

State of Louisiana
Department of Natural Resources
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New Dimensions for Oil & Gas in Louisiana
and at the Department of Natural Resources

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Prepared for
SPE Annual Technical Conference & Exhibition
New Orleans, Louisiana
September 25-28, 1994

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This public document was published at a total cost of \$1254.62. 2100 copies of this public document were published in this first printing at a total cost of \$1254.62. The total cost of all printings of this document, including reprints, is \$1254.62. This document was published by the Department of Natural Resources, P.O. Box 94396, Baton Rouge, LA 70804-9396 to disseminate information on the oil and gas industry in the state and on activities of the Department of Natural Resources under the authority of R.S. 36:354. This material was printed in accordance with the standards for printing by State agencies established pursuant to R.S. 43:31.

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September 14, 1994

OVERVIEW

Virtually everyone is aware of the turmoil producing states have suffered over the past decade with the bottom falling out of oil and gas prices and the consequential restructuring of the industry. The litany of woes is long: layoffs, abysmal rig count levels, stacked rigs rusting away, fallen tax revenues, etc. The worst is hopefully behind us. Is there reason for optimism now? Yes, we have entered the recovery, which, slow as it may be, is at least a recovery.

Rather than fuss about statistics of the recovery and what the rig count is today versus two months or one year ago, this report looks at what is new on the horizon in the oil patch. This paper discusses some of the new developments that are mostly technology driven that are creating new "*dimensions*" in opportunity for oil and gas development in Louisiana and the rest of the U.S.

For the purposes of this discussion, the term "*producing states*" refers to the southern producing states of Louisiana, Texas, Oklahoma, Mississippi, and Alabama. Though there are some significant differences from region to region based on such variations as geology, geography, and politics, all principal producing states have much in common. Details and examples discussed in this paper are taken mostly from Louisiana and the Department of Natural Resources (DNR), but the concepts and principles generally apply to most producing states. Major topics covered are:

- ◆ New state drilling incentives
- ◆ New technology and finding what we missed
- ◆ The potential of subsalt plays in the Gulf of Mexico and onshore
- ◆ Offshore development
- ◆ Louisiana Energy Access System (LEAS)
- ◆ Retaining marginal production & protecting the environment – the Louisiana Oilfield Site Restoration Act
- ◆ Compressed natural gas (CNG) motor fuel

NEW STATE DRILLING INCENTIVES

Recognizing the importance of the oil and gas industry to the economies of the producing states and the sustained struggle the industry has been having for more than ten years, the producing states have been trying to find a way to give the industry some relief at the state level. Thus, all of the producing states in the Gulf Coast area have either just enacted or are on the verge of enacting new drilling and production incentives.

Louisiana's new incentives package was passed in the 1994 regular session of the Legislature this summer. Its provisions are very similar to those of all of the producing states in our area. Act 2 of the 1994 Regular Session created the following incentives.

1. Any oil well certified as a stripper well (0 - 10 barrels per day) shall be exempt from severance tax in any month in which the average posted price for a 30-day period is less than \$20.00 per barrel.
2. On any horizontally drilled well or any horizontal recompletion from which production commences after July 31, 1994, all severance tax shall be suspended for a period of 24 months or until payout of well cost is achieved, whichever comes first. Payout of well cost shall be the cost of completing the well to commencement of production.
3. For oil and gas wells returned to service after being inactive for 2 or more years or having 30 days or less of production during the past 2 years, production shall be exempt from severance tax for a period of 5 years.
4. Wells drilled to a true vertical depth of 15,000 feet, where production commences after July 31, 1994, shall be exempt from severance tax for 24 months from the date production begins, or until payout of well cost, whichever comes first.
5. All severance tax on production from certified new oil and natural gas discovery wells is suspended for a period of 24 months from the date of completion or until recovery of payout of well cost, whichever comes first. The well must be completed between September 30, 1994 and September 30, 1996.

These drilling and production incentives in Louisiana and similar ones in Texas and surrounding states are too new to determine their impact. Analysis of data over the next couple of years will be necessary before any firm conclusions can be made.

NEW TECHNOLOGY AND FINDING WHAT WE MISSED

The preceding tax incentives will hopefully keep some older marginal wells in production and make it more economical to drill some new wells. Now let us turn our

attention to those resources that are out there still waiting for a drill bit to find, and some of the new methods and technology to help determine the right place to put a drill bit.

HISTORICAL EVOLUTION OF THE INDUSTRY^{1,2,3}

New ideas and technology are reshaping the ways industry goes about looking for oil and gas today. Briefly examining how oil and gas exploration and development evolved in the U.S., Louisiana is a good example to illustrate historical industry trends. Since the early days of production, there have been two groups that have brought the industry to where it is today—independent drillers and major oil companies, or, independents and majors.

Traditionally the major oil and gas companies (i.e., national and international corporations such as Texaco, Exxon, Royal Dutch Shell, British Petroleum, etc.) have utilized their financial and technological resources to develop primarily large volume, high grade deposits that have high up-front exploration and development costs but yield lower overall costs of production. The problem for Louisiana and for the U.S. is that most of the remaining large field resources are located in frontier areas such as deep offshore and the Arctic within the U.S., or overseas in areas such as the Middle East and the former Soviet Union. This is where the thrust of the new exploration of the majors is directed.

Historically in the U.S., as the majors shift their focus and resources on to the next frontier area, the independents with their lower overhead and operating costs have swept in behind the majors, developing the smaller fields not big enough to be economical for the majors and buying up properties and production the majors no longer wish to pursue. *Note, this is not intended to imply that independents are never involved in frontier exploration.* The majors happen to be the ones that have the vast resources to expend on developing new expensive resources and technology, often proprietary. Eventually, this technology filters its way down to the independents as costs fall, and the independents apply it with gusto once it becomes accessible to them.

Examination of Louisiana's production history supports this historical evolution of oil and gas development. The majors' thrust has gone from frontier to frontier in the state—shallow North Louisiana to deeper South Louisiana onshore to state offshore to shallow federal offshore to deep water Gulf of Mexico—in their quest for the big, lucrative deposits. Though the independents have followed this North to South trend, few have the resources to venture very far into the Gulf so far. Additionally, the independents remain deeply entrenched in all of the older producing fields of the state; whereas, the majors have increasingly reduced their presence in the older fields.

Research led by Dr. William L. Fisher, Director of the Bureau of Economic Geology at the University of Texas at Austin, indicates that of the remaining oil fields

to be discovered in the U.S., about 60% by volume and more than 95% by number are projected to be small to modest size fields of the type historically pursued by small companies (i.e., independents) with limited financial and technological resources.¹

WHAT WE MISSED^{1,3-10}

The significance of the preceding discussion is that the historical evolution of the way we have explored and developed oil and gas in the U.S. has led us to miss a lot of what is in the ground. There is a school of thought led by Dr. Fisher that supports the prospects for an extremely large potential reserve base. Dr. Fisher states, and history supports, that the major oil companies' historical approach to exploration and development, including such past practices as uniform well spacing and the pursuit of only large fields, along with the assumption of reservoir homogeneity, has resulted in the inefficient development of the ultimate oil and gas resource base, particularly that in smaller fields ignored by the majors.

This vast collection of small fields and bypassed portions of larger fields could potentially contain as much recoverable oil and gas as has already been produced. There is probably more of the extensive geological, seismic, and other technical data needed for this second search for oil available in Louisiana than in any other producing province in the country.

NEW TECHNOLOGY

Technology is constantly evolving. Two recent developments in technology will have a profound impact on developing America's oil and gas resource base: three-dimensional (3-D) seismology and horizontal drilling. The former helps to better see and thus find what is in the ground, and the latter helps recover more once it has been found.

In the past the only way to produce oil or gas once it was found was to poke a hole in the ground with a vertical well. Each vertical well has a limited radius of the producing reservoir it can drain, depending on fluid viscosity, reservoir porosity and other characteristics. Thus, numerous vertical wells may be required to efficiently produce a reservoir. The advent of horizontal drilling technology has enabled a single horizontal well to be drilled instead of a number of vertical wells. Properly placed, a single horizontal well bore can cut through hundreds or even thousands of feet of producing sand or rock. This larger production bore enables some horizontal wells to have three to five times the daily production and reserves than vertical wells. A higher production rate translates into higher cash flow and a quicker return on investment.

Alas, the advantages of a horizontal well come at a premium. A horizontal well is a lot more expensive than a vertical well. A single horizontal well may cost up to as much as four vertical wells.^{11,12} Additionally, reservoir dimensions and characteristics

may be such in many situations that vertical wells are a better choice. Applications that are most favorable for horizontal wells are:¹¹

- ♦ Low reservoir rock matrix permeability (ability to conduct fluid flow through the interconnections of its pore spaces) especially in the horizontal plane
- ♦ Low reservoir fracture permeability (i.e., chalk formations)
- ♦ When intrusion of gas or water can be expected to interfere with recovery
- ♦ Oil that has not yet migrated to a conventional trap and remains in the source rock
- ♦ Injection of fluids or heat into oil or tar sand reservoirs to improve recovery

Drilling any well is an expensive proposition; drilling a horizontal well is a very expensive proposition. Proper placement of the horizontal well bore is critical. The advent of downhole logging, telemetry, motors, and steering enables the well bore to be placed where it is intended. And, such things as 3-D seismology help determine where "*intended*" should be.¹³

Besides being expensive, drilling a well is an almost random way to find oil, and it is a one shot deal. If it misses, it could be because it was drilled too shallow, too far north, south, east, or west; or it could be because there is no oil or gas down there. If it does strike oil or gas, drilling more wells to define the boundaries of the reservoir is also very expensive and imprecise. Therefore, the more questions that can be answered and the better the geology is understood before a well is ever drilled, the more efficient that first wildcat and subsequent development wells can be placed. 3-D seismology is a technological breakthrough that enables scientists and engineers "*see*" deep below the surface electronically with sophisticated computers.

Going back into old fields with 3-D seismology, we are finding that there is a lot of oil and gas that was not found the first time around. So far, with the possible exception of subsalt plays discussed later in this paper, it does not appear that any really huge reservoirs were missed in old producing fields. The reason, of course, is that the big deposits are the easiest to find with older technology as well as with the new. On the other hand, the cumulative volume of small deposits that were missed could be enormous, as previously mentioned. These small deposits can be individual reservoirs never found or parts or branches of large producing reservoirs that were missed.

Because 3-D seismology is extremely expensive, its use is mostly confined to the majors, and currently even they primarily restrict its use to the most promising targets indicated by older, cheaper methods. Hence, the full implications of this new technology will take years to unfold. This leads to the next topic:

THE POTENTIAL OF SUBSALT PLAYS IN THE GULF OF MEXICO AND ONSHORE^{14,15}

From time to time, significant new developments occur that alter long-standing beliefs, or sometimes just old ways of thinking. We may be on the verge of one of those developments that could change our whole concept about producing formations below salt caps. Until recently, it has commonly been assumed that there were no sediments below salt, or that if there were, seismic evidence of them would be impossible to discern in seismic data due to the salt-sediment velocity contrasts.

Recent advances in geophysical technology have shed new light on this subject. As nature has grudgingly revealed a few more secrets, researchers have found that underground salt comes in more different shapes than previously thought. Many of those configurations have long horizontal reaches below which sediments lie.

Recent wildcats drilled to put this new knowledge to the test have not only proven the existence of sediments below the salt, but have now found oil and gas as well. In October of 1993, the *Oil & Gas Journal* reported a wildcat drilled in the Gulf of Mexico in 370 feet of water off Louisiana had test rates as high as 7256 barrels per day of oil and 9.9 million cubic feet per day of natural gas. This well was drilled by Phillips Petroleum Co. and partners Anadarko Petroleum Corp. and Amoco Production Co. Since that time a few additional wildcats have been drilled with promising results.

This, obviously, is a most promising development. We are just at the beginning point of the learning curve of this new geophysical knowledge. Engineers and scientists have developed a new capability to "see" down into formations that once revealed no more than fog on seismic data. The sophisticated computer analysis and simulation that converts the once useless data into meaningful results needs much further refinement. Furthermore, engineers and scientists need more experience in learning how to properly interpret the data which can only be proved out by drilling more wildcats.

So, what does this all mean? Well, the implications are enormous. Salt deposits lie under nearly two-thirds of the shallow waters in the Gulf of Mexico. This new development could open up a whole new realm of production potential in the Gulf of Mexico. Not only that, but subsurface salt is not confined to the Gulf of Mexico or to offshore. Hence, this activity in the Gulf offers potential for new exploration and production potential well beyond the Gulf. That is good news indeed.

OFFSHORE DEVELOPMENT

Now that we have taken a glimpse at some of the exciting new developments in technology and one of its nurturing grounds—the offshore Gulf of Mexico, we will shift focus and discuss the actual utilization of our offshore resources.

One of the most promising long term sources of supply of oil and gas to the citizens and industry of the United States is the offshore territory. The following list illustrates Louisiana's leadership role in offshore development.

PIONEERING EVENTS IN LOUISIANA OFFSHORE DEVELOPMENT.

- ♦ 1910 – The first over-water well ever drilled was in Caddo Lake, LA.
- ♦ 1933 – The first offshore well drilled was in Louisiana in 12 feet of water, approximately 3000 feet off the beach near Creole, LA.
- ♦ 1937 – The first offshore field developed in open, unprotected waters was the Creole Field in Louisiana located in state offshore waters 26 feet deep and 1.5 miles from shore.
- ♦ 1947 – The first successful well drilled completely out of sight of land was on Ship Shoal block 32 which is 45 miles south of Morgan City, LA.
- ♦ Louisiana federal offshore territory is the most extensively developed and matured offshore territory in the world.
- ♦ Louisiana federal offshore territory has produced 90.8% of the 9.5 billion barrels of crude oil and condensate and 84.5% of the 102 trillion cubic feet of natural gas extracted from all federal waters from the beginning of time through the end of 1992.

It is only a dream to think that the U.S. will ever again be independent of foreign sources of oil or even gas. (Canada currently supplies nearly 10% of U.S. natural gas supply.) We can, though, become less dependent if we utilize all of the resources we have. This means it is foolish beyond comprehension to exhaust whatever oil and gas is off the coasts of Texas, Louisiana, Mississippi, and Alabama and not even allow companies to look off any other coasts. This brings up **Drilling Bans**.

DRILLING BANS VS. DRILLING INCENTIVES

One key difference between the southern producing states and other coastal states is the attitude toward offshore development. The Gulf Coast producing states of Texas, Louisiana, Mississippi, and Alabama are aggressively supporting the exploration and development of both state and federal offshore waters off their coasts. In the current session of Congress, our Congressional delegation, led by Louisiana's Senator Johnston, has been pushing for federal tax and royalty relief to stimulate development of deep water deposits in the federal offshore.

Contrast this attitude with that of California's legislature, which in early September passed legislation that was awaiting the Governor's signature to ban all future development in California's state offshore waters. This is consistent with California's recent actions at the federal level banning future development of California's federal offshore territory.

Then, there are all of the eastern seaboard states that do not have any offshore production and little, if any, onshore production. They are doing everything within their power to ensure that there never will be exploration, much less production off their coasts by successfully invoking state and federal drilling bans.

Unfortunately, these states that have no oil and gas production and do not want to have any, are not willing to give up their insatiable appetite for energy, most of which is supplied by oil and gas. This summer the U.S. reached its highest levels of oil imports in history, with foreign oil supplying over 50% of U.S. supply.

The record of offshore development clearly shows that the odds for environmental disaster from spilled oil is hundreds or thousands of times greater from oil tankers than from oil well production platforms. And, though there are environmental considerations, what kind beach or water fouling do you get from a **natural gas spill!**

Oil and gas development should always be done in an environmentally responsible manner to ensure that our coasts and wetlands are protected with state and federal environmental regulators looking over industry's shoulder. But, to bury our heads in the sand and declare that by definition offshore production is bad, is misguided and dangerous. While all this foolishness is taking place, it takes more and more tankers to bring in all that foreign oil.

LOUISIANA ENERGY ACCESS SYSTEM (LEAS)

The Louisiana Department of Natural Resources (DNR) has extensive records and data on oil and gas drilling permits, well completions, production, transportation, lease records, state royalties, etc. DNR is the source of most Louisiana data ultimately reported in publications by others such as the U.S. Department of Energy, the American Petroleum Institute, the Interstate Oil and Gas Compact Commission, and numerous commercial publications. DNR data is also widely accessed directly by members of industry in DNR offices.

DNR has developed a system to extend to the public the capability to more easily access public oil and gas records. Specifically, the Department offers dial-up on-line access to oil and gas information via the Louisiana Energy Access System (LEAS). This system involves the transmitting of designated types of the Department's public computerized oil and gas records directly to the customer's place of business. This "at office" access eliminates the need to travel to DNR offices, decreases the customer's time away from his/her office, is less costly, eliminates waiting in line at DNR for an available terminal, and features easy access and increased system usage via a dedicated terminal.

LEAS works in conjunction with the customer's personal computer (PC), telephone modem, and PC communications software capable of communicating with the Department. LEAS is available seven days a week, 24 hours a day. LEAS charges are by connect time in minutes with no minimum or maximum monthly billing. LEAS features system documentation, user technical training sessions and Help Desk Support. For additional information, please contact:

Louisiana Department of Natural Resource
Information Processing Services Division – LEAS Project Coordinator
P.O. Box 94396, Baton Rouge, Louisiana 70804-9396
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Additionally, comprehensive summary statistics, time series, and selected analyses on the entire energy industry (crude oil, natural gas, petroleum refining, cogeneration, electric utilities, lignite, compressed natural gas motor fuels, etc.) are available from the Technology Assessment Division at the address below.

Louisiana Department of Natural Resources
Technology Assessment Division
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RETAINING MARGINAL PRODUCTION & PROTECTING THE ENVIRONMENT — THE OILFIELD SITE RESTORATION ACT

An issue Louisiana and many of the producing states have recently been addressing is **orphan well legislation**. The primary objective of regulations of this type is to set up some kind of fund to properly plug old wells that have been improperly closed or abandoned to prevent leakage or contamination of underground aquifers or surface land and water if the responsible party can no longer be found or has insufficient financial capability to pay restoration costs. There are currently 2225 orphaned wells in Louisiana. Also provided are measures to reduce improper abandonment in the future and to restore sites where leakage has already occurred.

The 1993 Louisiana Legislature in cooperation with the oil and gas industry enacted the Oilfield Site Restoration Act. It established a fund paid by industry through a fee on production of 1 cent per barrel of oil and condensate and 1/5 cent per thousand cubic feet of natural gas on production in Louisiana. There is also an annual fee of \$10 on non-producing wells, excluding temporarily abandoned or salt water disposal wells in stripper fields. This will generate about \$4.5 million per year. Currently, there is about \$2.8 million in the fund. The production fees are escalated 5% annually to offset production decline to hold the revenue constant, and the fund has a cap of \$10 million.

Another provision of this Act has a secondary benefit that will help prevent premature abandonment of older production sites. This provision allows the voluntary creation of site specific trust accounts for well abandonment liability that will cover the cost of properly closing a well when it is no longer productive. The trust fund stays with the well and is transferred each time the well is sold. The amount of funding established for each trust fund has to be reviewed by the newly established Oilfield Site Restoration Commission to make certain the funds will be sufficient to properly close the well.

Many of the large producers, mostly the major oil companies, are shifting their exploration and production activities out of the state and into the deeper waters of the federal offshore territory and foreign countries. As they do this, they often sell or shut-in small and marginal production properties within the state that are not economical for them to operate. Small producers, with their lower overhead and operating costs, often desire these properties and can keep them in operation for many years.

Increased environmental awareness and government regulatory enforcement of well closures combined with increasing contingent liability risks associated with selling producing properties to a buyer who might not properly close a well has led to the premature abandonment of some producing properties. The reason is obvious; a large operator may decide that the future liability risks of the buyer not properly closing a well outweigh the revenue gained by selling the property. In such a case, the large operator properly plugs the wells to guarantee no future liability, and the remaining production life is lost forever. The site specific trust fund provisions of this Act should help minimize these situations and keep more oil and gas in production.

COMPRESSED NATURAL GAS MOTOR FUEL

The environmental advantages of natural gas have come into a new light in this country's drive for clean air. And drive is just what most producing states want people to do with clean-burning, economical, domestically produced, compressed natural gas (CNG). With federal mandates to convert various fleets to alternative motor fuels under either the Clean Air Act Amendments of 1990 or the Energy Policy Act of 1992, most producing states have enacted state fleet conversion mandates and incentives. For the producing states of Louisiana, Oklahoma, and Texas, the alternative fuel preferred is compressed natural gas. Louisiana's initiatives are summarized below:

1. *Executive Order No. EWE 93-9*, of March 29, 1993 by Governor Edwin Edwards, directed the Department of Natural Resources (DNR) to convert to natural gas a minimum of 500 vehicles and up to 1500 vehicles, which is approximately 25% of the state on-road vehicle fleet. By the end of August 1994, approximately 125 vehicles had been converted to CNG. This program is administered in DNR by

the Technology Assessment Division. Ecogas of Louisiana, Inc. was selected by competitive bid to make the vehicle conversions and ultimately build eight CNG/LNG (Liquified Natural Gas) refueling stations accessible to the general public as well as to state government vehicles. Ecogas finances all conversions and stations, recouping their costs through a surcharge on the fuel.

2. The Energy Division of DNR administers the Louisiana Alternative Fuels Conversion Loan Program, which is a low interest revolving loan program available to state and local government fleets to finance vehicle conversions to CNG, LNG, or LPG (liquefied petroleum gas). Additional information on this program is available from :

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3. *Act 927 of 1990* provides for the conversion to alternative fuels of a certain percentage of state-owned vehicles, and for the regulation of compressed natural gas.
4. *Act 954 of 1990* provides for the conversion to alternative fuels of a certain percentage of vehicles owned by local governments.
5. *Act 531 of 1990* provides for the deregulation of direct sales of natural gas used in CNG fueled vehicles.
6. *Act 1060 of 1991* provides an income tax credit of 20% for conversion of vehicles to alternative fuels usage and for installation of refueling equipment for alternative fuels.
7. *Act 516 of 1991* provides for an alternate method of paying tax on liquefied petroleum gas and compressed natural gas when used as a motor vehicle fuel.
8. *Act 1067 of 1992* creates the Louisiana Natural Gas Marketing Commission within the Department of Natural Resources to promote and market natural gas, including the development of incentives to convert motor vehicles to natural gas.
9. *Act 666 of 1993*, reduces the special fuels tax rate previously provided by Act 516 of 1991 to a flat rate of \$150.00 per year or a variable rate of \$0.16 per gasoline equivalent gallon.

10. *Act 7 of 1994* lowers the special fuels tax rate for school buses to one-half the rate specified in Act 666.

CONCLUSION

All may not be well in Oil and Gas Patch, USA, but there is a lot of activity and a lot of new things on the horizon. The industry has suffered a great deal from more than ten years of low oil and gas prices, and those who are left are survivors, poised for recovery. Producing state economies and state treasuries have suffered a lot, forcing states, whether they wanted to or not, to diversify and develop other sources of employment and revenue. The petroleum resources of Louisiana and the nation, though, still have much to contribute to the prosperity of the state and the country. The Department of Natural Resources continues a high level of activity in managing the valuable oil and gas resources of the state and ensuring that these resources are developed in an environmentally responsible manner.

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