

# Winter 2010-11 U.S. Natural Gas Production and Supply Outlook

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## Introduction

This report presents ICF's current view of trends and forecasts of upstream industry activity, production and imports for the upcoming winter heating season. It also discusses regional production trends and exploration plays that will be important in the longer-term.

Recent years have seen large changes in North American gas development activity. The greatest change has been a shift toward onshore unconventional gas (tight gas, shale gas, and coalbed methane). Initially, this was focused on tight gas and coalbed methane. Since 2007, there has been a rapid emergence and expansion of horizontal shale gas development. There have also been large swings in drilling activity related to the U.S. economy.

The U.S. experienced one of the worst recessions and credit crises in history starting in late 2008. The economic impact on demand combined with abundant shale supply resulted in a sharp decline in drilling in 2009. With the continuing gradual recovery of the U.S. economy, drilling activity has increased in 2010, driven primarily by horizontal shale gas and tight gas.

In recent months wellhead prices have been in the \$4.00 -\$5.00 per MMBtu range at Henry Hub, Louisiana. Despite low wellhead gas prices, U.S. rig counts and gas completion activity in the U.S. have increased substantially since reaching a low of 893 rigs in June, 2009. The current rig count (late August) is

approximately 1650 rigs, including 985 gas-directed rigs and 665 oil or miscellaneous rigs. Most of the new activity is horizontal shale activity and vertical and directional tight gas activity.

Significant developments in North American gas supply since our last report in the fall of 2009 are:

- Moderate increase in overall U.S. gas production (1.2 Bcf/d in third quarter)
- Ongoing gas production increases from the major shale and tight plays
- Declining conventional production
- Increase in horizontal and directional onshore rig and completion activity
- Relatively low wellhead prices due to weak economy and more supply
- Emergence of the Appalachian Marcellus Shale as a giant play
- Continued growth of the giant Haynesville Shale
- Confirmation of British Columbia Shales (Horn River and Montney) as potential giant gas plays
- Emergence of Eagle Ford Shale gas and oil play in south Texas
- Increased activity in oil and associated gas or wet gas portions of shale plays, including Barnett, Eagle Ford, and Bakken.
- Excess deliverability caused by rapidly increasing gas production from shale plays
- Trend toward longer horizontal laterals and more frac stages in shale wells
- Drilling cost declines onshore and offshore.

ICF forecasts that 2010 Lower-48 gas production will be 20.5 Tcf, about 1.3 percent higher than in 2009. Going forward into next year we are forecasting a 2.7 percent increase relative to 2010.

The production analysis presented here is based upon analysis of data from commercial data, state agencies, and the Energy Information Administration

(EIA). It incorporates a procedure to estimate recent production where reported production is not yet complete due to a reporting lag. Historic gas production at the individual play level is based upon ICF analysis of state agency and commercial well level production data, as well as individual company reports. The gas production forecast presented here is consistent with the ICF Compass forecast which is a detailed forecast and market analysis of North America. The forecasts of gas storage, pipeline imports, and LNG imports presented here are derived from that forecast.

### **Drilling Activity**

U.S. drilling activity in recent years peaked in September, 2008. This was followed by one of the steepest and largest drops in history, bottoming in June, 2009. The large swing in activity corresponded to the sharp decline in the U.S. economy, reduced credit availability, shale gas deliverability additions, and other factors. As the economy and credit markets have improved, drilling activity has rebounded significantly in 2010.

U.S. total oil and gas rig activity (Baker-Hughes) in August 2010 averaged 1,632 rigs, which was 665 rigs (69%) higher than in August of 2009. The increase was driven primarily by shale gas activity in the Haynesville, Marcellus, Fayetteville, Barnett, and Woodford plays. Activity has increased in all major onshore producing areas, indicating some increase in conventional activity as well.

While shale gas drilling activity remains robust, a significant trend in drilling activity since the first half of 2010 has been an increase in oil-targeted activity including shale and tight sand plays that have significant liquid components such as the Eagle Ford play in Texas and the Granite Wash play in the Mid-Continent. This trend has been driven by large price differences between oil and gas on an energy-equivalent basis.

Baker-Hughes tracks three rig activity categories: vertical, horizontal, and directional. Horizontal activity is heavily dominated by shale gas plays. The number of horizontal rigs increased from approximately 420 in August, 2009 to about 900 rigs today, or about 54 percent of the total. Currently, about 67 percent of rigs are either horizontal or directional and 33 percent are vertical.

**Exhibit 1** presents 2010 trends in drilling activity by region. The overall increase in August was 69 percent relative to last year. All major areas except the Gulf of Mexico experienced increased activity.

**Exhibit 1**

<b>U.S. and Canadian Drilling Trends</b>			
<b>August Data - Total Rigs</b>			
Source: Baker Hughes	Total Rigs Aug 2009	Total Rigs Aug 2010	Total Rigs Change (%)
<b>Regional U.S. Rig Trends</b>			
Rockies	97	142	46%
Midcontinent	146	189	29%
Texas	358	709	98%
Louisiana	136	184	35%
Gulf of Mexico	29	20	-31%
Appalachia	84	124	48%
Other	117	264	126%
Lower-48	967	1,632	69%

**Exhibit 2** compares rig activity in 2009 and 2010. Looking at the U.S. rig counts for the first eight months of 2010, the average was 934 rigs. This can be compared to an average of 852 gas rigs during the same months last year, an increase of 9.6 percent. On a calendar year basis, ICF is forecasting an average of 948 gas rigs this year, an increase of 17 percent. ICF forecasts a continued moderate increase in rigs and completion activity in the last half of the year.

A large factor driving rig activity is the need to drill new leases in many areas of the large unconventional gas plays. Leases that are not held by production must be drilled or they will expire. This factor has been present since last year and will continue in the near future due to the extensive area of these plays. It appears that in some plays, well completion and production has been delayed after some leases are drilled, apparently due to poor market conditions and possibly infrastructure issues. This was confirmed in early 2010 by an examination of well history records in the Haynesville play. No quantitative analysis of this has been conducted to date by ICF.

**Exhibit 2**

Historical and Forecast Gas Rigs			
	Gas Rigs 2009	Gas Rigs 2010	Gas Rigs change
January through August (actual)	852	934	9.6%
Annual average (2010 forecast)	811	948	16.9%

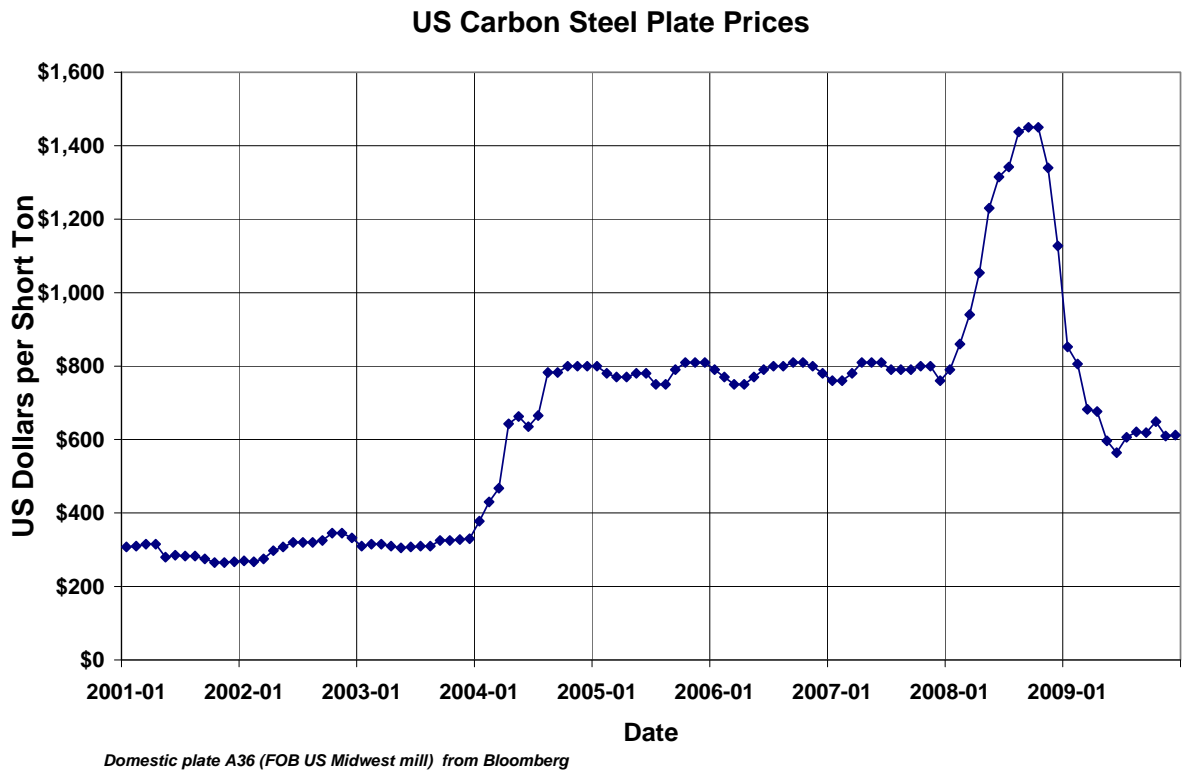
**Drilling Cost Trends**

In recent years there were large increases in the cost of upstream activity, including drilling, stimulation, and completion. This was driven by various factors including increased demand for specialized drilling rigs and equipment, material costs, labor costs, and increased commodity costs.

There were steep increases in the cost of materials and labor used in the construction of all types of energy infrastructure, including power plants, pipelines and oil and gas wells. These cost trends peaked in the first half of 2008. Since then, drilling rig rates have generally declined.

As one indicator of oil field commodity costs, **Exhibit 3** shows the trends in cost per ton of carbon steel plate (used in line pipe, casing, pressure vessels, etc.). There has been a steep price decline since the first half of 2008. However, prices appear to have recently stabilized at approximately 2004 levels.

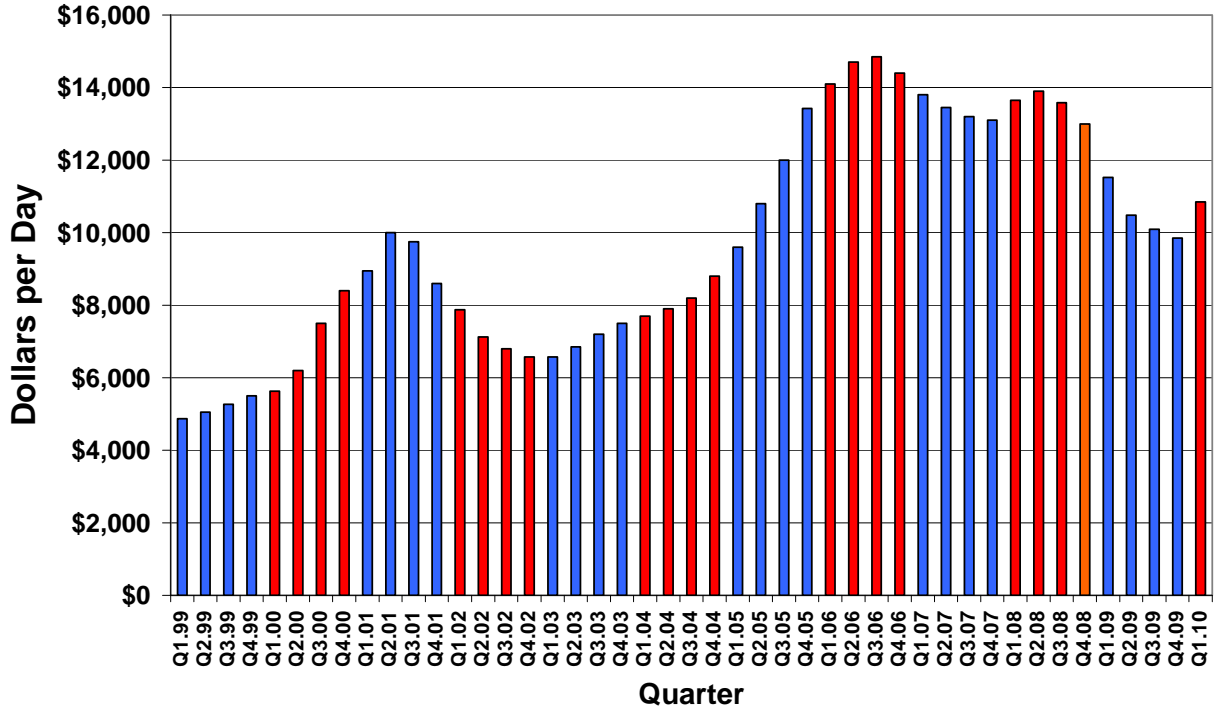
### Exhibit 3



**Exhibit 4** shows the average day rate for onshore drilling rigs in the U.S. This is a key component of U.S. drilling costs. The average day rate essentially doubled between 2003 and 2007. This had a major impact on overall resource development costs, especially when combined with cost increases for materials. There has been a sharp decline since 2008. However, this year has seen a slight uptick in rates.

Exhibit 4

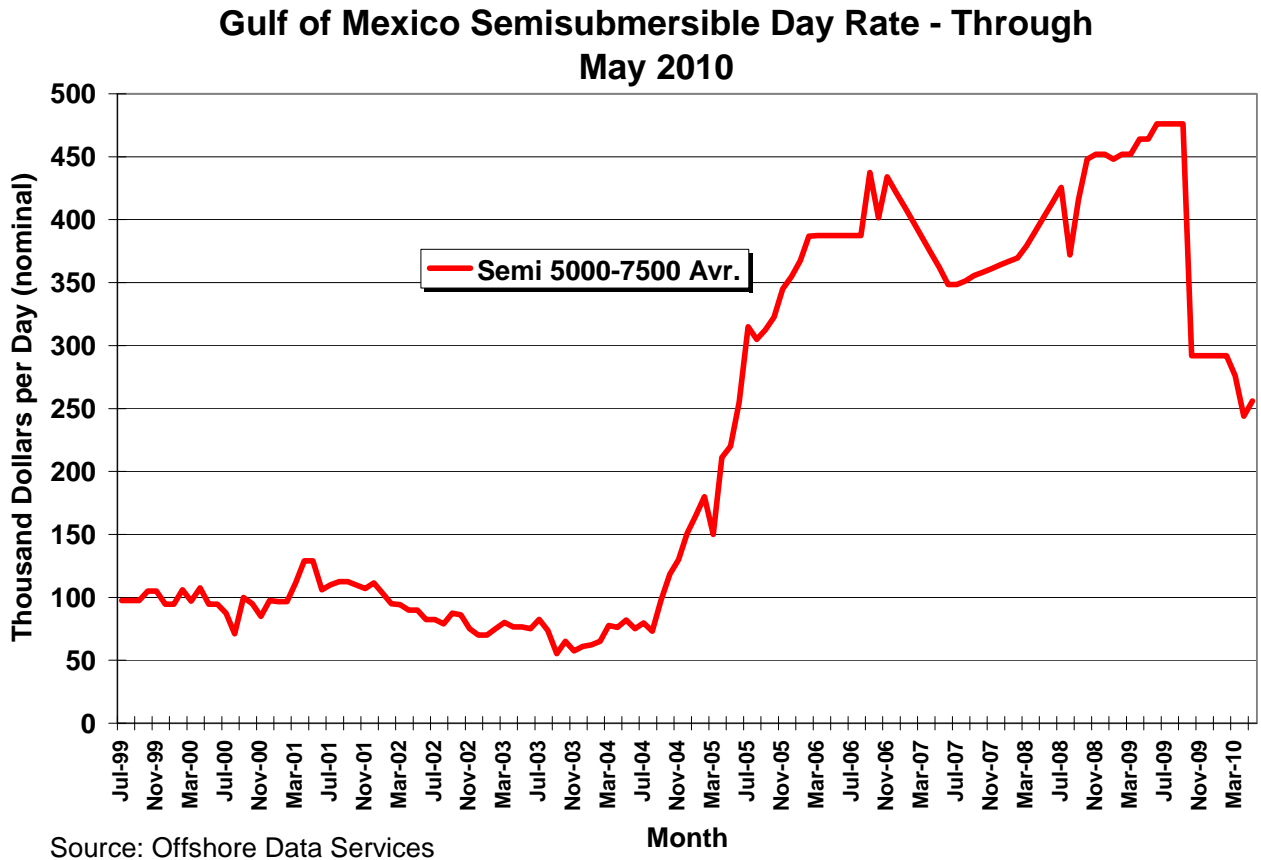
Average Onshore U.S. Drilling Rig Day Rate



The cost of onshore wells, while primarily driven by the rig day rate, is also impacted by other costs. For example, as operators drill deeper for shale and tight gas, drilling costs per foot increase. The reservoir stimulation component of completed well costs has also increased greatly, as a result of expensive, specialized multi-stage frac jobs. Industry outlays for drilling are affected by the number of high cost unconventional wells, well configurations (especially lateral length and number of stages), day rate, and stimulation costs. As a result of these trends, industry capital outlays for development have been very high.

**Exhibit 5** shows historic rig rates for offshore deepwater semisubmersibles. These day rates more than quadrupled since 2003, peaking in 2009. Since that time, rates have fallen by about 40 percent.

**Exhibit 5**

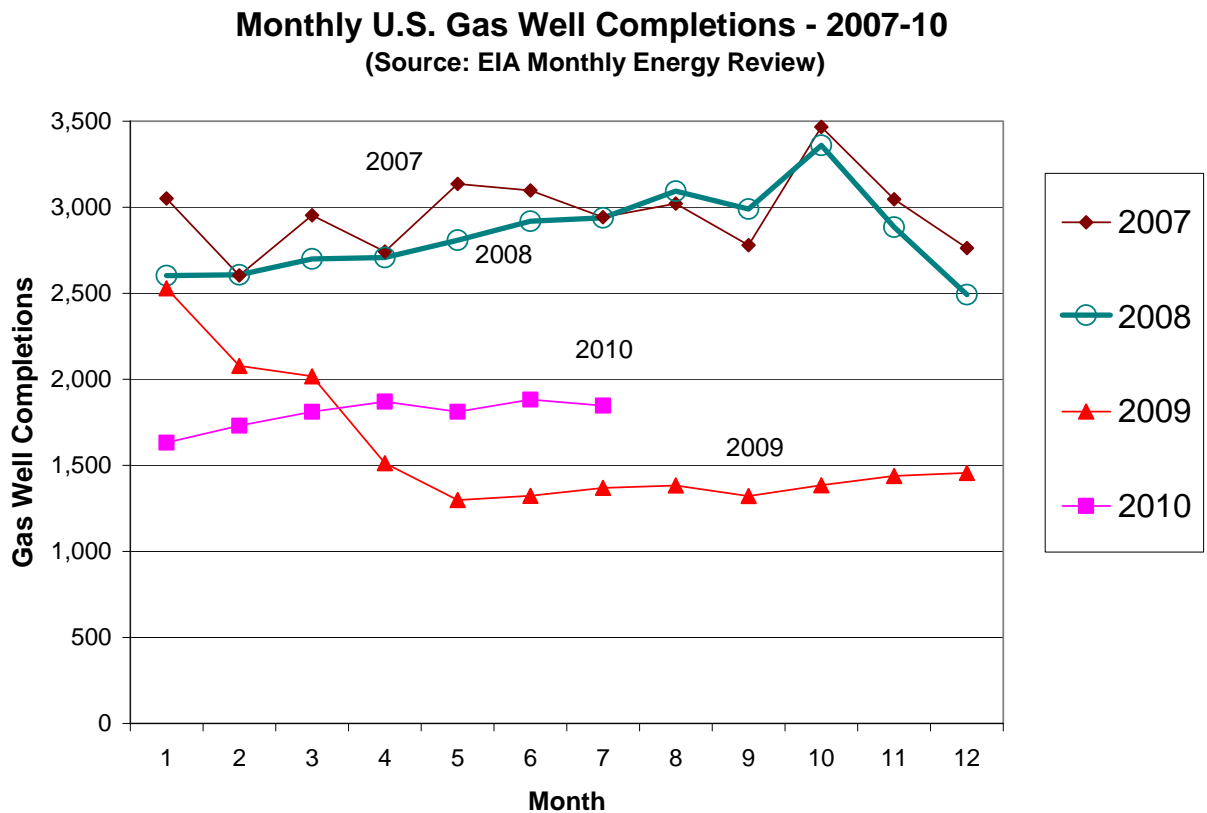




## Gas Well Completions

**Exhibit 6** shows monthly U.S. gas well completion statistics from the EIA Monthly Energy Review. Completion activity increased through most of 2008, then declined sharply in the last quarter of 2008. Declines continued through the first half of 2009. Activity was then flat through the remainder of 2009 and has since increased in the first half of this year.

### **Exhibit 6**



**Exhibit 7** presents Lower-48 gas well completion statistics starting with the first quarter of 2007. The table presents EIA Monthly Energy Review data, API Quarterly Completion Report data, and ICF estimates. Based upon trends in rig activity and available well-completion data for 2009, ICF is forecasting the completion of about 20,000 Lower-48 gas wells in 2010. This represents an increase of 18 percent from the estimated 16,969 wells completed in 2009.

## Exhibit 7

### Comparison of Quarterly Lower 48 Completion Counts

#### Estimated Gas Well Completions

Sources: EIA Monthly Energy Review and API Completion Report.

	EIA Monthly Energy Review Estimated	API Quarterly Comp. Report Estimated	ICF With Estimates	
2007 Q1	8,609	6,945	6,945	
2007 Q2	8,976	7,422	7,422	
2007 Q3	8,744	7,875	7,875	
2007 Q4	9,276	7,697	7,697	
2008 Q1	7,911	6,912	6,912	
2008 Q2	8,436	7,406	7,406	
2008 Q3	9,023	7,859	7,859	
2008 Q4	8,737	7,351	7,351	
2009 Q1	6,626	5,978	5,978	
2009 Q2	4,135	3,613	3,613	
2009 Q3	4,074	3,578	3,578	
2009 Q4	4,280	3,361	3,800	
2010 Q1	5,175		4,400	
2010 Q2	5,564		4,700	
2010 Q3	6,083		5,300	
2010 Q4	6,608		5,600	
<b>Annual Totals</b>				<b>% chg.</b>
2007	35,605	29,939	29,939	
2008	34,107	29,528	29,528	-1.4%
2009	19,115	16,530	16,969	-42.5%
2010	23,430	---	20,000	17.9%

## **Natural Gas Production**

There has been a continued increase in gas production from onshore non-conventional gas plays and new production from emerging unconventional plays. Shale and tight gas development continues to dominate activity onshore.

Unconventional drilling and completion activity in the U.S. has been largely focused on the following plays:

- Barnett Shale in the Fort Worth Basin
- Marcellus Shale in Appalachia
- Haynesville and Bossier Shales in North Louisiana and East Texas
- Fayetteville Shale in Arkansas
- Woodford Shale in Oklahoma
- Eagle Ford Shale in South Texas
- Bossier Tight Sand in East Texas and North Louisiana
- Lance Tight Sand in the Green River Basin (Jonah-Pinedale)
- Mesaverde Tight Sand in the Uinta and Piceance Basins
- Anadarko Basin Tight Cleveland and Granite Wash Sands
- Powder River Basin Coalbed Methane
- San Juan Basin Coalbed Methane and Tight Gas

**Exhibits 8a and 8b** illustrate gas production trends from several key onshore plays. Included in the chart in **Exhibit 8a** are the Barnett Shale in the Fort Worth Basin, the Bossier Tight Sand in East Texas, the Fayetteville Shale in Arkansas, the Woodford Shale in Eastern Oklahoma, the Jonah and Pinedale tight gas fields in Southwestern Wyoming, the Piceance Basin tight gas in Colorado, the Haynesville Shale of Northern Louisiana and East Texas, the Marcellus Shale in Appalachia and the Powder River Basin. These plays have experienced an increase in gas production of over 15 Bcf per day since 2000. During the same period, Lower-48 dry gas production increased, but at a much lower rate. Thus,

these few plays have been largely responsible for increasing U.S. gas production during this period.

**Exhibit 8b** shows the shale plays separately. Through 2008, the Barnett Shale continued to dominate shale gas production. While the rate of increase in the Barnett has slowed, the overall rate of production increase from the shale plays is very steep. Note that some of the Barnett production decline is likely due to a combination of reporting lag and temporary shut-ins.

**Exhibit 8a**

**Gas Production Through 2009 - Selected Plays**

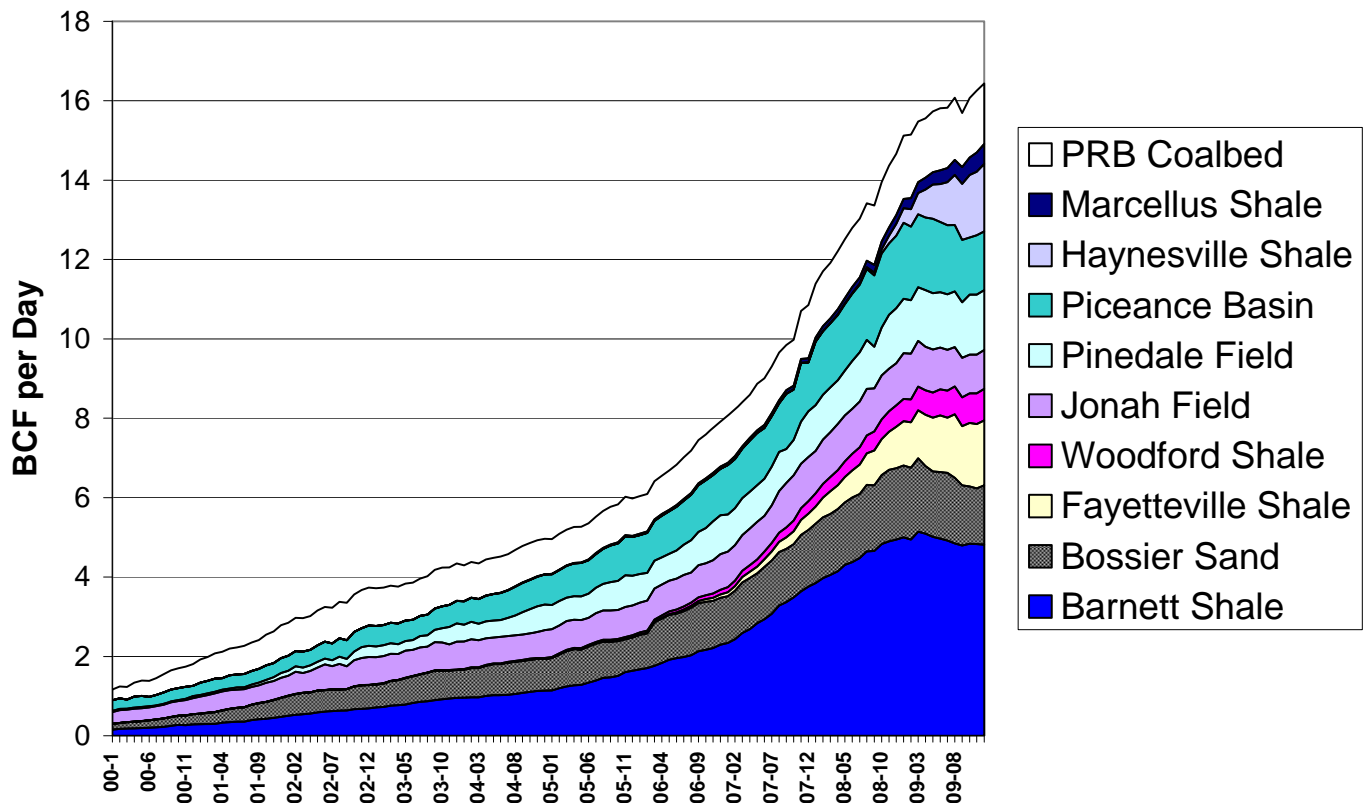
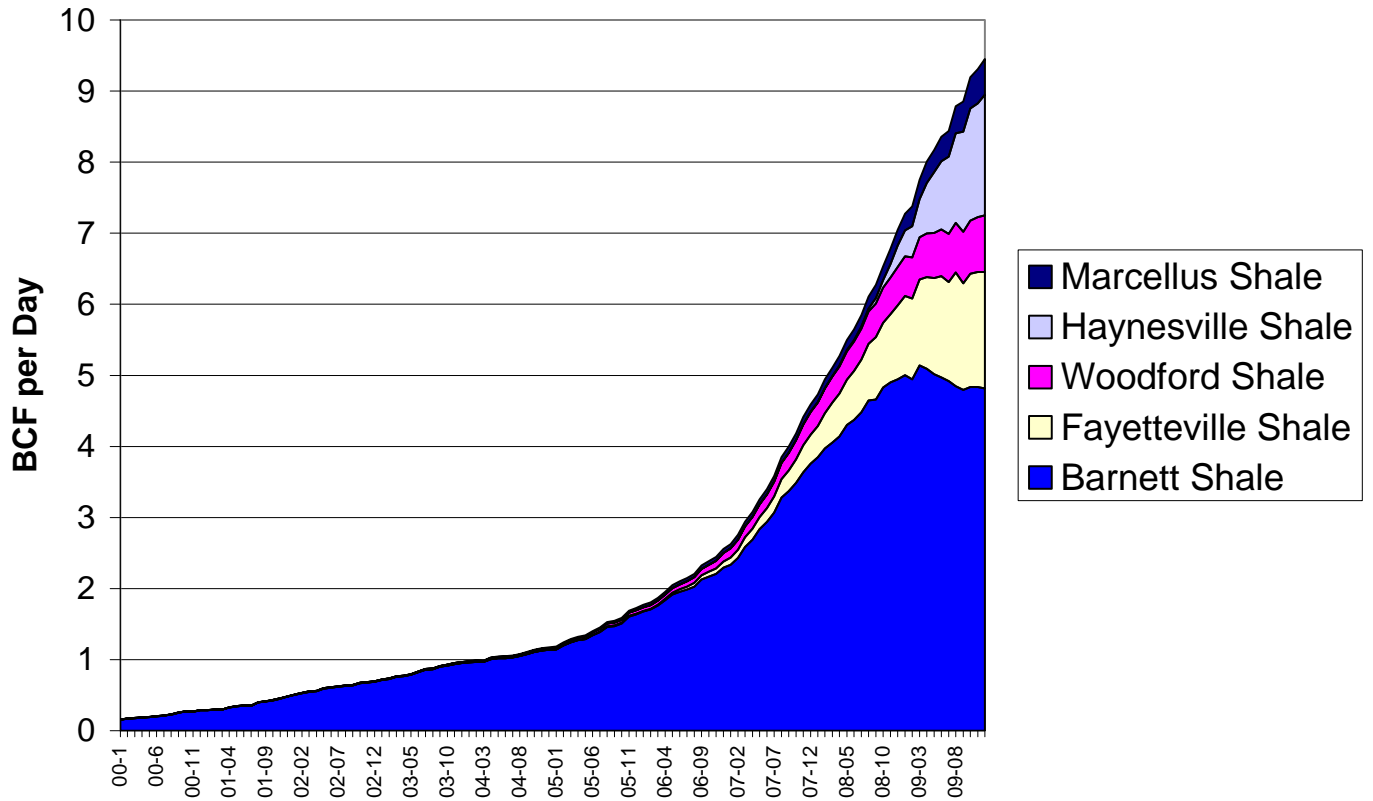


Exhibit 8b

Shale Gas Production Through 2009 - Major U.S. Plays



**Exhibits 9 through 11** present the ICF Lower-48 natural gas production analysis and forecast. Lower-48 gas production in the third quarter of 2010 is expected in this analysis to average 56.2 Bcf per day, up significantly from 55.0 Bcf/d in the third quarter of last year. These estimates are presented graphically in **Exhibit 10**. Lower-48 production since 2008 has increased fairly steadily, despite large swings in rig counts and completion activity. This is because of the prolific nature of the unconventional gas plays and the fact that completion rates in those plays have not varied as much as overall U.S. completion rates.

The highest rate of U.S. gas production in history occurred during the early 1970s, when dry gas production was approximately 60 Bcf per day. This rate will likely be exceeded in the near future.

The lower portion of **Exhibit 9** presents an annual summary and shows the percentage change in Lower-48 production. ICF estimates that 2010 production will average 56.1 Bcf/d (20.5 Tcf), a 1.3 percent increase over 2009. The forecast for 2011 is for an average of 57.6 Bcf/d, a 2.7 percent increase over this year.

**Exhibit 11** presents the details of winter monthly natural gas production since November 2008 and the ICF forecast for the upcoming winter. The forecast is for Lower-48 production to average 57.5 Bcf/d this winter through March of 2011. This is about 2 Bcf/d higher than last year.

## Exhibit 9

### ICF Analysis of Lower-48 Quarterly Wellhead Gas Production

Dry marketed total gas - Bcf per day

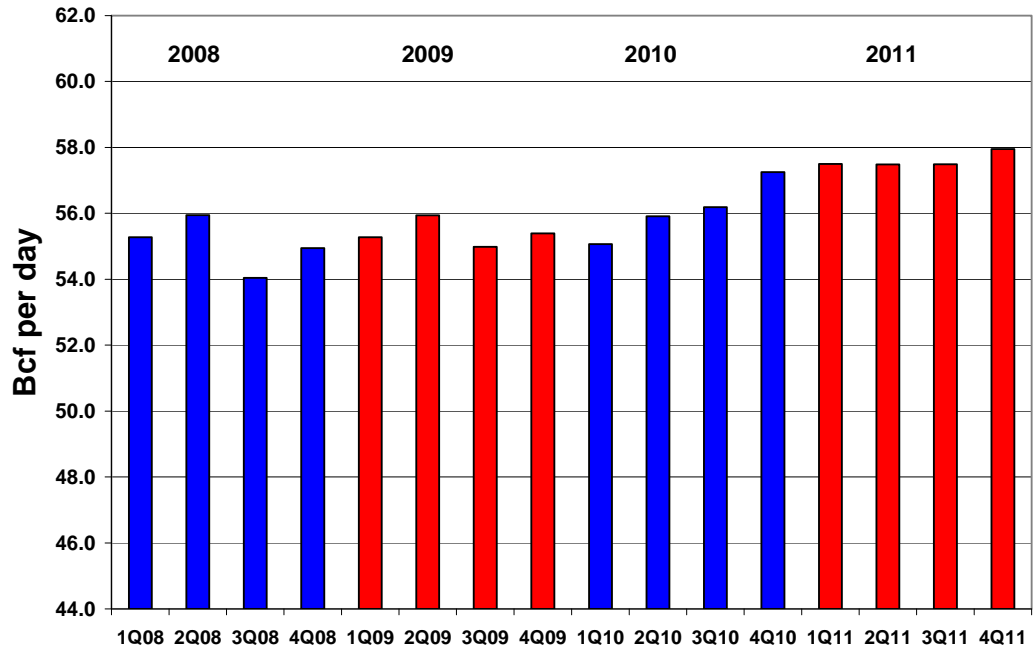
Quarterly averages		Bcf per day *	Quarterly Bcf Change	Quarterly Pct. Chg.
2006	1Q06	48.58	1.75	3.7%
	2Q06	49.57	0.99	2.0%
	3Q06	49.90	0.33	0.7%
	4Q06	49.77	-0.13	-0.3%
2007	1Q07	50.26	0.49	1.0%
	2Q07	51.28	1.02	2.0%
	3Q07	51.98	0.70	1.4%
	4Q07	52.95	0.97	1.9%
2008	1Q08	55.27	2.32	4.4%
	2Q08	55.95	0.67	1.2%
	3Q08	54.04	-1.91	-3.4%
	4Q08	54.95	0.91	1.7%
2009	1Q09	55.27	0.32	0.6%
	2Q09	55.94	0.67	1.2%
	3Q09	54.98	-0.96	-1.7%
	4Q09	55.39	0.41	0.7%
2010	1Q10	55.07	-0.32	-0.6%
	2Q10	55.91	0.84	1.5%
	3Q10	56.19	0.28	0.5%
	4Q10	57.25	1.06	1.9%
2011	1Q11	57.50	0.25	0.4%
	2Q11	57.48	-0.02	0.0%
	3Q11	57.49	0.01	0.0%
	4Q11	57.95	0.46	0.8%

Annual averages		Bcf per day	Bcf Change	Annual Pct. Chg.	Annual Production Bcf/Yr.	Annual Change Bcf
	2005	48.66	-1.21	-2.43%	17,761	-492
	2006	49.46	0.80	1.64%	18,053	292
	2007	51.62	2.16	4.37%	18,841	788
	2008	55.05	3.43	6.64%	20,147	1,306
	2009	55.39	0.34	0.62%	20,217	70
	2010	56.11	0.72	1.30%	20,480	263
	2011	57.61	1.50	2.67%	21,028	548

\* Production excludes approximately 1.0 Bcf/d of marketed Alaska gas production and 200 MMcf/d of supplemental gas production consisting of coal gas and propane-air.

**Exhibit 10**

**ICF Analysis of Lower 48 Dry Gas Production  
September 2010**





## Exhibit 11

### Historical and Forecast Winter Monthly Production

November - March

Source: ICF Database and Models

#### Bcf

Historical 2008-09			Historical 2009-10			ICF Forecast for this winter		
		Bcf			Bcf			Bcf
Nov	2008	1,673	Nov	2009	1,672	Nov	2010	1,726
Dec	2008	1,699	Dec	2009	1,709	Dec	2010	1,788
Jan	2009	1,677	Jan	2010	1,687	Jan	2011	1,785
Feb	2009	1,556	Feb	2010	1,550	Feb	2011	1,609
Mar	2009	1,742	Mar	2010	1,720	Mar	2011	1,782
total		8,347			8,337			8,689

#### Bcf per day

Historical 2008-09			Historical 2009-10			ICF Forecast for this winter		
		Bcfd			Bcfd			Bcfd
Nov	2008	55.8	Nov	2009	55.7	Nov	2010	57.5
Dec	2008	54.8	Dec	2009	55.1	Dec	2010	57.7
Jan	2009	54.1	Jan	2010	54.4	Jan	2011	57.6
Feb	2009	55.6	Feb	2010	55.3	Feb	2011	57.5
Mar	2009	56.2	Mar	2010	55.5	Mar	2011	57.5
average		54.9			55.2			57.5

### Comparison with EIA Short-Term Forecast

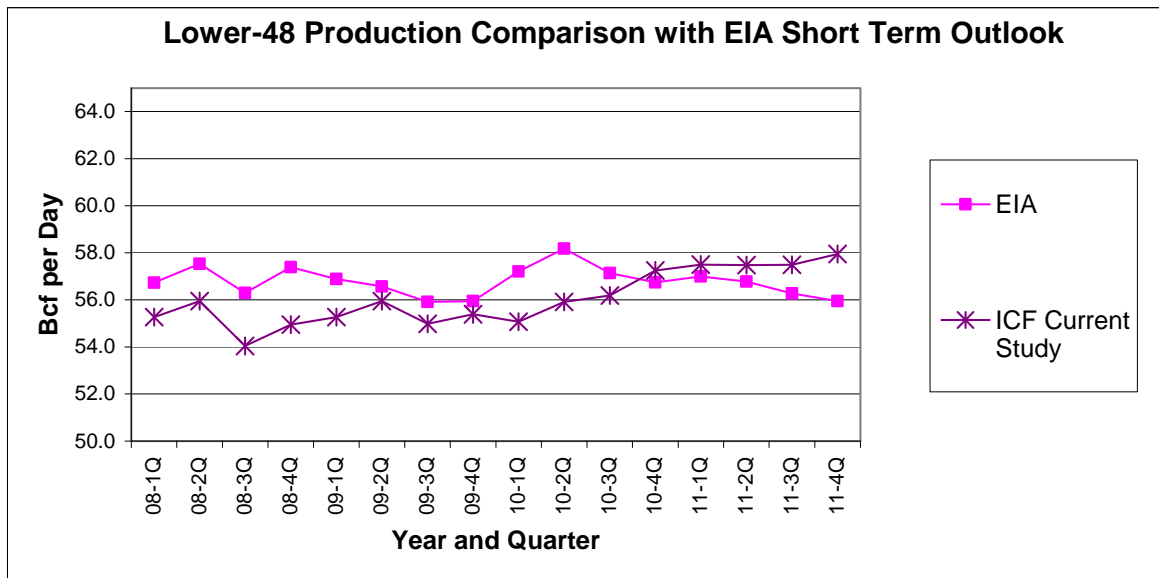
EIA publishes a short-term forecast each month with quarterly estimates of U.S. natural gas production and imports. **Exhibit 12** presents the EIA and ICF quarterly production averages for the Lower-48. EIA is forecasting a 2010 Lower-48 gas production increase of 2.1 percent. This compares to an increase of 1.3 percent in the ICF analysis. The EIA forecast for 2011 is for a 0.6 percent decline, compared with our 2.7 percent increase.

## Exhibit 12

### Comparison with EIA Short Term Outlook

Bcf per day; Lower-48 and U.S. Total Dry Gas Production  
ICF Current Study vs. EIA Short Term Outlook

	ICF (Lower 48)	EIA (U.S. Total)	EIA (Lower 48)	Lower 48 Difference ICF vs.EIA	
2008					
1Q	55.27	57.95	56.73	-1.46	
2Q	55.95	58.56	57.53	-1.58	
3Q	54.04	57.26	56.30	-2.26	
4Q	54.95	58.57	57.39	-2.44	
2009					
1Q	55.27	58.11	56.89	-1.62	
2Q	55.94	57.63	56.57	-0.63	
3Q	54.98	56.84	55.91	-0.93	
4Q	55.39	57.08	55.94	-0.55	
2010					
1Q	55.07	58.36	57.20	-2.13	
2Q	55.91	59.19	58.18	-2.27	
3Q	56.19	58.12	57.14	-0.95	
4Q	57.25	57.88	56.75	0.50	
2011					
1Q	57.50	58.19	57.00	0.50	
2Q	57.48	57.80	56.78	0.70	
3Q	57.49	57.26	56.27	1.22	
4Q	57.95	57.07	55.95	2.00	
		% chg.		% chg.	
2009	55.39	0.62%	57.41	56.32	-1.16%
2010	56.11	1.30%	58.57	57.50	2.09%
2011	57.61	2.67%	58.17	57.16	-0.60%
		Difference			



## **Storage Injection**

At the end of August, U.S. inventories of working natural gas in storage stood at about 3.16 Tcf, or 190 Bcf above the five-year average of 2.97 Tcf and 190 Bcf lower than the 3.35 Tcf at the end of late August, 2009. As shown in **Exhibit 13 (a)**, the 2009 storage volumes were significantly above the five year average during the first half of 2010. The ICF forecast is for the storage level on November 1 to be approximately 3.70 Tcf. This is slightly below the 3.81 Tcf last year. **Exhibit 13 (b)** presents the monthly working gas storage data.

In a recent report, EIA estimated that so-called “demonstrated peak storage capacity” in the U.S. as of April, 2010 was 4.049 Tcf, which was approximately 160 Bcf higher than in April, 2009.<sup>1</sup> As defined by EIA, demonstrated peak storage capacity is the sum of the highest actual facility level storage volumes reported over the prior five year period. EIA estimated that working gas “design capacity” as of April was 4.36 Tcf.

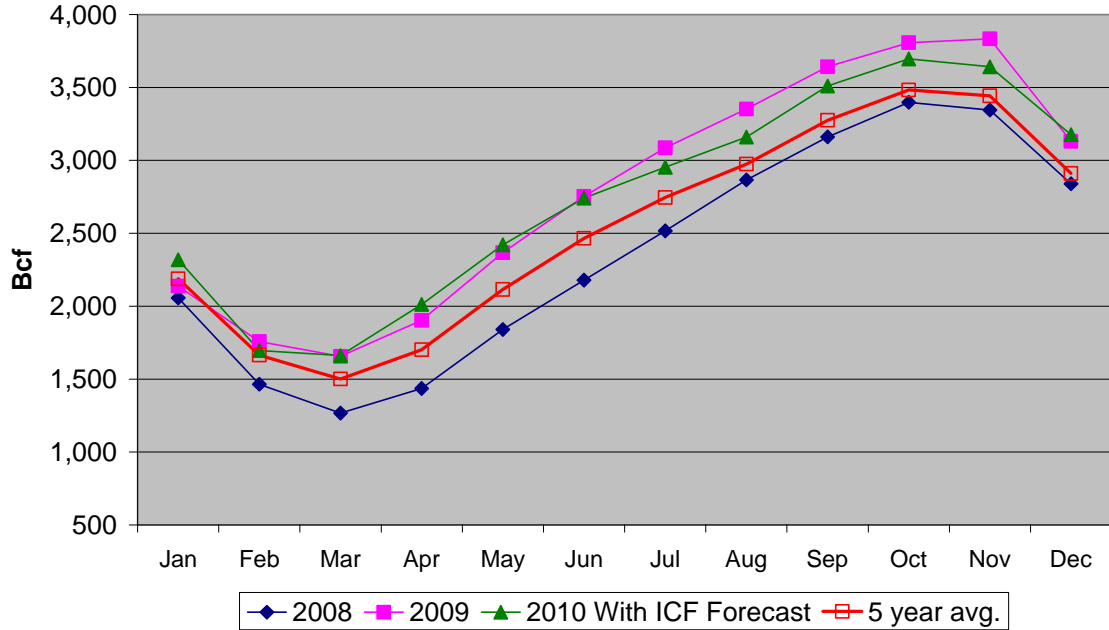
ICF estimates that U.S. working gas storage capacity is 4.00 Tcf. This estimate is based upon our project level analysis, including estimates for expected startups this year. The method used involves evaluation of historical storage fill in older facilities combined with design capacity for facilities without a history of storage. This estimate is generally equivalent in definition to the EIA “demonstrated capacity” estimate above. The current ICF forecast of peak storage this fall of 3.70 Tcf represents 92 percent of our estimate of storage capacity.

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<sup>1</sup> U.S. Energy Information Administration, 2010, “Peak Underground Working Natural Gas Storage Capacity,” September, 2010.  
[http://www.eia.gov/pub/oil\\_gas/natural\\_gas/feature\\_articles/2010/ngpeakstorage/ng\\_peak.html](http://www.eia.gov/pub/oil_gas/natural_gas/feature_articles/2010/ngpeakstorage/ng_peak.html)

**Exhibit 13 (a)**

Gas Storage - Entire Year With Forecast  
U.S. Working Gas Inventories - End of Month Volumes



**Exhibit 13 (b)**

	Underground Natural Gas Storage - BCF Working Gas - End of Month			
	2008	2009	2010 With ICF Forecast	5 year avg.
Jan	2,056	2,137	2,319	2,188
Feb	1,465	1,757	1,696	1,665
Mar	1,266	1,656	1,662	1,500
Apr	1,436	1,903	2,012	1,701
May	1,840	2,367	2,421	2,115
Jun	2,178	2,752	2,741	2,465
Jul	2,517	3,086	2,953	2,746
Aug	2,866	3,353	3,160	2,974
Sep	3,161	3,643	3,511	3,275
Oct	3,399	3,807	3,696	3,483
Nov	3,346	3,833	3,642	3,443
Dec	2,840	3,131	3,176	2,911

## **Pipeline Imports and Exports**

**Exhibit 14** shows the winter pipeline imports from Canada and exports to Mexico, starting with the winter of 2008-09. Import data are net to the U.S. The historical Canadian import data are taken from the ICF Compass and are a combination of Stats Canada data and pipeline bulletin boards.

Net imports from Canada last winter (2009-10) averaged 6.8 Bcf per day, about 6 percent lower than the previous winter's average.

This winter we forecast that imports from Canada will average 6.2 Bcf per day, a decline of 8 percent or 0.5 Bcf/d relative to last winter. The volume of Canadian pipeline imports depends on WCSB gas production and demand in both Canada and the U.S. Western Canada production has been declining, and ICF is forecasting that this will continue in the near-term, although longer-term potential is excellent and the trend will change with increased production. While production has declined, gas demand in Alberta has increased, primarily due to oilsands processing needs. Thus, net exports have declined at a greater rate than production.

While gas production from Western Canada coalbed methane is increasing, these gains have not resulted in an upturn in overall gas production. Canadian shale gas is just beginning to be produced in British Columbia. Significant plays are the Horn River Basin, the Montney Siltstone, and Deep Basin tight gas. Shale gas and tight gas in Canada is expected to make a very large contribution within the next few years.

## Exhibit 14

### Pipeline Imports from Canada and Exports to Mexico

November through March

Sources: ICF Monthly Gas Update and EIA Natural Gas Monthly

#### Net Imports from Canada

Bcf per day

positive = net imports

Historical 2008-09			Historical 2009-10			ICF Forecast for this winter 2010-11		
		Bcf/d			Bcf/d			Bcf/d
Nov	2008	7.10	Nov	2009	6.10	Nov	2010	6.50
Dec	2008	7.50	Dec	2009	6.60	Dec	2010	7.10
Jan	2009	7.60	Jan	2010	7.10	Jan	2011	6.10
Feb	2009	7.10	Feb	2010	7.70	Feb	2011	6.00
Mar	2009	6.80	Mar	2010	6.40	Mar	2011	5.50
average		7.22			6.77			6.24

#### Net Exports to Mexico

Bcf per day

negative = net exports

Historical 2008-09			Historical 2009-10			ICF Forecast for this winter 2010-11		
		Bcf/d			Bcf/d			Bcf/d
Nov	2008	-0.80	Nov	2009	-0.80	Nov	2010	-0.70
Dec	2008	-0.90	Dec	2009	-0.80	Dec	2010	-0.70
Jan	2009	-1.00	Jan	2010	-0.80	Jan	2011	-0.60
Feb	2009	-1.00	Feb	2010	-0.80	Feb	2011	-0.70
Mar	2009	-0.90	Mar	2010	-0.80	Mar	2011	-0.60
average		-0.92			-0.80			-0.66

### Winter LNG Imports

In recent years, the U.S. has typically imported 1.0 to 1.5 Bcf/d of LNG during the winter months. We have historically imported more LNG in the summer months when there is less demand in Europe. Prior to the boom in shale gas, most analysts believed that LNG imports would ramp up greatly in coming years to fill a supply gap. While LNG is still expected to be a major source of incremental U.S. supply over the long term, it is not expected to contribute greatly in the near term due to surging U.S. gas production.

**Exhibit 15** shows the recent history of worldwide LNG shipments and world gas production. LNG imports to North America (primarily to the U.S.) increased in 2009 to 658 Bcf, up from 524 Bcf in 2008. U.S. imports (not shown) increased to 452 Bcf in 2009 from 351 Bcf in 2008.

World production of LNG increased to 8,571 Bcf. However, world gas production fell slightly (about 2 Tcf) in 2009 relative to 2008.

LNG shipments to Europe increased greatly in 2009. The increase of 488 Bcf accounted for most of the worldwide increase in LNG production. Most of the increase was in Belgium and the U.K.

## Exhibit 15

### World LNG Imports and Gas Production

EIA data through 2005; BP Statistical Review for 2006 forward

	LNG Imports					Gas Production		
	North America Bcf	Europe Bcf	Asia - Pacific Bcf	Other Bcf	Total Bcf	LNG Post-2000 Increase Bcf	World Gas Production Tcf	Post-2000 Increase Tcf
2000	239	1,150	3,544		4,933	0	85.4	0.0
2001	261	1,157	3,776		5,194	261	87.6	2.2
2002	253	1,386	3,671		5,310	377	89.1	3.7
2003	544	1,390	3,978		5,912	979	92.4	7.0
2004	683	1,423	4,347		6,453	1,520	94.9	9.5
2005	664	1,668	4,495		6,827	1,894	98.2	12.8
2006	652	2,028	4,774		7,454	2,521	101.7	16.3
2007	886	1,883	5,225		7,994	3,061	104.3	18.9
2008	524	1,949	5,502		7,975	3,042	107.8	22.4
2009	658	2,437	5,376	100	8,571	3,638	105.5	20.1

Percentage of world LNG imports					
	North America	Europe	Asia - Pacific	Other	Total
2000	4.8%	23.3%	71.8%	0.0%	100.0%
2001	5.0%	22.3%	72.7%	0.0%	100.0%
2002	4.8%	26.1%	69.1%	0.0%	100.0%
2003	9.2%	23.5%	67.3%	0.0%	100.0%
2004	10.6%	22.1%	67.4%	0.0%	100.0%
2005	9.7%	24.4%	65.8%	0.0%	100.0%
2006	8.7%	27.2%	64.0%	0.0%	100.0%
2007	11.1%	23.6%	65.4%	0.0%	100.0%
2008	6.6%	24.4%	69.0%	0.0%	100.0%
2009	7.7%	28.4%	62.7%	1.2%	100.0%

**Exhibit 16** shows monthly LNG gross imports for the past two winters and the ICF forecast for this winter. The winter total volume imported for 2008-09 was 140 Bcf, or 0.92 Bcf per day. Last winter, the volume increased to 211 Bcf, or 1.40 Bcf/d. For the upcoming winter, ICF is forecasting a volume of 290 Bcf, or 1.92 Bcf/d -- about 0.5 Bcf per day more than last winter.

## Exhibit 16

### Historical and Forecast Winter LNG Imports

November - March; Gross Imports - Not Net of Alaska Exports

Source of historical data: EIA Natural Gas Monthly (Data shown through March 2010)

Source of forecast: ICF Compass

#### Bcf

Historical 2008-09			Historical 2009-10			ICF Forecast for this winter 2010-11		
		Bcf			Bcf			Bcf
Nov	2008	22.8	Nov	2009	36.7	Nov	2010	57
Dec	2008	30.7	Dec	2009	35.2	Dec	2010	59
Jan	2009	26.9	Jan	2010	56.4	Jan	2011	62
Feb	2009	27.9	Feb	2010	45.8	Feb	2011	53
Mar	2009	31.6	Mar	2010	37.1	Mar	2011	59
total		139.9			211.2			290

#### Bcf per day

Historical 2008-09			Historical 2009-10			ICF Forecast for this winter 2010-11		
		Bcf			Bcf			Bcf
Nov	2008	0.76	Nov	2009	1.22	Nov	2010	1.90
Dec	2008	0.99	Dec	2009	1.13	Dec	2010	1.90
Jan	2009	0.87	Jan	2010	1.82	Jan	2011	2.00
Feb	2009	1.00	Feb	2010	1.64	Feb	2011	1.90
Mar	2009	1.02	Mar	2010	1.20	Mar	2011	1.90
average		0.92			1.40			1.92



## Summary

Exhibit 17 summarizes the results of the supply analysis

### Exhibit 17

#### Supply Outlook for Winter 2010-11

	source	2009-10	2010-11	change	percent change
U.S. production vs previous year (trend)	1	---	Up	---	---
Annual well completions (calendar year)	2	16,969	20,000	3,031	17.9%
Annual rig count (gas rigs Jan. - December)	3	811	948	137	16.9%
Winter LNG imports (Bcf/d - Nov. - March)	4	1.40	1.92	0.52	37.1%
Winter average gas production (Bcf/d - Lower 48)	5	55.2	57.5	2.30	4.2%
Working gas in storage (Tcf - Nov.1)	6	3.81	3.70	-0.11	-2.9%
Net pipeline imports from Canada (Bcf/d - Nov. - Mar.)	7	6.77	6.24	-0.53	-7.8%

#### Sources:

1. ICF - Current Study - State and federal data with ICF adjustments and forecast.
2. API Quarterly Completion Report with ICF estimates.
3. Baker Hughes gas rigs with ICF forecast through December.
4. Historical data from EIA Natural Gas Monthly; Forecast from ICF Compass.
5. Historical and forecast from current study. Derived from state and federal data with adjustments and forecast
6. Historical data from EIA; Forecast from ICF Compass
7. Historical data from StatsCanada and bulletin boards; Forecast from ICF Compass