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**ENERGY INFORMATION ADMINISTRATION
U.S. DEPARTMENT OF ENERGY**

before the

COMMITTEE ON ENERGY AND NATURAL RESOURCES

U.S. SENATE

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Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to address current and projected supply and demand conditions for natural gas.

The Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. EIA is the Nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views expressed in our reports, therefore, should not be construed as representing those of the Department of Energy or other Federal agencies.

My testimony today addresses the hearing topic by providing a brief overview of recent natural gas developments, EIA's evaluation of U.S. natural gas reserves and resources, and a discussion of our natural gas projections to 2035 and some of the key uncertainties surrounding them.

Overview of recent U.S. natural gas data

Production. After a decade of stagnation, U. S. natural gas production increased by almost 17 percent between 2006 and 2010, reaching 21.6 trillion cubic feet (Tcf) in 2010, the highest level since 1973. Production has continued to increase despite a significant and sustained decline in natural gas prices since mid-2008.

The growth in U.S. supplies over the past few years is largely the result of increases in production from shale gas formations. Shale gas production grew from less than 3 billion cubic feet per day (bcf/d), representing 5 percent of overall production in 2006, to 13 bcf/d, accounting for 23 percent of overall production in 2010.

Imports. Increased domestic production has greatly diminished the Nation's need for natural gas imports, while lower prices have reduced foreign producers' incentive to supply the United States. In 2010, net imports to the United States dropped to 2.6 Tcf, representing 10.8 percent of U.S. consumption, marking the lowest volume of net imports since 1994 and the lowest percentage since 1992. As recently as 2007, net imports were the highest on record, equaling roughly 16 percent of consumption.

Demand. Natural gas has long played an important role in meeting U.S. energy needs. The main uses of natural gas are in buildings, the industrial sector, and electric power generation. Natural gas provides about 25 percent of the primary energy used in the United States, heating about half

of U.S. homes, generating almost one-fourth of U.S. electricity, and providing an important fuel and feedstock for industry. About 31 percent of the natural gas consumed in 2010 was used for electric power generation, 33 percent for industrial purposes, and 34 percent in residential and commercial buildings. Only a small portion is used in the transportation sector, predominately at pipeline compressor stations, although some is used for vehicles.

Demand for natural gas in buildings, and to a lesser extent in the electric power sector, is highly responsive to weather conditions, for space heating and air conditioning. In the industrial sector natural gas demand is more responsive to economic conditions, as illustrated by that sector's decline in natural gas use in late 2008 and 2009. However, the sector has rebounded with consumption in 2010 returning to essentially the same level as that in 2008.

Prices. In 2010 wholesale (Henry Hub) natural gas spot prices averaged \$4.37 per million Btu, close to the level a decade earlier after adjustment for inflation. On an energy-equivalent basis, natural gas has traded at a deep discount to oil over the last several years with oil prices more than 3 times higher than natural gas prices. Almost all easy opportunities to switch away from oil use to natural gas in industry, buildings, and electric power generation have already taken place or are being actively pursued. For example, in 2010, oil provided less than 1 percent of total electric power generation. Increasingly, the most important area for fuel switching involving natural gas is the competition between natural gas and coal as a fuel for electric power generation.

Drilling activity is also responding to the differential between oil and natural gas prices with the number of oil-directed rigs having recently exceeded natural gas-directed rigs for the first time since 1993. However, as noted above, domestic production of natural gas has continued to increase despite the renewed focus on drilling for oil. This reflects both the high productivity of current gas-directed drilling and the fact that oil-directed drilling activity often results in production of associated natural gas as well as oil.

Reserves and Resources. U.S. total natural gas proved reserves grew 11 percent in 2009 and are now at the highest level since 1971. Shale gas proved reserves grew 76 percent after having grown by 48 percent in 2008, reflecting continued strong drilling activity even as natural gas prices declined from their mid-2008 level.

Estimates of the mean technically recoverable resource of natural gas -- that is, resources that are technically producible using currently available technologies and industry practices -- have also been increasing. EIA's *Annual Energy Outlook 2011* uses a total resource estimate for U.S. natural gas (onshore and offshore, including Alaska) of 2,543 Tcf, including 862 Tcf of shale gas, (35 Tcf of proved reserves plus 827 Tcf of technically recoverable unproved resources.) (**Figure 1**).

The U.S. natural gas outlook

EIA projects and analyzes U.S. energy supply, demand, and prices through 2035 in our *Annual Energy Outlook*. EIA sees a continuing rise in both natural gas production and consumption as the probable future trend.

Some factors that supported recent production growth, however, are expected to play less of a role in the immediate future. These include hedging strategies that cushioned the impact of the decline in natural gas prices since mid-2008; and lease terms (signed when prices were high) that required drilling to begin within a fixed time period in order for lease rights to be retained. However, other drivers are starting to play a larger role in boosting production activity. For example, international joint venture partners, who appear to place a value on gaining technical experience and technology associated with shale drilling in addition to the value of production, have provided major infusions of cash to North American companies. Another driver that continues to boost production is the focus on areas where highly valued crude oil and natural gas liquids are being produced in conjunction with shale gas.

Production Growth to 2035. In EIA's Reference case projection, which assumes no changes in public policy, total natural gas production grows by 26 percent, from 21.0 to 26.3 Tcf, between 2009 and 2035, due primarily to significant increases in shale gas production, which comprises about 47 percent of U.S. dry gas production by 2035. Production increases faster than demand resulting in net imports declining to below five percent of consumption by 2023 (**Figure 2**) (**Figure 3**).

Price Projections to 2035. In EIA's Reference case projections, natural gas production costs and prices are expected to rise over time as production shifts away from the most attractive "sweet spots" to less productive areas. Average annual wholesale natural gas prices remain under \$5 per million Btu (all prices are in real 2009 dollars) through about 2020, increasing to higher levels thereafter. As the shale gas resource base is developed, production gradually shifts to resources that are somewhat less productive and more expensive to produce. At the same time, more shale wells are drilled to meet growth in natural gas demand and offset declines from other sources, increasing demands on the drilling sector and raising costs over time.

With respect to prices, we have already noted that the energy-equivalent price premium for oil relative to natural gas has grown dramatically in recent years. Oil prices, which were typically 1 to 1.5 times higher than natural gas prices on an energy equivalent basis during the 1995 to 2005 period, are now over 3 times higher than natural gas prices. In EIA's *AEO 2011* Reference case projection, the ratio of oil-to-natural gas prices remains above 3 on an annual average basis, as the balance of gas supply and demand within North America limits natural gas price increases at a

time when the world supply-demand balance for oil is expected to push oil prices up at a faster rate (**Figure 4**).

Shale Gas Uncertainties. EIA fully recognizes the uncertainties surrounding our Reference case natural gas projections. In fact, we actively highlight them. *AEO2011* includes a special section that examines some of the key uncertainties surrounding shale gas and presents the impact of higher and lower shale gas resource and cost assumptions for production, consumption, and prices. Several factors could lead resources and production to be lower or higher than what EIA includes in its Reference case. Some examples include: 1) As most shale gas wells are only a few years old their long-term productivity is untested, 2) Gas production has been confined largely to "sweet spots" that may not provide suitable data to infer the productive potential of an entire formation, 3) Many shale formations (particularly, the Marcellus shale) are so large or new that only a portion of the formation has been production tested, 4) Technical advances can lead to more productive and less costly well drilling and completion.

The Shale Gas cases in *AEO2011* illustrate how a wide variation in outlooks can occur due to the underlying uncertainty regarding this emerging resource. Two key determinants of the estimated technically recoverable shale gas resource base are the estimated ultimate recovery (EUR) per well and the recovery factor that is used to estimate how much of the acreage of shale gas plays contains recoverable natural gas. The largest variations occur in the High- and Low Shale EUR cases, where lower and higher costs per unit of shale gas production have the effect of increasing and decreasing projected total production from U.S. shale gas wells. In the Low Shale EUR case, the Henry Hub natural gas price in 2035 is 31 percent higher than the *AEO2011* Reference case price of \$7.07 per million Btu (2009 dollars). Conversely, in the High Shale EUR case, the Henry Hub price in 2035 is 24 percent lower than in the *AEO2011* Reference case. Shale gas production is more than three times as high in the High Shale EUR case as in the Low Shale EUR case, at 17.1 Tcf and 5.5 Tcf, respectively, as compared with 12.2 Tcf in the *AEO2011* Reference case (**Figure 5**).

Demand outlook to 2035. Demand for natural gas in the Reference case grows by over 16 percent between 2009 and 2035 (**Figure 6**). Consumption growth is driven by the industrial and electric generation sectors. Natural gas use in the industrial sector grows by 25 percent from 2009 to 2035, reflecting the recovery in industrial output and relatively low natural gas prices, which spurs a large increase in natural gas consumption for combined heat and power (CHP) generation more than offsetting the decline in natural gas use for feedstock. Electric generation also shows strong growth in natural gas use, where 65 percent of capacity additions between 2010 and 2035 are expected to be natural gas fired. In addition to capital cost considerations, uncertainty about future limits on greenhouse gas emissions and other possible environmental regulations reduce the competitiveness of coal-fired plants.

There are also significant uncertainties affecting the demand side of the natural gas market which EIA has examined in various previous editions of the *Annual Energy Outlook*. Some uncertainties relate to the impact of possible future policies, others to future developments in the North American and global markets for natural gas.

For example, several factors, including regulatory changes, could increase the use of natural gas in the electric power sector. *AEO 2011* includes several cases that look at the sensitivity of the generation mix and coal retirements to different assumptions regarding the price of natural gas, the extent and cost of environmental control retrofits required for existing coal-fired facilities and the recovery period for retrofit investments. A scenario that combines significant retrofit requirements, a rapid payback of retrofit costs, and continued low natural gas prices results in significant near-term retirements of existing coal plants and more use of natural gas for generation.

A second demand uncertainty involves increased use of natural gas as a transportation fuel. In the 2010 edition of the *Annual Energy Outlook*, EIA included sensitivity cases that explored the impact of significant incentives to promote the use of natural gas as a fuel for heavy duty trucks.

Another significant demand uncertainty involves the potential that the North American market for natural gas could become more fully integrated into the global market for natural gas. The degree of integration will depend on the extent of natural gas trade between North America and the rest of the world in the form of liquefied natural gas (LNG). The pricing regime in global LNG markets is another uncertainty, particularly the extent to which world LNG prices reflect “gas on gas” competition versus retaining the traditional linkage of LNG prices to oil prices. Shale gas resources in the rest of the world, which EIA has been closely following, and their potential development are among the key factors that will shape the development of global markets for natural gas (**Figure 7**).

This concludes my statement, Mr. Chairman, and I will be happy to answer any questions you and the other Members may have.

Figure 1. Recent Annual Energy Outlook Natural Gas Resources

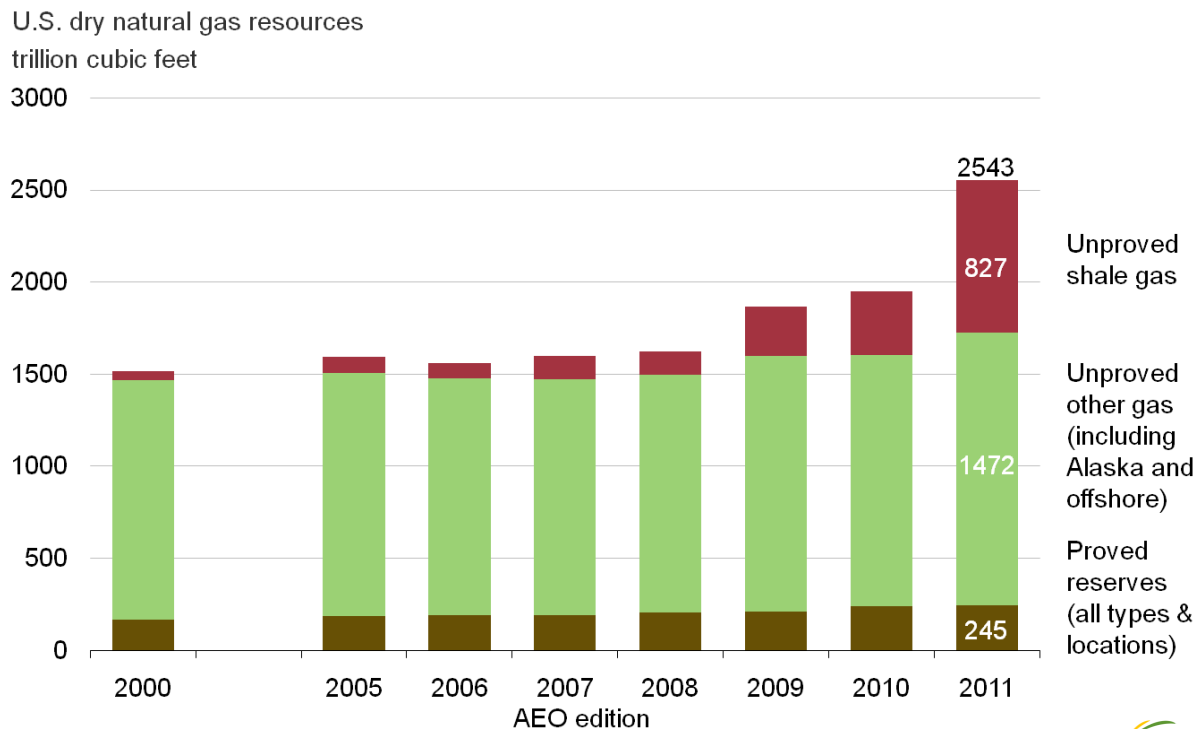


Figure 2. Shale Gas Offsets Declines in Other U.S. Supply to Meet Consumption Growth and Lower Import Needs

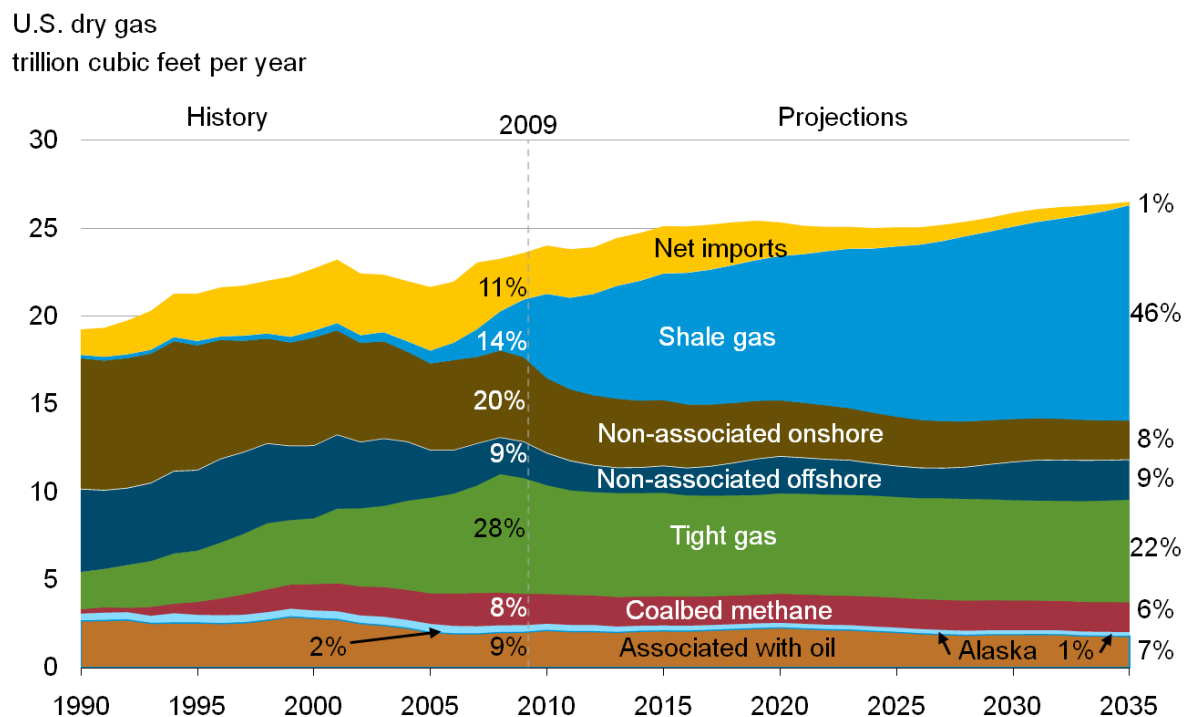
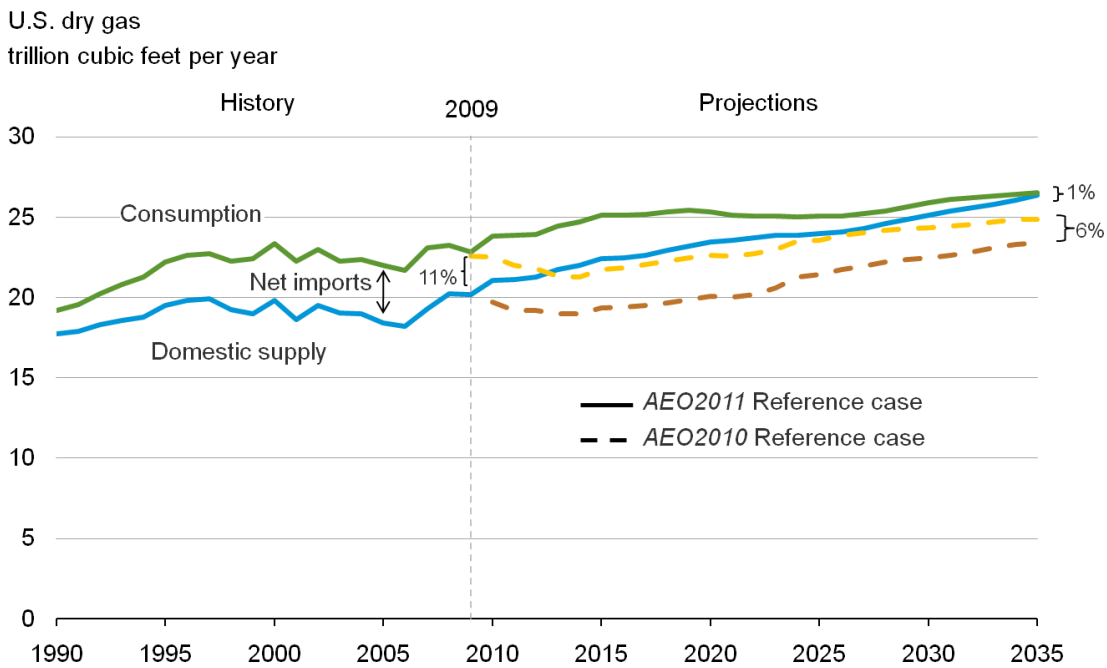


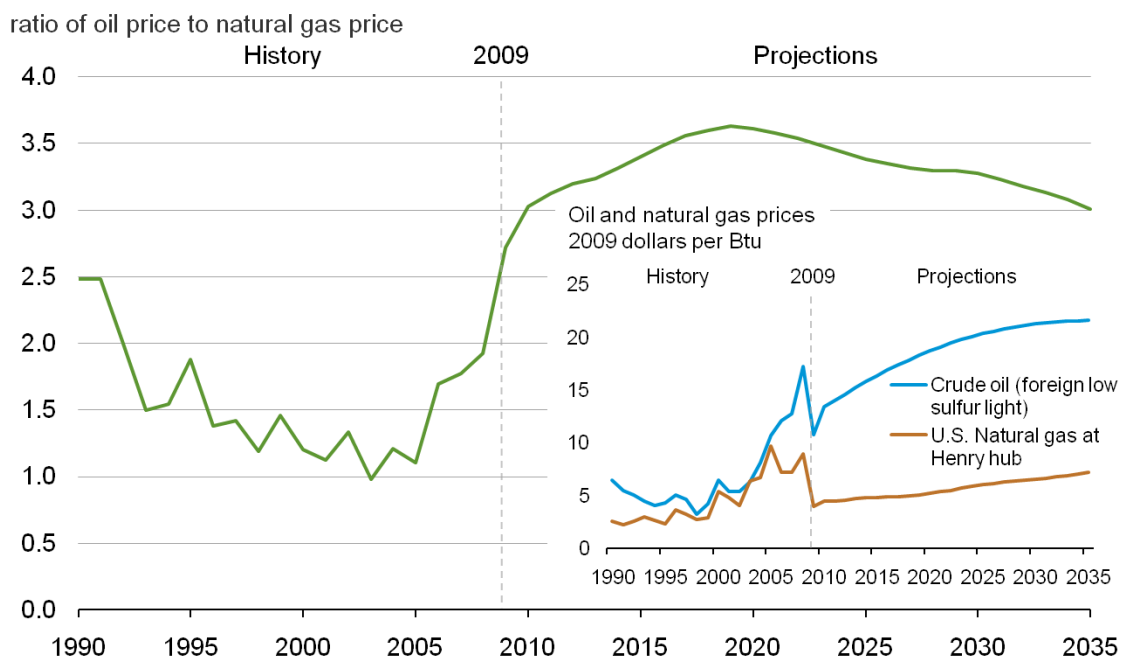
Figure 3. 30% Domestic Gas Production Growth Outpaces 16% Consumption Growth, Leading to Declining Imports



Source: EIA, Annual Energy Outlook 2011



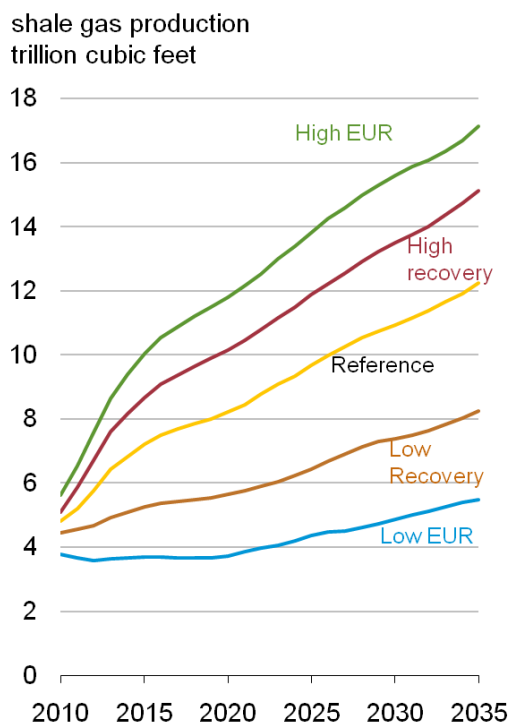
Figure 4. Oil-to Natural Gas Price Ratio Remains High Over the Projection



Source: EIA, Annual Energy Outlook 2011



Figure 5. Shale Gas Resource Potential and Related Costs Remain Highly Uncertain



Four alternate cases

High Estimated Ultimate Recovery (EUR) case assumes an EUR per shale gas well set 50% higher than in the Reference case. Results in lower per Mcf costs.

High Recovery case assumes 50% more natural gas can be recovered from the shale formation than in the Reference case. Per Mcf costs are unchanged.

Low Recovery case is like High Recovery but less.

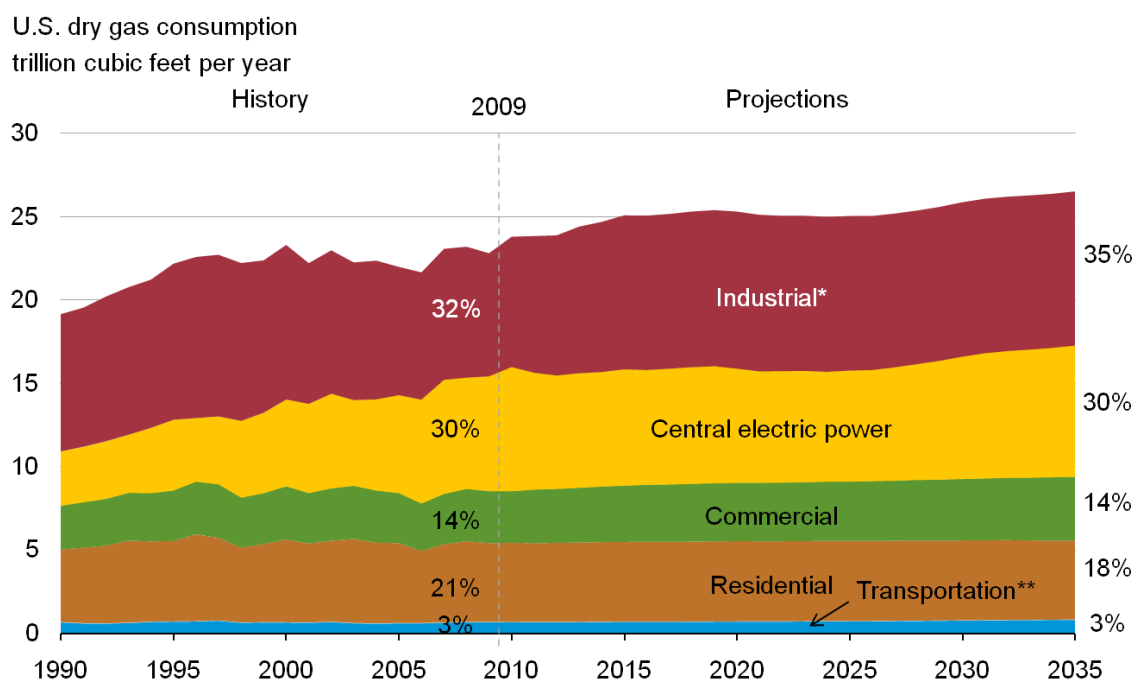
Low EUR case is like High EUR but lower.

2035 Results

Projection	Ref	High EUR	High Recov.	Low EUR	Low Recov.
Shale gas prod. (tcf)	12.2	17.1	15.1	5.5	8.2
Total gas prod. (tcf)	26.3	30.1	28.5	22.4	24.6
Henry Hub price (2009\$/Mcf)	7.07	5.35	6.03	9.26	8.17



Figure 6. Natural Gas Consumption is Quite Dispersed; Industrial and Electric Power Use Drives Future Demand Growth

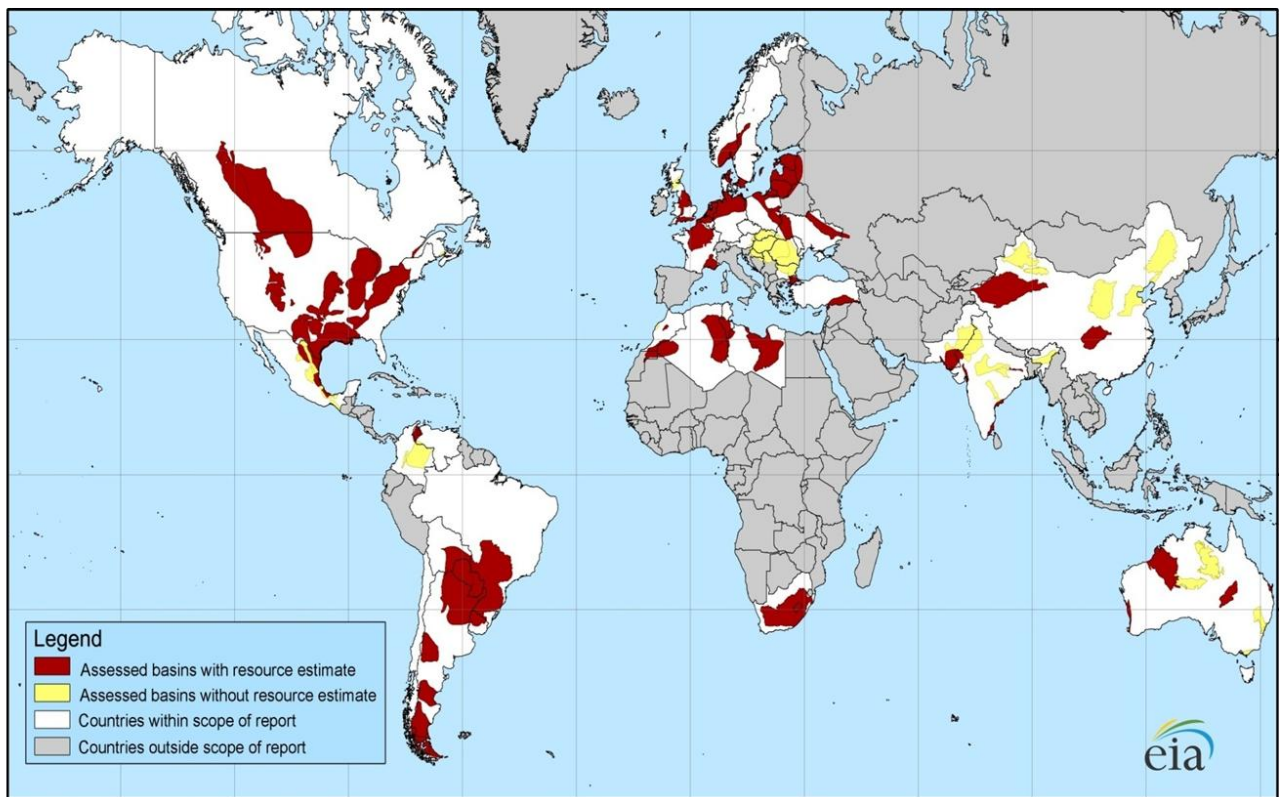


*Includes combined heat-and-power and lease and plant fuel. **Includes pipeline fuel.

Source: EIA, Annual Energy Outlook 2011



Figure 7. Initial Assessment of Shale Gas Resources in 48 Major Shale Basins in 32 Countries Indicates a Large Potential



Source: U.S. Energy Information Administration