Cushing, OK WTI Spot Price FOB.

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D> (Accessed June 1, 2016).

<sup>103</sup> Plains Marketing, L.P. Monthly average price per barrel for Illinois sweet crude. Monthly price bulletins can be accessed at <https://www.plainsallamerican.com/customer-center/crude-oil-bulletins/historical/plains-marketing,-l-p>.

2014 through 2015.<sup>104</sup> The effect of the \$100-plus-per-barrel oil of the first-half of 2008 was felt for the following two years.

To understand assessments and revenues from the ad valorem tax on oil in Illinois, two publications from the Illinois Department of Revenue (IDOR) should be consulted.<sup>105</sup> For the most recent year reported for Property Tax Statistics 2013, the Comparison of Current Taxes Extended by Class of Property (Table 11) reports tax revenues from each class of property in the state, including the aggregated revenue for all minerals.<sup>106</sup> Because the revenue statement obtained for minerals aggregates coal and oil, another reference needs to be used to separate the portion pertaining to oil production only. The assessed values of coal and oil leases are presented individually by IDOR under the document entitled Abstract of 2013 Locally Assessed Real Estate and Railroad Property by County (Table 17).<sup>107</sup> On the recommendation of the Property Tax Division of the IDOR, an approximation of the ad valorem oil tax revenues can be made by multiplying the ratio of oil lease assessed values to totals minerals assessed values, as found in Table 17, by the total property tax extended to minerals found in Table 11.<sup>108</sup>

In 2013, oil production occurred in 45 counties in Illinois. Figure 5-3 presents estimates of total ad valorem taxes paid from 2007 to 2013 (in 2015 dollars).<sup>109</sup> Table 5-1 on the following page reports the annual ad valorem oil tax revenue (in 2015 dollars) collected by county.<sup>110</sup>

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<sup>104</sup> 2009 Oil and Gas Assessment Schedule, mimeo, September 17, 2008, provided by Crawford County Assessments Office.

<sup>105</sup> Illinois Department of Revenue, Tax Statistics.

<http://tax.illinois.gov/Publications/LocalGovernment/Ptaxstats/2013/> (Accessed July 2015).

<sup>106</sup> Illinois Department of Revenue, Tax Statistics, "Comparison of Current Taxes Extended by Class of Property, Table 11," <http://tax.illinois.gov/AboutIdor/TaxStats/PropertyTaxStats/2013/> (Accessed July 2015).

<sup>107</sup> Illinois Department of Revenue, Taxstats, "Abstract of 2005 Locally Assessed Real Estate and Railroad Property by County, as Equalized Before Exemptions, Table 17" <http://tax.illinois.gov/AboutIdor/TaxStats/PropertyTaxStats/2013/> (Accessed July 2015).

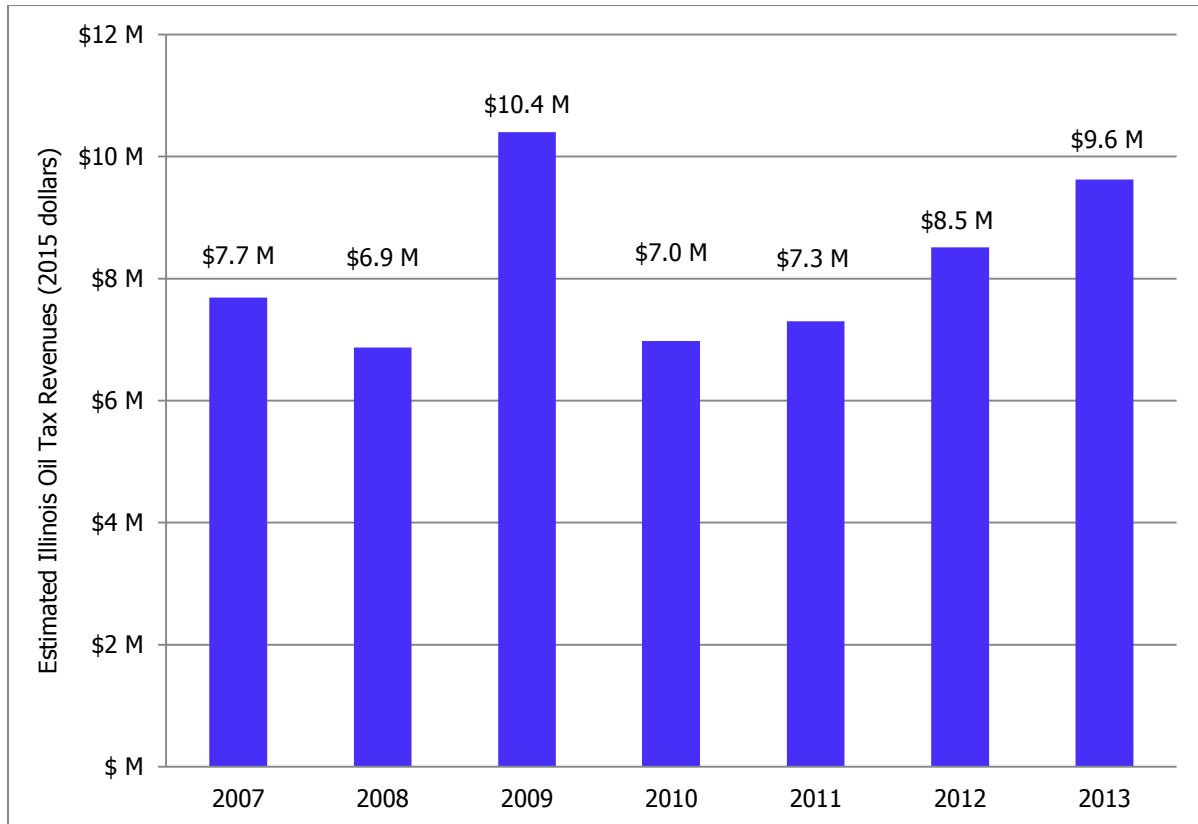
<sup>108</sup> RCF teleconference call with Illinois Department of Revenue, Department of Property Tax staff member.

<sup>109</sup> According to data obtained from the Illinois Petroleum Resources Board, Champaign County had a small amount of oil production in 2009.

<sup>110</sup> According to data obtained from the Illinois Petroleum Resources Board, Jackson County had no oil production 2007-2008 and Monroe County had no oil production 2007-2011. Some other counties have \$0 in estimated oil tax revenue due to one or both of the following conditions being true: (a) there was no assessed oil lease value in that year; (b) there was no reported total mineral tax value that year.



**Figure 5-3. Estimated Illinois Ad Valorem Oil Tax Revenues**



Source: Illinois Department of Revenue.

**Table 5-1. Estimated Annual Ad Valorem Oil Tax Revenues Collected by Illinois Department of Revenue (2015 Dollars)**

| <b>Illinois County</b> | <b>2007</b> | <b>2008</b> | <b>2009</b>  | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> |
|------------------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|
| Bond                   | \$15,492    | \$0         | \$19,646     | \$12,442    | \$17,136    | \$12,509    | \$17,095    |
| Brown                  | \$5,326     | \$5,107     | \$5,144      | \$5,031     | \$4,974     | \$4,698     | \$4,427     |
| Christian              | \$0         | \$40,881    | \$37,533     | \$29,490    | \$29,928    | \$30,866    | \$475,837   |
| Clark                  | \$22,879    | \$21,657    | \$23,170     | \$22,448    | \$22,207    | \$23,312    | \$22,290    |
| Clay                   | \$609,355   | \$562,006   | \$812,049    | \$501,099   | \$447,752   | \$543,464   | \$528,629   |
| Clinton                | \$91,610    | \$72,041    | \$124,201    | \$46,349    | \$87,165    | \$100,709   | \$115,240   |
| Coles                  | \$32,976    | \$0         | \$0          | \$0         | \$27,819    | \$21,683    | \$21,607    |
| Crawford               | \$364,177   | \$387,791   | \$512,855    | \$388,136   | \$417,965   | \$533,010   | \$602,180   |
| Cumberland             | \$4,189     | \$3,897     | \$108,985    | \$47,654    | \$49,507    | \$41,463    | \$78,507    |
| DeWitt                 | \$15,058    | \$15,005    | \$16,446     | \$14,883    | \$6,651     | \$0         | \$0         |
| Douglas                | \$434       | \$421       | \$420        | \$417       | \$443       | \$448       | \$436       |
| Edgar                  | \$32,959    | \$29,366    | \$43,562     | \$28,724    | \$27,446    | \$31,879    | \$33,170    |
| Edwards                | \$119,811   | \$148,089   | \$210,200    | \$112,851   | \$128,886   | \$178,446   | \$174,578   |
| Effingham              | \$149,923   | \$119,751   | \$142,219    | \$121,569   | \$142,209   | \$192,764   | \$124,012   |
| Fayette                | \$242,675   | \$236,026   | \$332,958    | \$255,871   | \$276,198   | \$339,730   | \$375,615   |
| Franklin               | \$390,644   | \$324,471   | \$533,787    | \$429,052   | \$446,028   | \$414,311   | \$311,774   |
| Gallatin               | \$183,197   | \$161,429   | \$321,965    | \$286,795   | \$571,806   | \$568,448   | \$498,427   |
| Hamilton               | \$299,993   | \$283,285   | \$447,256    | \$316,277   | \$239,395   | \$409,740   | \$336,554   |
| Jackson                | \$0         | \$0         | \$2,464      | \$1,714     | \$1,318     | \$1,170     | \$1,191     |
| Jasper                 | \$155,834   | \$142,347   | \$214,783    | \$170,153   | \$176,599   | \$219,678   | \$287,540   |
| Jefferson              | \$135,491   | \$134,193   | \$161,219    | \$131,071   | \$134,561   | \$135,097   | \$233,269   |
| Lawrence               | \$599,371   | \$639,449   | \$892,236    | \$498,428   | \$488,072   | \$556,176   | \$534,346   |
| Macon                  | \$0         | \$0         | \$15,933     | \$13,922    | \$8,446     | \$9,805     | \$204,693   |
| Madison                | \$51,213    | \$66,525    | \$60,580     | \$51,023    | \$47,300    | \$48,677    | \$43,756    |
| Marion                 | \$1,500,156 | \$1,229,450 | \$1,706,286  | \$1,089,620 | \$1,052,875 | \$1,269,254 | \$1,306,767 |
| Montgomery             | \$0         | \$31        | \$32         | \$31        | \$31        | \$462       | \$29        |
| Moultrie               | \$306       | \$0         | \$300        | \$290       | \$277       | \$269       | \$260       |
| Perry                  | \$546       | \$4,074     | \$5,776      | \$8,520     | \$4,695     | \$4,546     | \$4,745     |
| Randolph               | \$6,699     | \$6,338     | \$6,466      | \$6,588     | \$2,359     | \$2,388     | \$1,561     |
| Richland               | \$277,140   | \$243,218   | \$466,500    | \$300,499   | \$287,815   | \$342,161   | \$433,235   |
| Saline                 | \$60,981    | \$51,082    | \$60,409     | \$58,665    | \$39,604    | \$35,558    | \$31,405    |
| Sangamon               | \$179,968   | \$65,193    | \$64,816     | \$34,236    | \$18,423    | \$32,905    | \$19,558    |
| Schuyler               | \$2,013     | \$1,992     | \$1,933      | \$2,906     | \$1,443     | \$1,616     | \$2,694     |
| Shelby                 | \$6,195     | \$0         | \$4,991      | \$2,050     | \$2,349     | \$4,054     | \$3,644     |
| St. Clair              | \$4,393     | \$5,794     | \$5,267      | \$4,847     | \$4,691     | \$4,685     | \$3,183     |
| Wabash                 | \$300,254   | \$319,289   | \$519,141    | \$327,534   | \$329,185   | \$430,589   | \$502,649   |
| Washington             | \$151,853   | \$129,594   | \$173,637    | \$108,550   | \$120,271   | \$130,027   | \$144,003   |
| Wayne                  | \$577,574   | \$575,311   | \$849,497    | \$452,218   | \$469,004   | \$572,942   | \$613,858   |
| White                  | \$1,071,058 | \$806,550   | \$1,441,153  | \$1,054,620 | \$1,133,565 | \$1,224,977 | \$1,494,144 |
| Williamson             | \$27,983    | \$38,203    | \$52,251     | \$43,197    | \$36,249    | \$36,547    | \$37,529    |
| Total, 45 counties     | \$7,689,727 | \$6,869,854 | \$10,398,066 | \$6,979,767 | \$7,302,648 | \$8,511,062 | \$9,624,437 |

**Source: Illinois Department of Revenue.**

## 5.3 Well Development and Operating Costs

### 5.3.1 Well Development Costs

Interview respondents asked about well drilling costs described similar total costs in 2015 as were experienced at the time of the previous report approximately seven years ago. Some interview respondents noted that labor costs, and insurance costs in particular, had increased at rates higher than inflation over the 2009 to 2014 time frame.<sup>111</sup> Additionally, China at the time was a large supplier of steel materials including tubulars used in wells, and supply disruptions for steel occurred due to the 2008 earthquake in China and summer Olympics in Beijing which further tightened supply.<sup>112</sup> More recently, according to IHS, the rise in well development costs observed during the 2010 to 2013 time period was largely driven by labor cost increases while costs associated with materials such as steel tended to stagnate or decline.<sup>113</sup>

Interviews with industry representatives in 2009 and 2015 found that the average capital cost of a new producing vertical well are approximately \$300,000.<sup>114</sup> This estimate does not include the cost of dry holes which may be drilled prior to completing the producing well. The average cost of drilling a dry hole is approximately \$150,000.<sup>115</sup> Using the average rate 2 to 3 dry holes drilled before one can be completed, the total cost for installing a new producing vertical well could be on average \$600,000 to \$750,000 per well in an existing field, and over \$1 million for a well in a new field. According to several industry representatives, horizontal wells can cost 2.5 to 4.0 times more than vertical wells, making horizontal wells more feasible at higher oil prices.<sup>116</sup> Even though horizontal wells cost more, it may be possible to drill fewer horizontal wells and still develop the same volume of reserves for the same or less money.<sup>117</sup>

### 5.3.2 Well Operating Costs

As described in Chapter 2, most oil produced in Illinois comes from older, marginal wells which are defined as wells that require a higher price per barrel to be operating. Many of these wells are considered stripper wells (i.e., wells whose daily average oil production does not exceed 10 barrels per day in any 12 month period). Operating costs vary widely depending on operation and maintenance requirements. Most stripper wells in the U.S. can cost anywhere from \$10 to \$50 per barrel to operate

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<sup>111</sup> RCF interviews with industry representatives (2015).

<sup>112</sup> RCF interviews with industry representatives (2009).

<sup>113</sup> IHS, Inc. (December 2013), "Costs of Building and Operating Upstream Oil and Gas Facilities Hold at or Near Record Levels," <http://press.ihs.com/press-release/energy-power/ihs-costs-building-and-operating-upstream-oil-and-gas-facilities-hold-or-> (Accessed January 15, 2016).

<sup>114</sup> Both the 2009 and 2015 interviews took place after significant evolutions in the cost environments for both development and operations.

<sup>115</sup> RCF interviews with industry representatives (2009, 2015).

<sup>116</sup> RCF interviews with industry representatives (2015).

<sup>117</sup> *Ibid.*

which can be problematic when oil prices are low.<sup>118,119,120</sup> Industry representatives noted that some marginal wells could be shut down at lower prices and might not come back online even if prices because water or sand will fill in the bottom of the well when the well is not in production.<sup>121, 122</sup>

Additionally, high and steady oil prices from 2011 to 2014 were cited by some industry representatives in the 2015 interviews as a key determinant to attracting new and qualified people into the industry. The jobs outlook may have been changing recently with lower oil prices observed since late 2014.

Illinois industry representatives at the time of the previous report noted that production costs had increased significantly over the previous few years.<sup>123</sup> Labor, insurance, and materials were all noted as having had large increases. Industry representatives in the 2015 interviews described cost increases from 2009 to 2014 especially related to labor and health insurance.<sup>124</sup> Some industry representatives described cutbacks in personnel and/or wages associated with lower prices and activity.<sup>125</sup>

Another benchmark for operating costs is the IHS Upstream Operating Cost Index (UOCI) which measures changes in costs related to oil and gas field operations. Although this index reflects movements in underlying global data, it can serve as a useful comparison to information gained from industry representatives in Illinois.

At the time of the last report, the IHS Upstream Operating Costs Index (UOCI) had substantially increased since 2000. As shown in Figure 5-4, the rise in costs began in 2003. The cost index declined slightly in 2009, about the time of the Great Recession and the major last drop in oil prices. The index began to rise again as the economy recovered and oil prices began to climb. Reasons cited were continued high activity levels and continued tightness in the supply markets and distribution of raw materials.<sup>126</sup> As of the third quarter of 2015, the operating cost index was at approximately the same level as it was at the time of the last report.<sup>127</sup>

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<sup>118</sup> Wade, T. & Driver, A. (2015). "Collapsing Oil Prices Are Forcing Small US Producers To Shut Down Wells," *Business Insider*. <http://www.businessinsider.com/r-us-oil-well-shut-ins-start-as-crude-rout-batters-small-producers-2015-1> (Accessed January 25, 2016).

<sup>119</sup> Friedman, N. (2015). "Strippers' Pose Dilemma for Oil Industry," *The Wall Street Journal*. <http://www.wsj.com/articles/stripper-wells-are-wild-card-in-oil-rout-1441660049> (Accessed January 23, 2016).

<sup>120</sup> RCF interviews with industry representatives (2015).

<sup>121</sup> *Ibid.*

<sup>122</sup> Carroll, J. (2016). "Price Collapse Hits Scavengers Who Scrape the Bottom of Big Oil's Barrel," *Bloomberg Business*. <http://www.bloomberg.com/news/articles/2015-01-20/scavengers-pumping-big-oil-s-castoffs-face-grim-choice-amid-rout> (Accessed January 15, 2016).

<sup>123</sup> RCF interviews with industry representatives (2009).

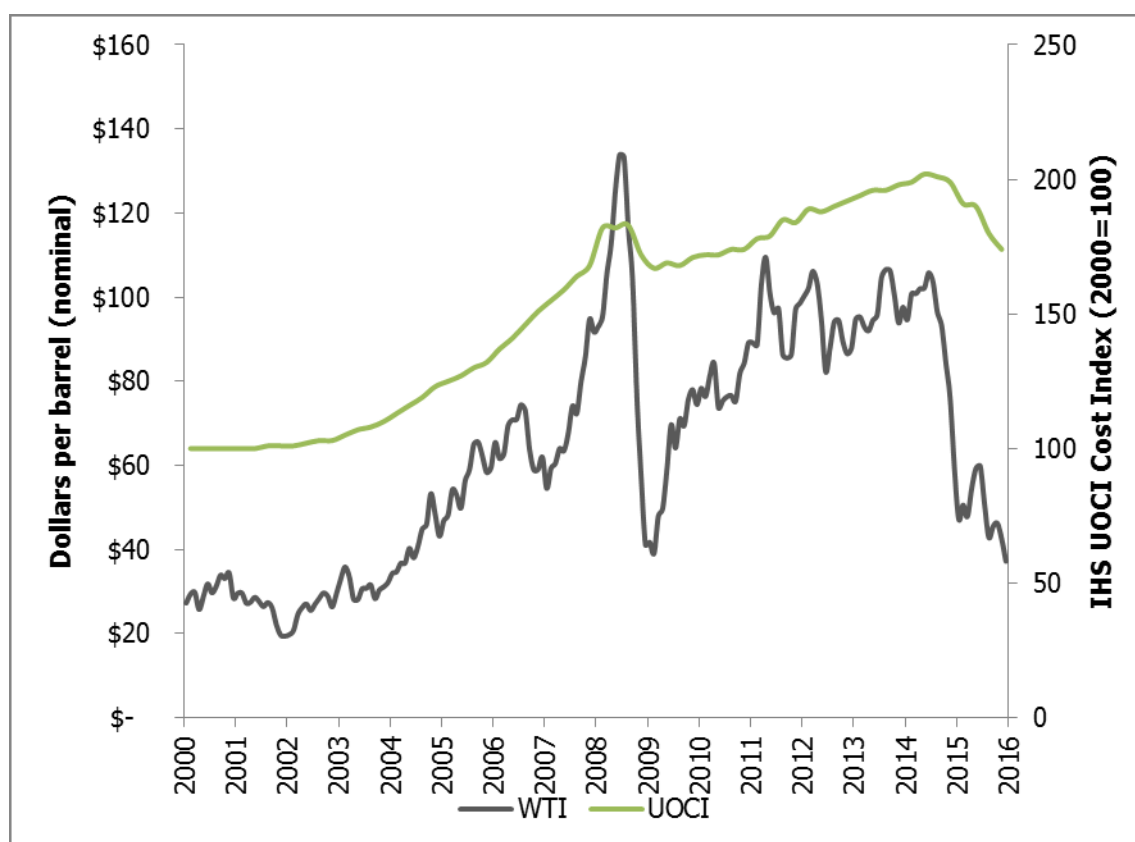
<sup>124</sup> RCF interviews with industry representatives (2015).

<sup>125</sup> *Ibid.*

<sup>126</sup> IHS, Inc., "Oil and Gas Field Operations Costs Reach New High," Press release, December 11, 2008, <http://press.ihs.com/press-release/energy/oil-and-gas-field-operations-costs-reach-new-high-ihs-cera-upstream-operating-c> (Accessed February 10, 2016).

<sup>127</sup> IHS, Inc. Upstream Operating Costs Index (UOCI), <https://www.ihs.com/info/cera/ihsindexes/> (Accessed June 1, 2016).

**Figure 5-4. WTI Oil Price and IHS Upstream Operating Cost Index (UOCI)**



Source: U.S. Energy Information Administration; IHS UOCI Index.

## 5.4 Implications of the Changing Quality Mix of Crude Oil in the United States

As crude oil production in the U.S. has risen, roughly 90 percent of the growth between 2011 and 2014 consisted of light sweet crude oil. The growth in domestic production resulted in a decline in imports of similar quality. However, as light and medium crude imports have declined, heavy imports have remained steady. As a consequence, the share of imported crude oil that is heavy has increased.<sup>128</sup>

The refining process for crude oil varies according to the physical and chemical properties of the oil. As these physical and chemical properties change according to the various sources of crude oil, refineries are also responding and making changes to refining processes. In general, refineries that are designed to refine light sweet crude oil are not suited to refine heavier crude oil, but refineries that can refine heavier crude oil do accept lighter crude oil.

<sup>128</sup> U.S. Energy Information Administration. (2015). "U.S. Crude Oil Production to 2025: Updated Projection of Crude Types." <https://www.eia.gov/analysis/petroleum/crudetypes/> (Accessed January 24, 2016).

## 6. Current and Recent Developments

This chapter describes recent developments affecting the Illinois oil and gas industry. Section 6.1 discusses resource players' activity since 2008. Section 6.2 addresses the regulatory environment in Illinois including the Illinois Hydraulic Fracturing Regulatory Act. Section 6.3 looks at the impact of recent oil price changes on the oil and gas industry in Illinois.

### 6.1 Shale Gas Resource Players and Leasing Activity

Industry representatives interviewed for this report described significant activity in Illinois from 2010 to 2012, including leasing and research related to preparations for use of shale gas extraction techniques in Illinois.<sup>129</sup> Industry representatives described attributes favorable to shale development in Illinois. Illinois offers relatively good weather, access to highways, and flat terrain.<sup>130</sup>

Industry representatives estimated that over \$300 million was invested in Illinois on leases and related expenditures in preparation for fracking; landowners were receiving upwards of \$300 per acre.<sup>131</sup> As an example of the benefits to Illinois, according to the Illinois Department of Employment Security, from 2011 to 2012, Wayne County collected approximately \$200,000 in processing fees from companies wanting to explore for oil and gas in the area.<sup>132</sup>

However, the situation has now changed. Given the introduction of a strict regulatory environment and the decline in oil prices since 2014, the future of leasing activity and investment in shale gas development in Illinois has become uncertain, as will be discussed in the following two sections.

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<sup>129</sup> RCF interviews with industry representatives (2015).

<sup>130</sup> Strata-X. (2014). "An Emerging Illinois Basin Oil Producer: November 2014." [http://www.strata-x.com/presentations/Strata-X-Illinois\\_Nov-2014-reduced.pdf](http://www.strata-x.com/presentations/Strata-X-Illinois_Nov-2014-reduced.pdf) (Accessed January 23, 2016).

<sup>131</sup> Williams, N. (2015). "Illinois 'fracking' on hold after leases signed," *Illinois Farmers Today*, [http://www.illinoisfarmertoday.com/news/regional/illinois-fracking-on-hold-after-leases-signed/article\\_e10e1576-a81d-11e5-9c7b-47d08044ae93.html](http://www.illinoisfarmertoday.com/news/regional/illinois-fracking-on-hold-after-leases-signed/article_e10e1576-a81d-11e5-9c7b-47d08044ae93.html) (accessed January 15, 2016).

<sup>132</sup> Bieneman, D. (2013). "The Fracking Industry and Its Potential Impact on the Illinois Economy," Illinois Department of Employment Security. <http://www.ides.illinois.gov/LMI/ILMR/Fracking.pdf> (Accessed January 24, 2016).

## 6.2 Recent Regulations and Hydraulic Fracturing

However, during the same period that preparation for shale development was at a high point in Illinois, regulations for permitting and drilling in the state were being developed. The regulatory environment in Illinois began to change in anticipation of shale activity in the state. In June 2013, the Illinois Hydraulic Fracturing Regulatory Act (HFRA) was passed by the General Assembly. Implementing regulations for the HFRA were developed over the next 17 months amid debate by interested parties on all sides. These regulations which have been described as some of the strictest in the country were approved and enacted on November 6, 2014.<sup>133,134</sup> At the time these regulations were approved, oil prices exceeded \$70 per barrel but subsequently fell to less than \$50 per barrel in January 2015, and have continued to fall to approximately \$30 per barrel at the time of writing of this report.<sup>135</sup>

Industry representatives have described the new fracking regulations as excessive and burdensome. Some companies have pursued fracking and horizontal drilling opportunities in nearby states, in areas with similar geological attributes as those found in Illinois, spurred by the relatively lower regulatory burdens in those other states.<sup>136</sup>

The Illinois Department of Natural Resources (IDNR) is responsible for granting permits under the HFRA. As of early 2016, two companies – Kimmeridge Tri-State Exploration and Strata-X Energy – have registered but there have been no permit applications for HVHF.<sup>137</sup> For now, it appears that onerous and expensive regulatory requirements combined with the current low oil price environment are discouraging hydraulic fracturing activity in Illinois.

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<sup>133</sup> A consortium of landowners and an environmental group moved for a preliminary injunction after the implementing regulations were passed in November 2014. Later that month a circuit court denied that preliminary injunction and in July 2015 an appellate court upheld that denial. Obrecht, A. & Tzanetopoulos, G. (2015). "The Drumbeat Of 'Drill Baby Drill' Dawns In Ill." <http://www.law360.com/articles/689125/the-drumbeat-of-drill-baby-drill-dawns-in-ill> (Accessed January 25, 2016).

<sup>134</sup> Kasper, M. (2013). "Illinois Adopts Nation's Strictest Fracking Regulations," <http://thinkprogress.org/climate/2013/06/19/2177811/illinois-adopts-nations-strictest-fracking-regulations/> (Accessed January 15, 2016).

<sup>135</sup> U.S. Energy Information Administration, "Cushing, OK WTI Spot Price FOB," <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D> (Accessed January 15, 2016).

<sup>136</sup> RCF interviews with industry representatives (2015).

<sup>137</sup> Landis, T. (2015). "2nd company registers for fracking in Illinois," *The State Journal-Register*, <http://www.sj-r.com/article/20150806/news/150809694> (Accessed January 15, 2016).

## **6.3 Impact of World Oil Prices on the Illinois Oil and Gas Production Industry**

The considerable variation in world oil prices in recent years has impacted the various sectors of the Illinois oil and gas industry in different ways. Section 6.3.1 reviews oil price movements in recent years. Section 6.3.2 considers the impact of oil prices on Illinois crude oil production. Sections 6.3.3 and 6.3.4 discuss recent oil prices and the impact on drilling and support services sectors in Illinois, respectively. Section 6.3.5 offers thoughts on the future of oil and gas production in Illinois and the role of changing world oil prices.

### **6.3.1 Recent Oil Price Movements**

The unknown future course of oil prices is a major source of uncertainty facing the oil and gas production industry. As shown in Figure 6-1 on the following page, a commonly used measure of world oil price (Cushing, OK WTI Spot Price) exceeded \$140 per barrel in mid-2008 before declining in late 2008 during the Great Recession. By 2011, the WTI price had reached \$100 per barrel and hovered between \$75 and \$115 per barrel from then until June 2014. Since that time, with the exception of a temporary small rebound in 2015, oil prices have been on a steady decline. At the time of writing of this report, the most recent price published was \$30.31 per barrel on January 25, 2016.<sup>138</sup> The forecast for oil prices is extremely uncertain at this point. As only one example of the uncertainty, the EIA forecast made in January 2016 regarding where the WTI price might be in April 2016 was \$37 per barrel<sup>139</sup>, but the expressed confidence range was \$25 to \$56 per barrel.<sup>140</sup> The long-run range of price uncertainty is even greater.

### **6.3.2 Oil Production in Illinois**

Figure 6-1 shows the WTI spot oil price compared to monthly crude oil production in Illinois since 2000.<sup>141</sup> Oil production in Illinois declined slowly and steadily from 2000 to 2009, and did not seem to exhibit a strong influence from changes in prices.

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<sup>138</sup> U.S. Energy Information Administration. "Cushing, OK WTI Spot Price FOB (Dollars per Barrel)."

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D> (Accessed January 27, 2016).

<sup>139</sup> U.S. Energy Information Administration. (2016). *Short-Term Energy Outlook (STEO)*.

<http://www.eia.gov/forecasts/steo/> (Accessed January 12, 2016).

<sup>140</sup> Range associated with a 95 percent confidence interval.

<sup>141</sup> U.S. Energy Information Administration. "Illinois Field Production of Crude Oil."

[http://www.eia.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbbl\\_m.htm](http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_m.htm) (Accessed January 29, 2016).



**Figure 6-1. WTI Spot Price and Illinois Crude Oil Production**



Source: U.S. Energy Information Administration (EIA).

Total annual production was over 10 million barrels in 2005, as shown in Table 6-1 below. Production declined slightly through 2010 but has since increased to 9.6 million barrels per year for 2014 and 2015.

**Table 6-1. Illinois Annual Crude Oil Production**

| <b>Year</b> | <b>Millions of Barrels</b> |
|-------------|----------------------------|
| 2005        | 10.2                       |
| 2006        | 10.0                       |
| 2007        | 9.6                        |
| 2008        | 9.4                        |
| 2009        | 9.1                        |
| 2010        | 9.0                        |
| 2011        | 9.2                        |
| 2012        | 9.8                        |
| 2013        | 9.5                        |
| 2014        | 9.6                        |
| 2015        | 9.6                        |

Source: Illinois Petroleum Resource Board

Despite the large decrease in oil prices since June 2014, oil production in Illinois has not slowed down as of 2015. This may be due to the highly variable operating costs of marginal wells. Industry representatives in Illinois who were interviewed noted that some marginal or stripper wells could be shut down at low prices. However, these operators can also change operations to reduce costs and attempt to preserve mineral rights and wells. One industry representative described the small, family-owned businesses that operate stripper wells in Illinois as “resilient” because they often elect cost-cutting measures to avoid halting production.<sup>142</sup>

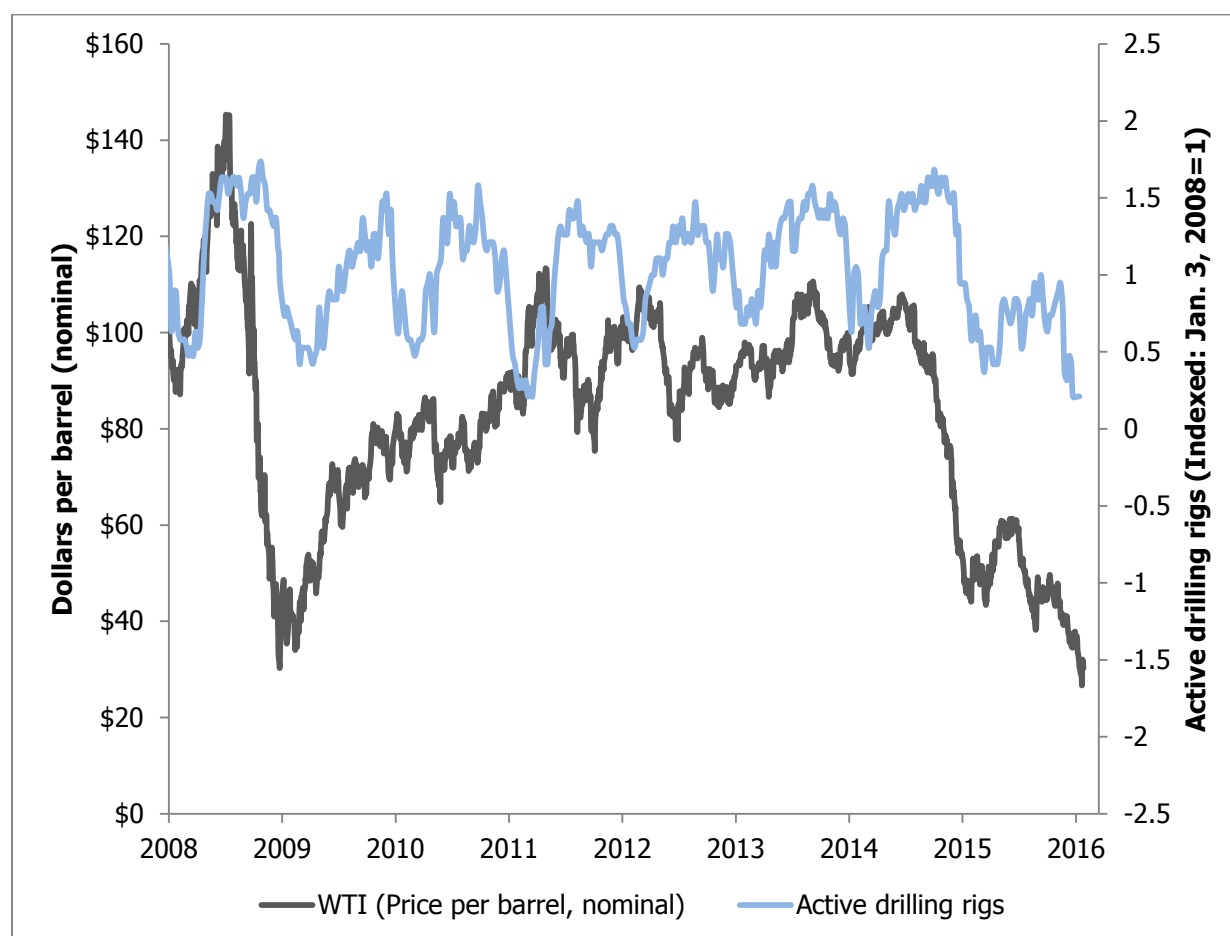
### **6.3.3 Oil Well Drilling Services in Illinois**

Changes in oil prices can impact different segments of the industry at different times and to varying degrees. Figure 6-2 shows the WTI oil price compared to active drilling rigs in Illinois since 2008. Drilling oil and gas wells in the Illinois Basin has very pronounced seasonal fluctuations that can make it difficult to discern other influences. Still, looking past the seasonal effects, there was a reduction in the typical level of active drill rigs which is likely to be a result of the recent low oil prices and uncertainty over the future of oil prices.

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<sup>142</sup> Kemp, J. (2015). “Breakeven and shut-in prices for oil wells,” *Reuters*. <http://www.reuters.com/article/oil-shale-prices-kemp-idUSL6N0US2GE20150113> (Accessed January 25, 2016).

**Figure 6-2. WTI Spot Price and Active Drilling Rigs in the Illinois Basin**



Sources: U.S. Energy Information Administration (EIA)<sup>143</sup>; Scout Check<sup>144</sup>

### 6.3.4 Monthly Oil Production and Support Services Employment in Illinois

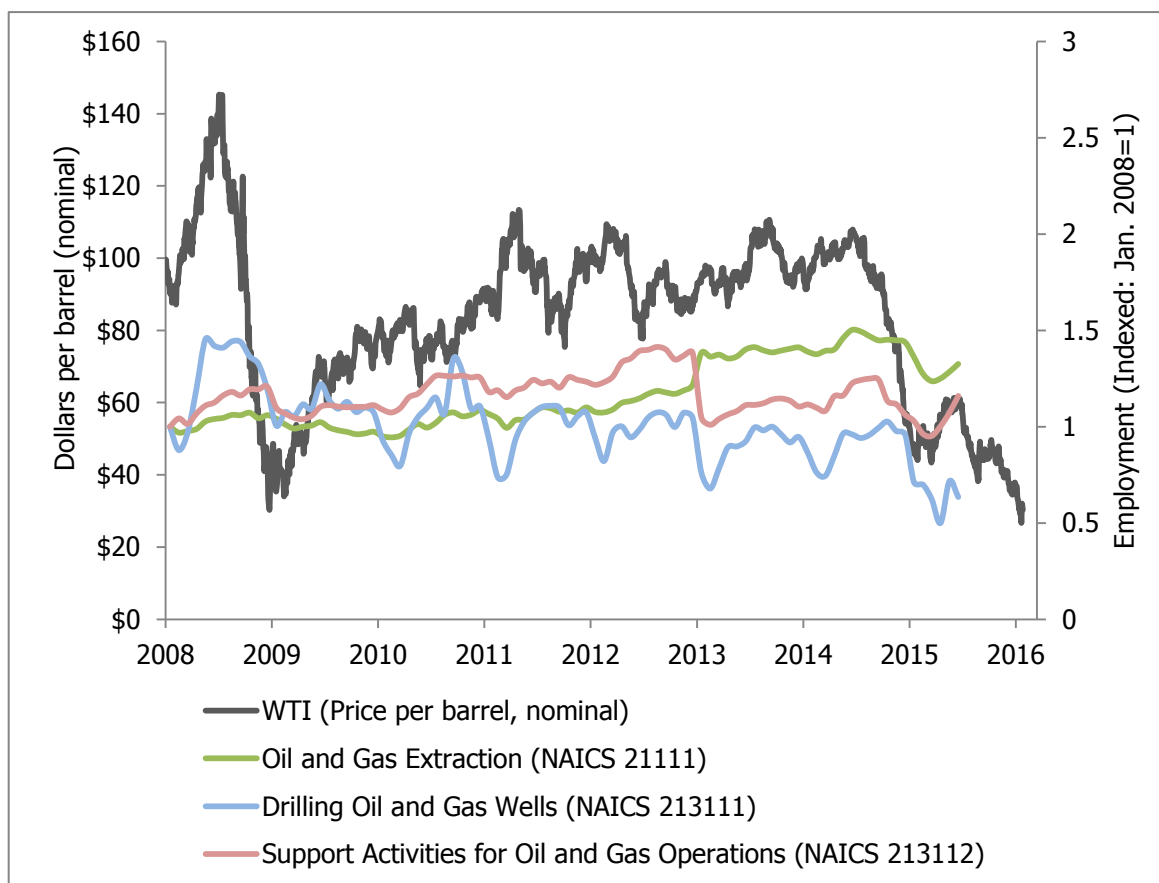
As discussed in Chapter 4, there are three main employment categories for the oil and gas production industry presented in this report. These include Oil and Gas Extraction (NAICS 2111), Drilling Oil and Gas Wells (NAICS 21311), and Support Activities for Oil and Gas Operations (NAICS 21312). Monthly data from the U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) are only available for employees who work for firms. The QCEW data do not include independent contractors who comprise approximately 50 percent of employment in these categories in Illinois. Nevertheless, the monthly QCEW data are the most

<sup>143</sup> U.S. Energy Information Administration. "Cushing, OK WTI Spot Price FOB (Dollars per Barrel)." <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D> (Accessed January 27, 2016).

<sup>144</sup> Historical active drilling rig data was provided to RCF by Scout Check.

currently available, and are used here to represent trends in total employment. The three employment categories described above are presented in Figure 6-3, and are indexed to employment levels in January 2008.<sup>145</sup>

**Figure 6-3. WTI Spot Price and Monthly QCEW Employment in Oil and Gas Production**



Sources: U.S. Energy Information Administration (EIA)<sup>146</sup>; U.S. Bureau of Labor Statistics<sup>147</sup>

Employment in the Oil and Gas Extraction (NAICS 21111) and Support Activities for Oil and Gas Operations (NAICS 213112) sectors appear to be less affected by oil prices than employment in the Drilling Oil and Gas Wells (NAICS 213111) sector. These observations appear to be consistent with the information presented regarding levels of oil production, and drill rig activity in the Illinois Basin. Oil and Gas Extraction (NAICS 21111) and Support Activities for Oil and Gas Operations (NAICS 213112) are reflective

<sup>145</sup> U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) through June 2015. For more information, please see the detailed discussion in Chapter 4.

<sup>146</sup> U.S. Energy Information Administration. "Cushing, OK WTI Spot Price FOB (Dollars per Barrel)." <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D> (Accessed January 27, 2016).

<sup>147</sup> U.S. Bureau of Labor Statistics. Quarterly Census of Employment and Wages. <http://www.bls.gov/cew/data.htm>. (Accessed January 29, 2015).

of occupations in oil extraction and production, which held up well through June 2015 despite a large decrease in oil price since June 2014. The decline in oil price since 2014 does seem to have had an effect on the number of active drilling rigs through the middle of 2015, falling below where would be expected even on a seasonal basis. Employment in all three sectors did decline after the oil price decline in the second half of 2014. However, employment levels for all three sectors increased when oil prices rebounded slightly in the second quarter of 2015. Data from the second-half of 2015, not available at the time of this report, will allow for an improved understanding of the recent low oil price environment and employment in the oil and gas industry in Illinois.

### **6.3.5 Oil Prices and the Illinois Oil and Gas Industry – Going Forward**

Information gathered within the past few months indicate that low oil prices are having a negative effect on employment in the oil production industry in Illinois. While official published industry data have a long lag, the most recent accounts from producers indicate there have been employment reductions in the hundreds during the past year and that financial trouble may be ahead for firms in Illinois if prices remain at such low levels.<sup>148</sup> These descriptions are consistent with what would be expected after the large decline in oil prices. But overall, according to other industry representatives, employment has been at very high levels in the past two years, and even layoffs in the hundreds may only serve to bring employment back to historical averages. Given the continued uncertainty regarding future oil prices and the influences of the international oil market, it remains to be seen if there will be any permanent effects from recent price declines on the traditional oil production industry in Illinois.

In terms of future development of shale gas resources in Illinois, the confluence of low prices and a difficult and expensive regulatory environment does seem to have negatively affected prospects for development using HVHF at a time when the state is deeply in need of new sources of employment and revenue.

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<sup>148</sup> Giles, A. (2016). "Southern Illinois oil companies struggle with record low oil prices," *WSIL-TV*. <http://www.wsiltv.com/story/30970895/southern-illinois-oil-companies-struggle-with-record-low-oil-prices> (Accessed January 25, 2016).