

Committee on Environment and Public Works
United States Senate
Legislative Hearing on S. 1733, Clean Energy Jobs and American Power Act.
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Statement of
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Good afternoon Madam Chairman and members of the Committee. My name is Joel Bluestein and I am a Senior Vice President at ICF International. ICF is a consulting firm located in Fairfax, Virginia that has been in business providing energy and environmental consulting services for 40 years. ICF provides objective technical analysis to public and private sector clients, including agencies of the U.S. Government but does not take advocacy positions on these topics. Thank you for the opportunity to appear before the Committee to discuss the role of natural gas in addressing greenhouse gas reductions.

Many people expect that natural gas will play an important role in achievement of GHG reduction targets. This is not surprising since natural gas:

- Has the lowest carbon content of fossil fuels – a little more than half that of coal
- Can be used in very efficient technologies
- Can be used effectively in power generation, transportation and direct end use applications

At the same time, there is concern for some that gas could play too large a role; that a massive “dash to gas” will occur in the electric power sector and that North American gas supply is limited to the extent that increased gas consumption could cause shortness of supply and or much higher gas prices.

Natural Gas Supply

The good news in this respect is that recent developments in gas drilling and production have greatly increased estimates of the U.S. gas resource in ways that can address these concerns. The view of these resources has changed rapidly in recent years. The focus of these changes is in the estimated volumes of undeveloped recoverable gas resources. These are the estimated volumes of gas that are not yet classified as proved but that are expected to be recoverable or producible in the future. The volume of such undeveloped resources is estimated using a range of assessment methodologies, depending upon the nature of the resource and its stage of development.

Several organizations in the U.S. assess the volume of technically recoverable resources from tight gas, shale gas, and coalbed methane, as well as from future conventional fields. The USGS is the principal organization for assessing onshore gas and oil resources. It assesses oil and gas resources at the formation or play level. The USGS maintains a website with the latest assessments for each geological basin¹. The U.S. Energy Information Administration (EIA) and National Petroleum Council (NPC) also publish assessments of unconventional natural gas. The EIA publishes the Annual Energy Outlook², which includes assumptions about natural gas supply and resources. The NPC published its most recent North American natural gas study in 2003³, which included extensive documentation about resources and activity trends in the U.S.

¹ USGS National Oil and Gas Assessment; <http://energy.cr.usgs.gov/oilgas/noga/>

² U.S. Energy Information Administration, *Annual Energy Outlook*; <http://www.eia.doe.gov/oiaf/aeo/>

³ National Petroleum Council North American Gas Study, 2003; <http://www.npc.org/>

and Canada. Another prominent U.S. assessment group is the Potential Gas Committee, which publishes a detailed assessment every two years (discussed below). ICF also prepared a study in 2008 for the INGAA Foundation on the status of unconventional gas resources⁴.

The most recent assessment by the EIA is for 2007, showing the total U.S. natural gas resource base (proven reserves plus unproven resources) at 1,771 trillion cubic feet (Tcf) of technically recoverable natural gas, including 238 Tcf of proven reserves⁵.

The rapid change in the understanding of the U.S. natural gas resource is most recently depicted in this year's report of the Potential Gas Committee. The Potential Gas Committee (PGC) is a non-profit, independently governed, 100% volunteer staffed entity founded in 1964. It is assisted in its work by the Potential Gas Agency at the Colorado School of Mines which provides objective scientific and technical guidance, formal comparisons with others' estimates, training of new Committee members, representation of the Committee at industry association and professional meetings, lectures and presentations on the work and estimates of the Committee, and administrative support for report production and Committee meetings. The Potential Gas Committee consists of volunteer experts who are associated with a wide variety of natural gas industry, governmental, and academic institutions. The Committee currently has about 105 members. The PGC develops periodic, independent estimates of the U.S. natural gas resource.

The PGC's most recent report⁶, the 2008 assessment released in June of 2009, estimates that the total U.S. natural gas resource base (proven reserves plus unproven resources) at year-end 2008 is 2,074 trillion cubic feet (Tcf), more than 36 percent higher than the 2006 estimate. This total reflects the highest level in the Committee's 44-year history and represents almost 100 years of supply at current consumption levels.

The Committee's year-end 2008 assessment of 1,836 Tcf unproven resources (statistically aggregated mean value) consists of 1,673 Tcf of gas attributable to traditional and shale reservoirs and 163 Tcf in coalbed reservoirs. Compared to year-end 2006, traditional and shale resources increased by nearly 519 Tcf (45%), while coalbed gas resources decreased by 3 Tcf (1.9%), resulting in a net increase in total potential resources of 515 Tcf (39%).

When the PGC's results are combined with the U.S. Department of Energy's latest available determination of proved gas reserves, 238 Tcf as of year-end 2007, the United States has a total available future supply of 2,074 Tcf, an increase of 542 Tcf over the previous evaluation (2006).

While unconventional natural gas has been a significant component of U.S. production for a long time, its contribution has grown rapidly in recent years. Notable trends include the growth in production from tight gas reservoirs in the Rockies and East Texas, coalbed methane in Wyoming and New Mexico, and shale gas in North Texas and the Mid-Continent region. The most significant contributor to this increased estimate is the increased unconventional gas resource and in particular shale gas. The growing importance of shale gas is shown by the fact that, of the 1,836 Tcf of total potential resources, shale gas accounts for 616 Tcf (33%). As shown below, these resources are widely distributed across the U.S.

⁴ ICF International, *Availability, Economics, And Production Potential Of North American Unconventional Natural Gas Supplies*, The INGAA Foundation, November 2008.

⁵ U.S. Energy Information Administration, *Annual Energy Review 2008*, June 2009.

⁶ Potential Gas Agency, *Potential Supply of Natural Gas in the United States (December 31, 2008)*, Colorado School of Mines, June 2009.

Shale Gas Plays, Lower 48 States



Source: Energy Information Administration based on data from various published studies
Updated: May 28, 2009

The growth and future importance of shale gas resources is largely due to the development and application of new drilling and production techniques. Shale formations do not allow the gas to flow freely to a well bore. Producers must “stimulate” the well by pumping high pressure fluids into the well (hydraulic fracturing) to create a network of fractures in the rock that will allow the gas to flow out.

The recent emergence of new shale plays and rapid technology changes have made it difficult for the assessment groups to develop assessments that reflect current activity. For example, the NPC assessment was published in 2003 but did not include the Arkoma Basin Fayetteville and Woodford shales because, at the time of publication, these resources had not yet emerged. Neither the NPC study nor earlier USGS and EIA studies evaluated the horizontal drilling potential in the Marcellus play in Appalachia or the Louisiana Haynesville Shale.

Published resource assessments should be viewed with an awareness of rapidly evolving technology and the emergence of large new plays. In addition, former assessed shale resources were based upon an assumption of vertical drilling and older completion technologies. Some of the assessed shale resources in older reports represent the low pressure, shallow part of a shale play that was developed in past decades, as opposed to the deeper, higher pressure area that is now the development target for horizontal drilling. The table below shows the increase in estimated shale resources in recent years as these factors have been taken into account.

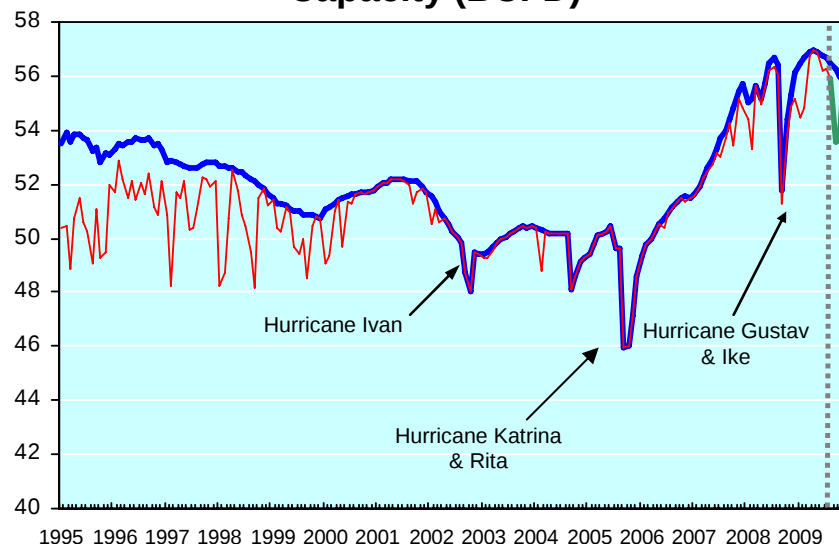
Published Estimates of U.S. Lower 48 US Recoverable Shale Gas Resource (Tcf)

USGS (various years)	NPC 2003	EIA 2007	ICF 2008	PGC 2009
85	35	125	385	616

The growing production from the Barnett Shale in the Fort Worth Basin of North Texas and the more recent startups of the Fayetteville and Woodford Shale plays in the Mid-Continent region have shown the greatly improved production potential of horizontal drilling and stimulation technologies. Many of the advances made in these technologies have come just within the past decade. In the last few years, numerous company announcements have been made about additional North American horizontal drilling shale gas plays. These include the Haynesville Shale in Northern Louisiana, the Marcellus and Huron Shales in Appalachia, the Pearsall Shale in Texas, the Utica Shale in Quebec, and the Horn River Basin and Montney Shale in British Columbia. It appears certain that shale gas production will expand in coming decades, and production will emerge in new regions in the U.S. and Canada.

The increased supply associated with unconventional gas and shale gas in particular, has fundamentally changed the supply/demand balance for natural gas in North America. Whereas gas production has been flat or declining for much of the last ten years, with no excess capacity relative to demand, production has increased in the last few years, creating some surplus deliverability and a decline in prices. With the current economic downturn, production has dropped as consumption is lagging production capacity and gas prices are still less than half of prior year levels. Even with an economic resurgence, U.S. and North American natural gas resources are now understood to be much more robust than previously expected.

Lower-48 Dry Gas Production Vs. Dry Gas Capacity (BCFD)



Source: ICF International

The Role of Gas in GHG Reduction

Interestingly, the base case modeling of the Waxman-Markey bill (and by extension of the Kerry-Boxer bill) performed by the U.S. EPA⁷ and EIA⁸ does not show a dash to gas. These projections show gas use flat or slightly declining, even in the power sector. The key determinants of these results are:

- Very low energy demand growth – driven by slower economic growth and/or greatly expanded investments in energy efficiency
- Very high reliance on offsets – especially international offsets – which reduces the need for domestic reductions, keeps the allowance price low and avoids the need for increased gas use
- High reliance on new low- or zero-emitting technologies such as renewables, nuclear and coal with carbon capture and storage (CCS).

When there is little or no growth in energy demand, an ample supply of offsets and rapid availability of alternative zero-emitting technologies, there is limited demand for gas. However, this combination of positive conditions may not occur. In particular most analysts expect that the supply of both domestic and international offsets will be significantly less than the maximum allowed under the bills.

Both EPA and EIA have run alternative scenarios with limited offset availability, in which they find expanded natural gas use. EIA has a case⁹ with no international offsets and no new technology, which generates a 15% increase in gas consumption in 2020 and a 25% increase in 2030 compared to the reference cases. Even with this increase in natural gas consumption, the wellhead price of gas increases by \$1/MMBtu (16%) in 2020 and actually does not increase from the base case in 2030. So although this fairly extreme sensitivity case does yield a significant increase in gas consumption, it does not result in a major increase in the long-term price of gas. Moreover, these cases do not include the most recent data on expanded natural gas supply, which could ameliorate the price impacts even further.

One of the important changes in the Senate bill is the delay in direct regulation of fugitive methane emissions. This allows the generation of offsets from methane sources through 2020, which would otherwise be precluded. Since the use of offsets is one of the most important cost control measures in the bill, the ability to increase the supply of offsets, could be important to ameliorate allowance prices and be mechanically simpler than direct regulation of these diverse sources.

Summary

Overall, we expect that compliance with GHG legislation will require and will occur through the use of a diverse mix of clean technologies including gas, coal with CCS, renewables, nuclear and energy efficiency. We do not expect any one to dominate. That said, we do not expect several of these options to be widely available until at least 2020, thus we do see an increased role for natural gas at least through that time, especially if availability of offsets is limited and the economy is revitalized. Fortunately, new drilling and production techniques have expanded our natural gas supply options and should allow us the flexibility to use gas as one of the options for GHG reduction.

Thank you for the opportunity to testify and I look forward to your questions.

⁷ U.S. EPA, *EPA Analysis of the American Clean Energy and Security Act of 2009*, June 2009. http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis.pdf

⁸ U.S. Energy Information Administration, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, Report #SR-OIAF/2009-05. August 2009

⁹ U.S. Energy Information Administration, <http://www.eia.doe.gov/oiaf/servicerpt/hr2454/excel/hr2454nibiv.xls>. August 2009