

AN ECONOMIC IMPACT ANALYSIS OF THE
HAYNESVILLE SHALE NATURAL GAS
EXPLORATION, DRILLING AND PRODUCTION

SOME PRELIMINARY RESULTS

Manfred Dix, Ph.D.
Staff Economist
Louisiana Department of Natural Resources
Technology Assessment Division

Greg Albrecht
Chief Economist
Legislative Fiscal Office

August 28, 2008

Executive Summary

The Haynesville Shale Play is still very much an unexploited natural gas reservoir, and thus, not much is known about its petrophysical characteristics and productive capacity. Neither do we know much about the costs of exploration, drilling and production on the Play. In order to give an initial birds-eye view of the prospective benefits of the exploitation of the Play, we had to rely on a series of assumptions. No matter how realistic we tried to make these assumptions, they are still *assumptions*, which may or may not pan out.

Given our assumptions, the prospective Haynesville Shale Play exploration, drilling and natural gas production can potentially bring big benefits to the economy of the State of Louisiana. In the first five years, it may add a total of over forty thousand jobs, and even after that period, new jobs would be in the order of 25,000 more compared to the case the Play is not developed at all. Disposable income [this is income after taxes] could increase by \$2 to \$3 billion dollars a year in the state as a whole. And state tax revenue would increase by at least \$150 million per year, with a higher increase [over \$200 million] in some of the first five years of the analysis [*note*: this tax revenue does *not* include the state revenue from severance tax and state royalty income].

Introduction

The Haynesville Shale area is a rock formation composed of clay-sized particles deposited in the north Louisiana geological area more than 170 million years ago during the Jurassic time. The Shale lies between 10,500 and 13,000 feet, and it is thought to be approximately 200 feet thick. Its existence has been known for quite some time, but exploration and drilling have not been possible for economic and technical reasons. However, in the last several years technology has made exploration possible. Developments in horizontal drilling, which together with natural gas prices rising above \$10/Mcf, have given exploration, drilling and production of natural gas in the Haynesville Shale a new impulse. In March 2008, Chesapeake Corporation put out a news release that read in part:

“OKLAHOMA CITY--(BUSINESS WIRE)--March 24, 2008--Chesapeake Energy Corporation (NYSE:CHK) today announced a new natural gas discovery in the Haynesville Shale in Louisiana. In addition, the company announced two other new unconventional natural gas discoveries and five new unconventional oil projects. The company believes these discoveries and projects are significant and [the company] has decided to increase its capital expenditure budget for 2008 and 2009 in order to increase drilling and leasing activity on these new plays as well as its three most important existing unconventional shale plays: the Barnett Shale, the Fayetteville Shale and the Marcellus and Lower Huron Shales in Appalachia.

Chesapeake Provides Information on the Haynesville Shale Discovery and Seven Other New Discoveries and Projects

As a result of recent drilling results, Chesapeake is announcing eight new unconventional natural gas discoveries and unconventional oil projects described below.

Haynesville Shale: Based on its geoscientific, petrophysical and engineering research during the past two years and the results of three horizontal and four vertical wells it has drilled, Chesapeake believes the Haynesville Shale play could potentially have a larger impact on the company than any other play in which it has participated to date. Chesapeake is currently utilizing four rigs to drill Haynesville Shale wells and plans to increase its drilling activity level to approximately 10 rigs by year-end 2008 and potentially more in 2009. The company currently owns

or has commitments for more than 200,000 net acres of leasehold in the Haynesville Shale and has a leasehold acquisition effort underway with the goal of owning up to 500,000 net acres in the play. “

This news-release by Chesapeake Corporation is informally considered the beginning of the serious exploration of the Haynesville Shale. Of course, exploration and drilling by Chesapeake and other operators had begun earlier, but the news-release made the public [investors, land and/or mineral rights owners] conscious that they were standing in front of something potentially big.

Unfortunately, not much is known yet about the Haynesville Shale. There are conjectures about its size. One conjecture situates the Shale in the southern halves of Caddo, Bossier and Webster Parishes, the southern fraction of Claiborne, the southwestern side of Lincoln, the northern half of Sabine, northeastern half of Natchitoches, and the entirety of De Soto, Red River, Bienville, Jackson and almost all of Caldwell Parishes [possibly extending into the western side of Franklin Parish]. However, the most active area so far in the Shale has been the Shreveport/Bossier area, and adjacent lands. It remains to be seen how far into the eastern portion mentioned above the Shale actually extends. Geologists seem to be sure that it does not extend further north [for geological reasons], but it does extend into eastern Texas. How far west is not known.

Because so little is actually known of the Haynesville Shale, for this first run of the economic impact of its exploration, drilling and production, we had to make many [and at times, heroic] assumptions. Even though being assumptions, we tried hard to make them as realistic as possible, and when in doubt, *err on the cautionary/conservative side*. Next, we turn to the assumption made for this study.

Assumptions

We can divide the assumptions of this study into five groups: 1) Leasing and Royalty income assumptions; 2) Drilling expenditures assumptions; 3) Ongoing production assumptions; 4) Pipeline Construction assumptions; and 5) other miscellaneous assumptions. We turn to each of them next.

a) Leasing and Royalty Assumptions

Currently, the major operators in the area, Chesapeake Corporation and Petrohawk have a combined leasing commitment of about 850 thousand acres. This is the acreage we are assuming leased in the following proportion: 80% to private landowners and 20% to public landowners [state and local governments]. Of such acreage, we assume also that 5% [42,500 acres] were leased in the year 2007 at \$400 per acre; 85% [722,500 acres] was leased in 2008 at \$20,000 per acre; and 10% [85,000 acres] is going to be actually leased in 2009 at \$20,000 per acre. The total windfall incoming in those three years is \$17 million [2007], \$14.45 billion [2008] and \$1.7 billion [2009]. Now, the share of the windfall to the private landowners [80%] is assumed that it will not be spent as a normal salary or wage increase, but that this windfall will be spent over five subsequent years. For royalty income, we assume a royalty rate of 25% of the value of [assumed!!] production [repeat, assumption about price *and* volume of production]. Furthermore, we assume that the royalty income is 80% in the hands of private mineral right owners, 10% for the state of Louisiana, and the rest 10% to local governments [school boards, parishes]. More on the royalty will be said when discussing the production assumptions.

b) Drilling Expenditures Assumptions

The assumption on the number of wells drilled is shown in the table below. We assume no dry holes; all wells produce. In addition, we recognize that the assumption on the number of wells may be on the low side, but we did this [as mentioned before] to err on the conservative side. The cost of drilling and completing each well is assumed at \$8.5 million dollars.

	Wells Drilled	2016	300
2007	2	2017	300
2008	20	2018	300
2009	180	2019	300
2010	220	2020	300
2011	250	2021	300
2012	250	2022	300
2013	300	2023	300
2014	300		
2015	300		

c) Well Production Assumptions

As mentioned before, there are no dry holes; all wells produce. The production volume of each well is assumed to be a constant 312 million cubic feet per year for all years of the well's life. This is probably a conservative number, but we did not want to overstate production either. Furthermore, we assume that a well drilled in a certain year, comes on-line the following year. This is probably not true for all wells, but it might be true for some [in consequence, *on average*, it is possibly a reasonable assumption]; we made such summary assumption to avoid complications in the calculations. The life of each well is assumed to be 10 years. Thus, the well count in year 2018 declines by the well count of 2007; the well count in 2019 declines by the well count of 2008; and so forth.

The price forecast for natural gas in future years is taken from Moody's. Thus, the value of production for each well is the price forecast times the assumed production for said well. By state law, the severance tax rate depends on the price of natural gas; thus, the applicable severance tax rate has been calculated with the Moody's price forecast. The royalty rate assumed is 25% *after* severance tax rate is paid.

Note on the severance tax: Current state law allows for a 24 month tax exemption for horizontal drilling. Horizontal well exemption is included by adding a line for severance taxable volumes, which is simply total volume shifted by 2 years. A two-year exemption is assumed for all production. Reduced severance tax revenue (through delayed taxation) actually works to bump up both private and public royalty receipts. The private sector effect here has been built into the REMI runs (along with the 20% downward adjustment to private lease income above). In addition, it is important to keep in mind that for the purposes of this analysis to be conservative, *state tax revenue due to the Haynesville investments was not fed back into the economic model, which would have generated further economic stimulus effects.*

d) Pipeline Construction Assumption

In the Baton Rouge Business Report we read:

“Two companies studying Haynesville pipeline - Two companies have agreed to pursue the development of a large pipeline to move natural gas from the Haynesville shale in northwestern Louisiana, considered potentially to be one of the largest domestic gas finds in years. The pipeline—to be known as the Haynesville Connector—would extend about 150 miles from western DeSoto Parish to several major pipelines that cross in the Delhi area of northeastern Richland Parish. The deal was announced by Denver-based DCP Midstream Partners LP and Houston-based M2 Midstream LLC, both of which are involved in the transportation of petroleum. A price was not disclosed. If the pipeline is built, completion is expected during the third quarter of 2009. The pipeline will have an estimated 1.5 billion cubic feet per day of capacity, the companies said.”

Thus, for the economic impact analysis, we assume that 150 miles of new transmission pipeline will be built; 25% of the distance in 2008, and 75% of the distance in 2009. We assume the construction cost to be \$1 million dollars per mile. The operating costs of the pipeline are assumed to be \$15,150 per mile. It could well be, that as development and production increase, more transmission pipelines will be constructed.

e) Miscellaneous Assumptions

News reports also indicate that Chesapeake Corporation is performing a seismic survey in an area 500 square miles big [320,000 acres]. The cost is \$85,000 per square mile, of which we allocated 25% to this year and 75% to 2009. We are assuming that the expense of this survey is spent locally. This might be one of the “heroic” assumptions, because this may not be necessarily true [for example, Chesapeake could be subcontracting the seismic survey to another company, which is doing the actual analysis of the data outside Louisiana].

Results

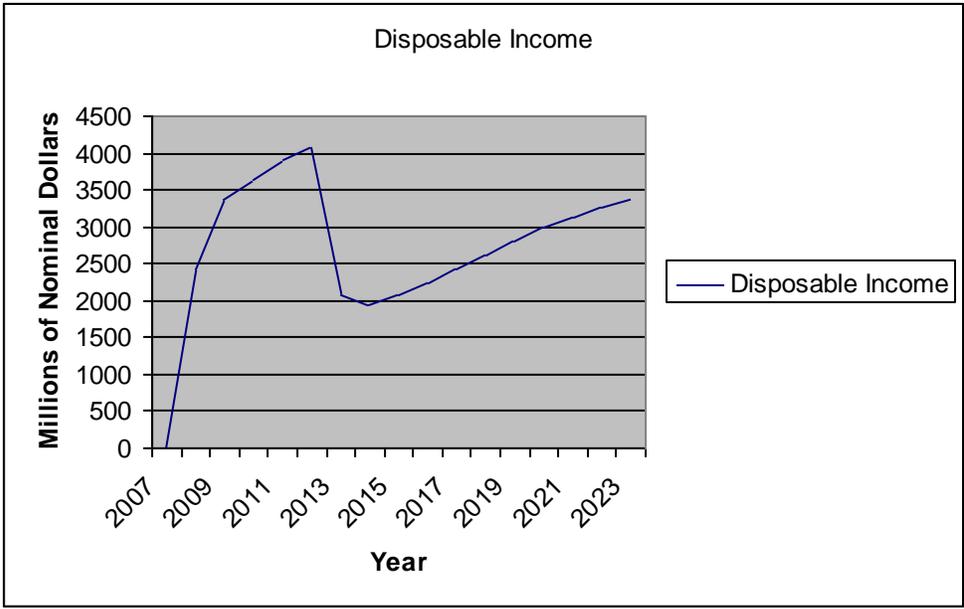
When looking at these results it is important to keep in mind that they are state-wide. The current REMI model available to us does not have the modules with the capability to analyze parish-level effects. Local modules can be added to the REMI model for an added cost of about \$50,000 for the number of parishes affected. Given the size of the investments and expenditures assumed, the impact of these in all aspects is significant. In what follows, we offer a summary of the important variables.

Employment

In general, the pattern with employment gains is that there is a substantial increase in the first five years or so, but then the effects diminish dramatically after (and including) the sixth year. The sectors with the highest employment gain are Construction and the Retail Sector. There, employment increases steadily until the years 2011/2012, but then decreases [however, still in levels above the employment level, had the Haynesville area not been developed]. In Construction employment rises up to about 9,000 new jobs, while in the Retail Sector up to about 6,400. Other sectors with significant employment gain are the Health Care and Mining sectors.

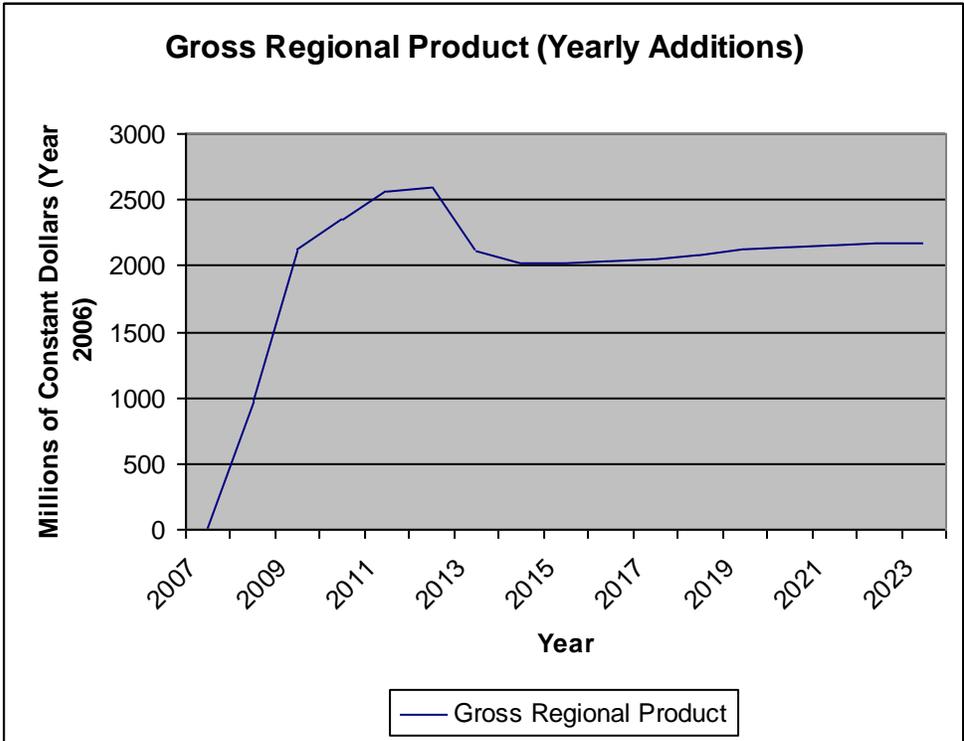
Disposable Income

Disposable Income is the income that residents of Louisiana get, after paying taxes, with the investment in the Haynesville Shale. In the early years of the developments, the gains in personal income are the highest, then it tapers off, and between 2018 and 2023 it stays between \$2.5 and \$3.3 billion dollars. These are net additions per year, not cumulative additions.



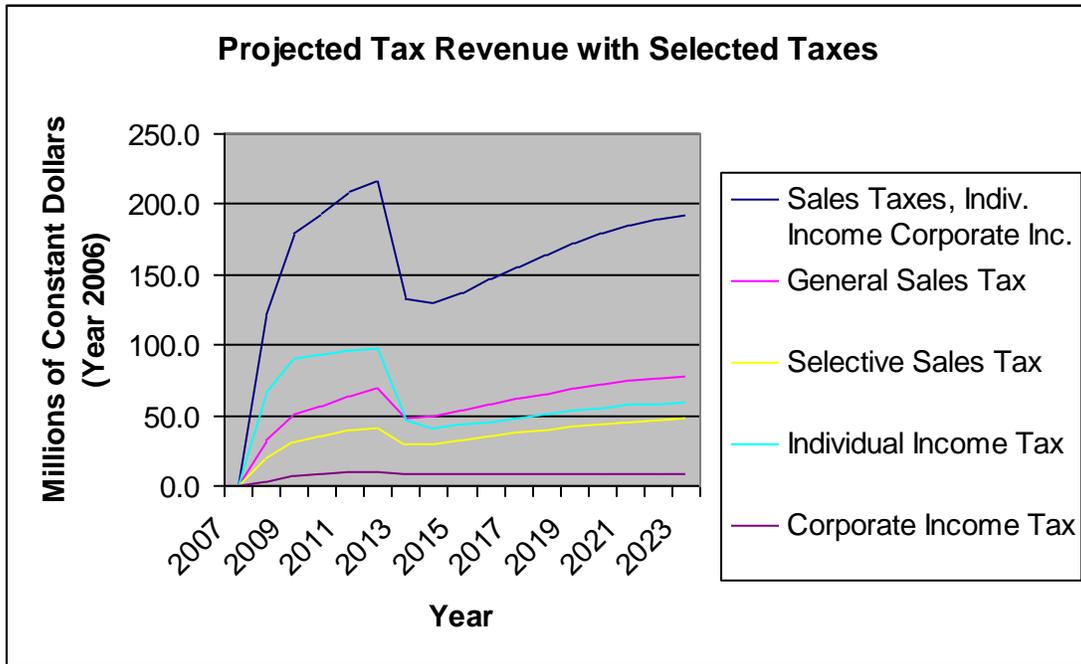
Gross Regional Product

The Gross Regional Product (GRP) is a measure similar to the Gross Domestic Product [thus, a value added measure, that does not take into account intermediate inputs], but at a regional level. In our case “regional” means the State of Louisiana. What REMI gives us is a measure of the difference between what the GRP is with the Haynesville Shale investments and expenditures, and what it would be without. The Play will add between \$2 and \$3 billion dollars in GRP per year over the next fifteen year period. The next diagram shows the yearly additions to GRP:



State Indirect Revenue

Of the major state indirect tax revenue sources [general sales tax, selective sales tax, individual income tax, and corporate income tax, and excluding direct revenue streams of severance taxes and state royalty], it is the individual income tax that has the highest revenue impact in the first five years. Of this tax alone, revenues increase by approximately \$100 million until 2012. After that it is the general state sales tax that produces most income for the state, with an average of about \$65 million per year as revenue. Below is a diagram of the tax revenue of the four taxes mentioned, and the sum of all of them.



STATE GOVERNMENT DIRECT REVENUE ESTIMATES

State Government Severance Tax and Royalty

(This data was estimated and used as input to the economic impact model.)

<u>Year</u>	<u>State Severance Tax</u>	<u>State Royalty</u>	<u>State Total Sum</u>
2008	0	163,220	163,220
2009	0	1,792,188	1,792,188
2010	251,834	15,898,266	16,150,100
2011	2,680,600	31,053,837	33,734,437
2012	23,174,509	49,471,855	72,646,365
2013	50,269,764	69,779,455	120,049,219
2014	84,275,408	91,268,174	175,543,581
2015	116,267,887	113,265,454	229,533,341
2016	154,994,251	134,812,425	289,806,676
2017	194,081,023	156,314,063	350,395,086
2018	233,213,192	178,228,459	411,441,651
2019	273,171,830	199,323,893	472,495,723
2020	313,988,541	206,088,991	520,077,532
2021	351,463,004	211,933,705	563,396,709
2022	371,374,676	218,964,902	590,339,578
2023	389,146,522	226,352,257	615,498,780

State Government Bonus Revenue Estimates (Inputted into model also.)

\$34 million from June 2008 lease sale, \$92 million from August 2008 sale, \$200 million from subsequent lease sales