PETROLEUM PROFESSIONALS

Blue Ribbon Task Force:
A Follow Up Report

Interstate Oil and Gas Compact Commission
January 2007

Governor John Hoeven

Foreword

Oil and natural gas resources found domestically continue to be the key to the nation's energy and national security. However, without qualified petroleum professionals to fill open positions, these valuable resources may not be fully maximized.

The following report, written by IOGCC Chairman Gov. John Hoeven of North Dakota, provides current information about the status of a manpower shortage facing the domestic petroleum industry. In addition, the report evaluates the efforts of state governments, the federal government and industry in solving the problem.

The IOGCC would like to thank Gov. Hoeven for his commitment to this important issue. Because of his outstanding leadership and the work of his Blue Ribbon Task Force to develop a comprehensive solution to the dilemma, the nation has finally taken steps to alleviate the problem. More needs to be done, and the IOGCC calls on all stakeholders to recommit to this effort.

Christine Hansen
IOGCC executive director

INTRODUCTION

The story of our nation's petroleum industry is an exciting tale of ingenuity and prosperity. In 1859, Edwin Drake struck oil in Titusville, Pennsylvania. That first well drilled specifically for oil was commercially successful and the world was changed forever.

Today, oil and natural gas drive the world economy and provide most of the energy necessary to live our daily lives. The petroleum industry in America generates direct revenue for state and federal governments, as well as providing jobs for citizens. Petroleum has become a daily necessity and a matter of national security.

Today the industry employs sophisticated technologies to locate and recover oil and natural gas from elusive reserves previously unattainable and to do so in an environmentally friendly fashion. The demand for petroleum resources has spurred the development of enormous technological advances and those technologies, in turn, have resulted in advances beyond the petroleum industry itself.

This story of success was written by numerous geoscientists including geologists, geophysicists, chemists and engineers, as well as skilled technicians of every kind who have developed the means to find and recover these precious resources. New successes are daily being discovered by petroleum scientists using horizontal drilling and ultradeep water drilling.

Several years ago, it became apparent to many industry, professional and government leaders that there was a shortage in the numbers of these professionals and that the situation was growing more acute. The IOGCC first published a study profiling the issue. I then created a Blue Ribbon Task Force to further investigate and make recommendations for action. The findings were bleak. Not only had the bust cycle of the eighties caused an unprecedented loss of the core workforce, but the industry was facing an aging workforce. At the same time, universities were seeing an alarming decline in enrollment for petroleum specific degrees, causing some to close those programs.

While technology had made the workforce more efficient, it did not completely compensate for the need for core talent. This became especially clear as a boom cycle began to emerge and the industry found it difficult to ramp up to meet the demand. The task force recognized that the outcome of the next chapter in the petroleum story would not only rest in the hands of industry, but also depend upon the support of both the state and federal governments.

The task force issued its final recommendations in 2003. This report seeks to shine a light on the current state of the domestic petroleum industry, the status of the recommendations toward a more robust public and private partnership, and the work that must still be addressed to sustain and strengthen the domestic industry. The progress is encouraging.

A HISTORICAL PERSPECTIVE

Although Native Americans had many uses for crude oil, white settlers before the 1850s generally regarded petroleum as the unwelcome byproduct of salt wells, sometimes causing those wells to be abandoned. Sometimes the oil was bottled and sold as medicine. Sometimes it was thickened with flour and used to grease wagon wheels and saw mill machinery. It was too smoky and odoriferous for use as lamp oil.

But, by 1840, sperm whales were nearly extinct and the Industrial Revolution was in full steam. The emerging new economy demanded new, inexpensive sources of fuel and lubricants. Abraham Gesner developed a method for extracting oil from coal to make kerosene and by 1859, more than 50 companies in the United States were manufacturing kerosene from coal. Samuel Kier, who bottled and sold crude oil as medicine from his father's salt wells, began to distill it into lamp fuel, a product he called carbon oil. He built a refinery with a five-gallon still in Pittsburgh. In 1853, the Dartmouth chemistry department, in what might possibly be the industry's first research program, examined a bottle of medicinal petroleum and concluded that it was very valuable with great potential for meeting the nation's fuel needs. By 1858, carbon oil was quickly replacing other dangerous and more expensive lamp fuels. Petroleum from northwestern Pennsylvania became the chosen product. Arguably the first boom cycle in the industry occurred as demand for oil drove the price from 75 cents to $2 a gallon.

At first, the fledgling industry adapted techniques employed by mining technology for finding underground sources of water or salt. As the volume of activity grew, professionals were attracted from other fields of engineering, until in 1900 engineers and other geoscience professionals specializing in petroleum began to emerge from United States colleges and universities. In 1907, Kern Oil and Trading Co. of California hired five mining and geology graduates from the University of Stanford to do oil-production work. In 1914, the U.S. Bureau of Mines established its Petroleum and Natural Gas Division. University courses began to appear and the first degrees were awarded in 1916.[1]

During the first thirty years of the 20th Century, petroleum engineering primarily addressed drilling, completing and producing, one well at a time. Technological improvements began to emerge which shifted the professional focus toward reservoir development and control. These advances were made possible by partnerships in research and development that included the U.S. Bureau of Mines, oil companies and universities, which led to the emergence of a robust network of research laboratories. United States petroleum engineers became the international leaders over the next four decades. Other nations sent their students to America to study and obtain degrees.[2] The United States literally trained the world in petroleum engineering and set the standard for education and technology.

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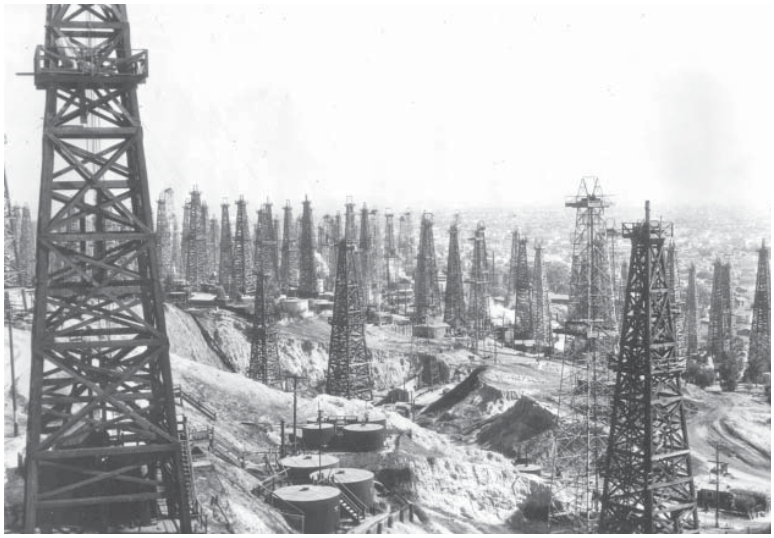
[1] Warner, C.A.: "Sources of Men," The History of Petroleum Engineering, API, Washington, DC (1961) 1, Chap.3
[2] The History of Petroleum Engineering, API, Washington, DC (1961)

The international energy crises of the mid-1970s began to reshape the industry. As new nations emerged into the world economy in the post World War II boom, countries that had not previously considered a need for developing a native petroleum industry established education and research programs. From that point forward, the American petroleum industry has been profoundly shaped by the world economy, the development of reservoir resources internationally, and the boom-bust cycles of investment and activity. The industry collapses in 1986 and 1998 sent many smaller companies into bankruptcy, toppled financial institutions and caused a general constriction and consolidation of everything from budgets, to workforce, research and educational programs. For example, BP is the result of the mergers of 10 separate companies, including British Petroleum, Amoco, Atlantic Richfield and Sinclair.



The American petroleum industry reduced its workforce fully 60 percent between 1986 and 2000, with a record 38,000 jobs lost in 1999 alone.[3] Many of those laid off were World War II veterans who have since retired, taking their institutional knowledge with them. Of the remaining oil and natural gas industry workforce, half are now between the ages of 50 and 60, while only 15 percent are in their early 20's to mid-30's. The average age in the industry is 48, with some major and super major companies reporting an average age in the mid-50's. This statistic was reflected in comments made by Brian Jennings, former chief financial officer of Devon Energy in an article published in 2005, "One-third of our geotechnical staff is eligible to retire in the next five years."[4]

During this bleak period, oil and natural gas companies were not the only ones losing revenues. In 1985 states collected $7 billion in severance taxes, accounting for 3.3 percent of total state tax receipts. By 1993, severance tax revenue had fallen to $4.6 billion or 1.3 percent of total tax revenues. Among the top eight producing states in 1985, energy severance taxes accounted for $5.8 billion or 10.6 percent of state revenues. By 1993, those states only collected $3.7 billion or 4.3 percent of total revenues as marginal wells were shut down and E&P activities slowed.[5] As the industry downsized, unemployment increased and state budgets were squeezed from both sides. Funding to universities and research programs dried up as corporate contributions and state funding disappeared.

Similarly, geoscience enrollment dropped 66.8 percent between 1983 and 2000.[6] From a peak of 11,000 students enrolled at 34 universities in 1983, only 1,300 were enrolled in 17 programs by 1997.[7] In 2004, those institutions had a combined enrollment of 1,500 students.

At the 1991 Frontiers in Education Conference, a paper entitled "Overcoming Declining Enrollments in

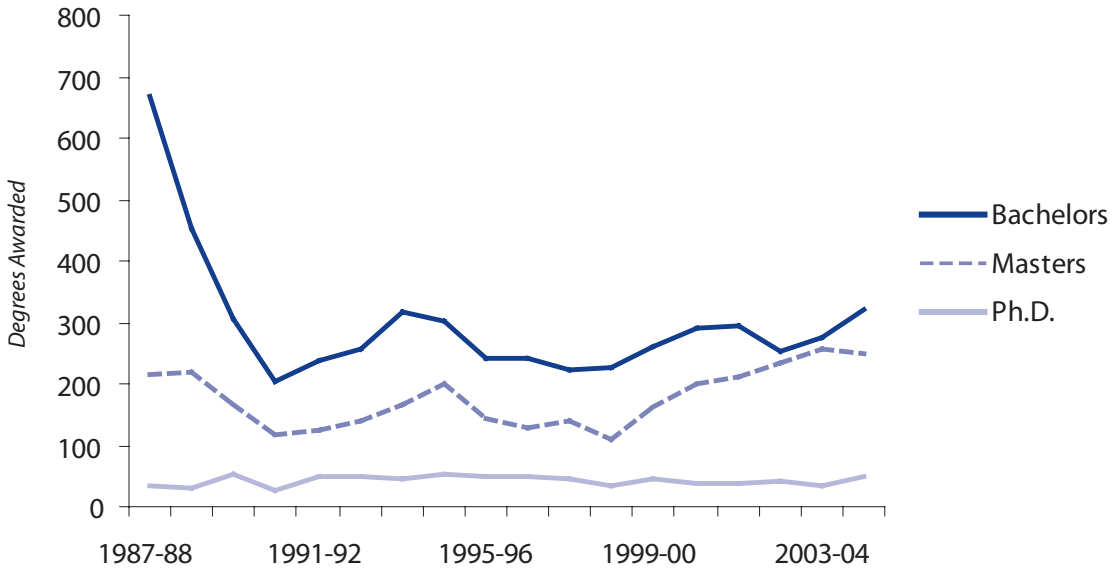
[3] "Workforce Woes Loom," Hart's E&P., August, 2000
[4] Shottenkirk, Jerry: "OKC-based Devon Attacks Aging Problem: Intern Program Accelerates," Journal Record, June 21,2005
[5] "State Energy Severance Taxes, 1985-1993," U.S. Department of Energy, Energy Information Association
[6] "2001 Report on the Status of U.S. Academic Geoscience Departments," American Geological Institute
[7] Mouawad, Jay: "A Global Shortage of Tools For The Oil Industry," International Herald Tribune, Oct. 27,2005

Petroleum Engineering," noted that national enrollment in petroleum engineering dropped from 10,800 undergraduates to 1,419 in the span of five years. The study goes further to suggest that the decline is symptomatic of other engineering disciplines as well.

In a study released in March 2006, the Commission of Professionals in Science & Technology discussed some very sobering demographic trends. The report begins by pointing out the drop in U.S. births beginning in 1962 means there are 2.5 million or one-fourth fewer college-age students today than in the late 1970s. Birth rates rose after 1975, but this new generation is altogether a different group than the Baby Boomer generation. More of these children are Black, Hispanic, Native American and Asian. In 1982, minorities made up one-fourth of school-age children. Today, they account for one-third and by 2010 are estimated to account for one-half. As science and engineering have heretofore been predominantly embraced by white males, the new demographics call for a significant education paradigm shift. Unfortunately, our education system has done very little to prepare for that. At best, student interest in math and science drops drastically after elementary school and declines throughout college. However, the drop is greater for women than for men and faster for minorities. The percentage of freshmen planning to major in engineering or any of the physical sciences has dropped steadily for 15 years.

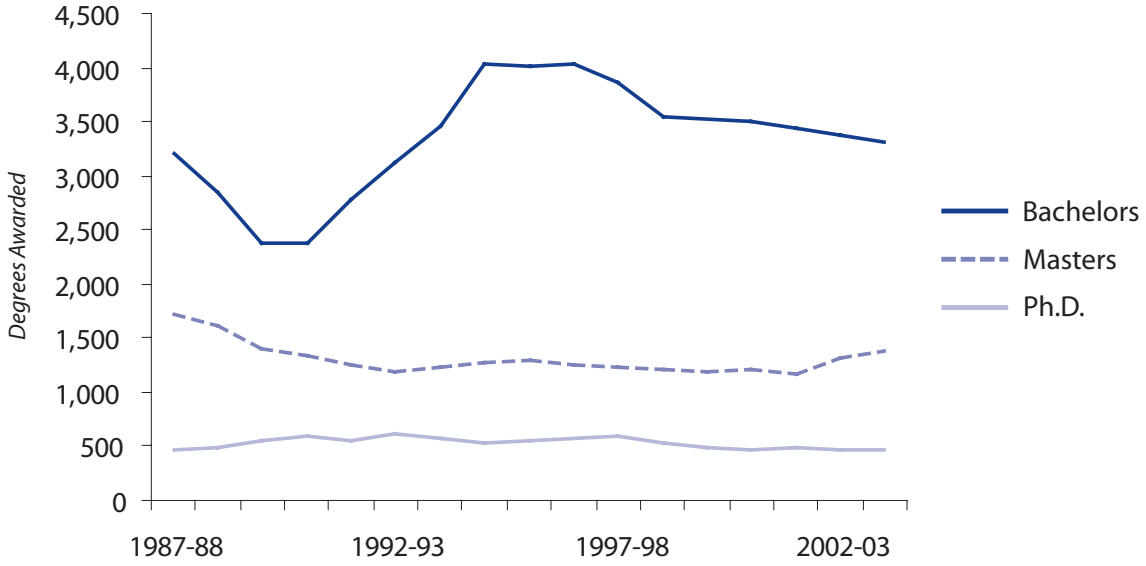
In addition, the number of freshmen enrolled in engineering is not indicative of the number who will graduate with a bachelor's degree. During the junior year, engineering degree programs access a number of students coming from other sources, including foreign students. Bachelor's degrees awarded since 1986 have dropped by 16 percent, while the number of foreign students awarded degrees has risen. In petroleum engineering specifically, B.S. degrees dropped to 307 in 1990 and less than half of those were awarded to U.S. citizens, so the real decline in degrees awarded is much steeper than it appears. To further complicate the issue, graduating seniors with a B.S. degree in petroleum engineering or the geosciences can earn significant starting salaries. These salaries not only top the offers to B.S. graduates in all other fields, but have been rising since 1990 at rates

Trends in Petroleum Engineering Degrees



Digest of Education Statistics (1990 version - 2005 version), 2004-05 data from National Center for Education Statistics COOL Database

Trends in Geology Degrees



U.S. Department of Education, National Center for Education Statistics, Higher Education

nearly double that of other fields. While this has not appeared to have attracted an increase in students enrolled in these degree programs, it has also meant fewer students remain in school to work on higher degrees, especially a doctorate. Increasingly, these spots also have gone to foreign students who have earned more than half of all Ph.D. degrees in engineering since 1980. About half of those remained to teach at universities or conduct research, but many are now leaving for their home countries, such as Korea, where emerging economies now have use for their talents.

The report concludes that a large part of the problem is our education system itself. It projects that less than half of U.S. 18-year-olds will graduate high school with sufficient background in math and science to have even the option to choose a career in engineering or the sciences. In today's technology driven world, this is a crisis.[8]

Similar issues were identified in the 2001 report on U.S. academic geoscience departments published by the American Geological Institute. The report related the historic stability of graduate enrollment, except for a dip in 2001, where graduate enrollments declined 12 percent and degrees awarded dropped 17 percent. The report also noted that research funding support fell from 1999 to 2003, with the largest declines coming from the federal and industry sectors. In its demographic profile, it noted that while foreign-student enrollment in undergraduate programs has been declining steadily since 1992, foreign students are far more prevalent in graduate degree programs.[9]

In many respects, while it would appear that the United States is still training the world, in fact it is becoming increasingly reliant on foreign talent. Unfortunately, in a global economy where the United States has experienced the pain of outsourcing jobs via technology, insufficient attention has been given to rebuilding those education programs. Strong math and science education programs at all levels can provide jobs in this country, while maintaining technological leadership.

[8] Betty M. Vetter: "Changing Demographics and Shrinking Engineering Enrollments," Commission on Professionals in Science & Technology, JPT, March 1992
[9] "2001 Report on the Status of U.S. Academic Geoscience Departments," American Geological Institute

A CURRENT PERSPECTIVE

The new century quietly ushered in, if not a boom cycle, then at least an improvement in the economics of the oil and natural gas industry. Domestic energy supplies had been dwindling as the industry reduced their exploration efforts, nearly a third less in 2000 than they were in 1998.[10] As geopolitical instability in the Middle East increased, world supplies were also affected. By 2002, total world consumption of marketed energy reached 412 quadrillion British thermal units (Btu).[11] The worldwide active drilling rig count is now nearly double that of the dark days of 1999, and that picture is predicted to sustain itself for the next 20 years.[12]

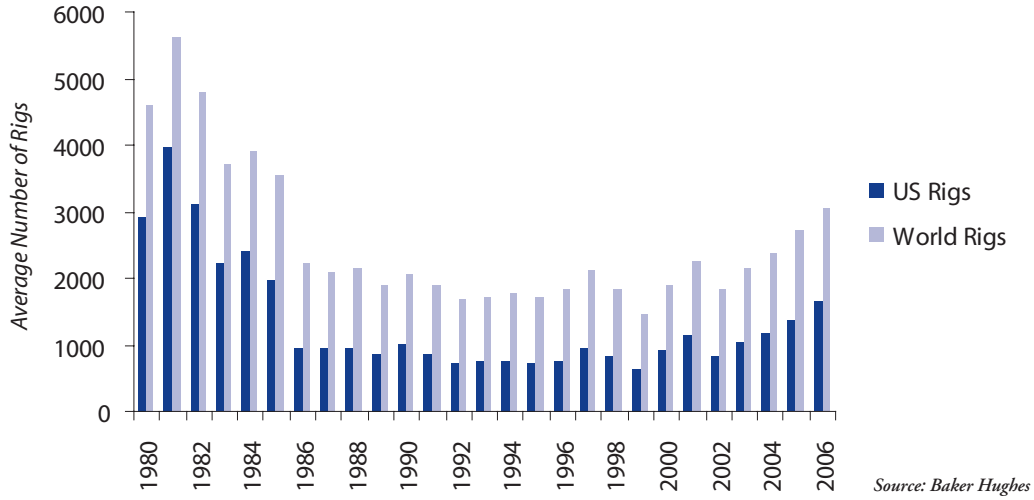
Crude oil prices have more than doubled since 1988; natural gas prices have almost tripled. The National Energy Policy Report issued by President George W. Bush in 2001 predicted an increase in U.S. oil consumption of 33 percent and natural gas consumption over 50 percent, with a concomitant increase in demand for electricity of 45 percent, and that's including aggressive practice of conservation measures. Likewise, worldwide demand continues to increase, with world oil consumption predicted to grow from levels in 2002 of 78 million barrels per day to 95 million barrels per day by 2010.[13] World demand is being driven by emerging economies in Asia, particularly China and India, where primary energy consumption is projected to grow at an average annual rate of 3.2 percent between 2002 and 2025.Furthermore, demand is also significantly affected by the growth in information technologies. As Mark Mills, coeditor of the Digital Power Report noted, "Every generation of microprocessors consumes more energy than the previous one and server farms that power the New Economy are huge energy users." The verity of this statement was starkly evident during the energy crisis in California in 2001. Reports noted that electricity demand in Silicon Valley had grown 6 percent annually since 1994.[14]

It is important to note that the world energy market has changed in one very significant respect. As we enter this new century, we will find that oil prices are now driven by world demand. In the past, OPEC, the 12 producing nations controlling the majority of the world's known petroleum reserves, controlled price through production. Supply side leverage is now yielding to world demand as supply has become relatively inelastic compared to demand. China alone is projected to account for 20 to 25 percent of global energy demand growth. Should China develop the energy consumption appetite of the United States, current world reserves would be insufficient to supply China, much less the rest of the world.

These conditions place more importance on the role of the domestic industry, which is struggling to ramp up. Just as the domestic industry was beginning to respond to the strengthening demand and already finding a shortage of drilling rigs and crews, petroleum engineers and geologists, contractors and suppliers, tankers, pipelines, storage tanks, refineries and import terminals, hurricanes Katrina and Rita sent energy supplies into

[10] Mouawad, Jay: "A Global Shortage of Tools For The Oil Industry," International Herald Tribune, Oct. 27,2005
[11] "International Energy Outlook 2005," Energy Information Administration, August, 3, 2006
[12] Brown, David: "Boom Feels Like A Bust --For Now," Explorer, November 2003
[13] Report of the National Energy Policy Development Group, Overview of National Energy Policy, Washington, DC, GPO, May, 2001
[14] Kurlantzick, Joshua: "How Green Is the Valley?," U.S. News & World Report, April 30, 2001: 38

Average Rig Counts (United States vs. Total World)



a tailspin. In late 2005, oil prices surged past $70 per barrel. Increased geopolitical instability from world terrorism added to the upward pressure. According to Arthur Smith, chief executive officer of John S. Herold, a research firm, "The concern now is that there will be a backlash against big oil companies who do not seem to be doing enough to bring in new supplies and push oil prices down." And, indeed, as gasoline prices at the pump soared, the media was only too quick to target the petroleum industry, conveniently ignoring the impact of excise taxes and access restrictions. Among oil products, highway fuels (gasoline) are the most heavily taxed. Federal and state excise taxes account for 40 cents of every dollar spent at the pump.[15]

Nevertheless, the rapaciousness of the news reports does not bode well for an industry already suffering from a bad image. Nevertheless, the domestic petroleum industry picture is the best that it's been in the past 15 or 20 years. Most industry experts agree that price swings and boom-and-bust cycles will continue, but expect that the lower end of the ranges will be higher than they have been.[16] That bodes well for a sustainable recovery capable of attracting new talent, funding research and rebuilding education programs.

It also spells financial relief for state revenues. Severance tax collection in the first three quarters of 2005 exceeded the total collection in 2004, with top producing states reporting increases ranging from 90 percent to 135 percent over the prior year.[17] For example, Kansas reported a rise of 27 percent in severance tax collections in 2005 over 2004 and an increase of 170 percent from 1999. In Oklahoma, the state budget includes a 5.1 percent growth in total funding, benefitting education, health care, public safety, roads and bridges. Most of the state's revenue increase comes from dramatically increased gross production tax collections on oil and gas, together with a more than 10 percent increase in state income tax collection, thanks to the improved employment picture provided by energy jobs.[18]

Clearly, the domestic oil and natural gas industry can anticipate a brighter economic future. However, it must still resolve its greatest challenges, regenerating its workforce at all levels and re-establishing its world leadership in R&D. To do so, it must, as the 2003 Blue Ribbon Task Force Final Report suggested, establish a coordinated industry effort involving industry, government and educational institutions.

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[15] "Taxes on Crude Oil Production," U.S. Department of Energy, Energy Information Adminstration
[16] Brown, David: "Boom Feels Like A Bust --For Now," Explorer, November 2003
[17] "State Energy Revenues Gushing," StateStats, U.S. Census Bureau, State Tax Collections 2005
[18] Oklahoma Independent Petroleum Association, "Gross Production Tax Helps Coffers Overflow," May 22, 2006

IOGCC Blue Ribbon Task Force Report

The IOGCC first warned of a shortage of personnel in its 1997 report "National Geoscience and Engineering Manpower Issues for the Petroleum Industry." In 2001, the IOGCC published a report, "HR: the Missing Piece of the Energy Puzzle," written by Dr. William L. Fisher and Sarah Seals, profiling the elements of the workforce crisis: market forces, jobs, workforce demographics, R&D and degree programs. Dr. Fisher called for the development of a task force to address the issue, increased efforts to win favorable public opinion toward the industry, mentoring, research and internship programs.

At the end of 2001, in my role as chairman, I assembled a Petroleum Professionals Blue Ribbon Task Force and charged it with developing proposals. The task force released its preliminary recommendations at the June 2002 meeting, following with the final report in December 2002.

Findings

The task force identified a complex network of challenges that were synergistic with the original focus on a shortage of qualified professionals and a skilled workforce. Underlying everything is the price volatility driven boom-and-bust cycles that characterize the industry. The bust cycle of the 1980s was severe enough to cause a large reduction in the excess delivery capacity that the industry had traditionally maintained. Similarly, every aspect of the industry was downsized. Proprietary research and development by the major operating companies were exchanged for reliance on outside technology developed by service companies and universities. Unfortunately, these programs were also affected by the funding squeeze as corporate support waned. Government-funded energy R&D similarly experienced dramatic reductions. Corporate mergers dramatically reduced the workforce, many of whom left the industry permanently. The energy industry is as affected by the aging of the Boomer generation as any other industry, but the impact is exacerbated by the lack of hiring over the past 15 years, which would ordinarily have filled in the tail of the age curve. This employment climate caused a dramatic decline in the number of students seeking petroleum industry related degrees. Declines in enrollment created a loss of major educational programs.

Fortunately, the information age with its improvements in computer hardware, software and operating platforms coupled with technological advances enabled the industry to be more efficient with its workforce than at any previous time in history. As Cheryl Knight, executive director of the Petroleum Human Resources Council of Canada, notes, "The traditional sources of skilled staff are not going to be adequate ...more (Canadians) must realize how attractive the petroleum community really is as a workplace. In oil and gas, you're judged by what you know and what you can do. This industry is remarkably open to people of any background."

These same sentiments apply to the American petroleum industry. In its final report, the task force strongly emphasized the need for a coordinated effort involving industry, government agencies and educational institutions to establish a new understanding of today's petroleum industry and the opportunities it offers, as well as its strategic importance to our local, state and national economies.

The task force also made note of the significant changes in the domestic industry. Shifts in environmental policy and domestic access challenges encouraged the major and super-major operating companies to shift their investment emphasis to other regions of the world with large reserves and less environmental and legal regulation. Mid-size major and independent operators now represent the majority of investment in the domestic industry. These smaller companies do not have the same level of recruiting, hiring and R&D resources that the major and super-major operators have historically provided.

Recommendations

The task force concluded that the solution to its charge of regenerating the workforce requires a national effort focused on three areas:

- **State Government** - education of the public and state stakeholders
- **Federal Government** - research and national outreach
- **Industry** - on the ground focus and involvement

The task force developed templates of recommended actions for each area, calling on all stakeholders (government, agencies, academia, operating and service companies, non-governmental organizations) to join together to improve the workforce situation.

Federal Template: The federal government is the largest resource owner and chief regulator and as such must commit its infrastructure and financial resources to assure that a long-term focus is developed and maintained. Appropriate actions by the departments of the federal government (Energy, Interior, Labor, Education, and Commerce) include:

- Work with the IOGCC and other federal departments in a coordinated effort
- Provide federal funding for pilot and applied research programs and for academic research
- Inventory and advise the IOGCC and the states of grant funding available
- Each department to establish a specific staff member to liaise with the IOGCC
- Department head to alert field offices of the need to address workforce issues
- Hold federal department staff accountable for progress
- Alert the IOGCC and the states of similar projects, to avoid duplication
- Promote awareness to education associations
- Participate in a public relations campaign on the importance of the petroleum industry - use EIA/MMS materials already produced, show importance to federal budget of production on federal leases
- Create internships within federal departments for geosciences graduates and undergraduates

State Template: The states have critical roles in managing regional energy resources, providing regulatory structures and providing funding for all levels of professional and vocational education and research infrastructure. Appropriate steps a state and its agencies may take include:

- Governor appoints a specific staff or cabinet member to staff the issue
- Governor alerts state employment agency and workforce development entities, state oil and natural gas regulatory agency, and state university system and department of education
- Organize state/industry public relations campaign on importance of industry, high-tech nature using support from industry tax contributions
- Create an industry/education partnership with internship programs, continuing education credits for teachers, working with career counselors, funding research
- Educate industry on ways to improve employee retention programs
- Promote linkages to other associations (trucking, utilities, etc.) and utilization of the IOGCC Web site career center
- Outreach to U.S. Government officials and advance issue through member organizations, such as the Western Governors Association

Industry Template: Industry must work with the other stakeholders to develop and deliver a long-range plan, providing data, technology and training/internship opportunities as well as funding. Appropriate steps industry may take include:

- Executives alert HR professionals of the need for sustained effort
- Seek support and attention of state and federal officials
- Dedicate financial resources to support state/industry public relations, public education, and scholarship/internship programs
- Organize an industry team within the state to formulate long-term solutions
- Provide summer jobs, outreach to high school and college students, partner with specific organizations/schools
- Participate with the IOGCC electronic career resource center on the Web
- Develop scholarships and grant programs for employees to extend their education

Progress Report

Since the task force issued its final report in 2003, significant progress has been made. Most encouraging is the evidence of public-private partnerships at every level. The task force recommendations for establishing internships, scholarships and other programs designed to attract young people to petroleum science careers have especially taken root in all areas. Following is a report on the progress of each sector as it has focused on its own particular areas of leverage and applied these to positive effect. The rating scale begins at 0 for little to no effort and ends at 4 for significant effort.

Federal Actions

The task force recognized that the role of the federal sector derived most importantly from its position as the largest resource owner and chief regulator.

Fossil fuels currently provide more than 85 percent of all the energy consumed in the United States, accounting for almost two-thirds of electricity and all but a fraction of transportation fuels.

- ◆◆◆ Work with the IOGCC and other federal departments in a coordinated effort
- ◆ Provide federal funding for pilot and applied research programs and for academic research
- ◆ Inventory and advise the IOGCC and the states of grant funding available
- ◆ Each department to establish a specific staff member to liaise with the IOGCC
- ◆◆ Department head to alert field offices of the need to address workforce issues
- ◆ Hold federal department staff accountable for progress
- ◆ Alert the IOGCC and the states of similar projects, to avoid duplication
- ◆ Promote awareness to education associations
- ◆ Participate in a public relations campaign on the importance of the petroleum industry - use EIA/MMS materials already produced, show importance to federal budget of production on federal leases
- ◆◆◆ Create internships within federal departments for geosciences graduates and undergraduates

The federal government periodically struggles to address the deficit, eyeing programs with significant budgets. Pre-9/11, the defense budget and Medicare

took their hits. But global terrorism and the Baby Boomer constituency soon blocked those opportunities. During the Clinton Administration, the purchase of reserves for the Strategic Petroleum Reserve was suspended in an effort to address the federal deficit. In 1999, with the reserve dangerously low, the administration developed a new plan to fill the reserve by acquiring royalties in-kind (acquiring the crude oil itself) from federal leasehold in the Gulf of Mexico.[19] Research funding recently presented itself as a budget reduction target. R&D funding had already dropped dramatically beginning in 1989, remaining flat between 2001 to current time. Of the $8 billion budgeted in 2006 for energy R&D, only $65 million was slated for oil and natural gas R&D. The news gets worse as the 2007 budget begins to emerge. To date, nothing is budgeted for oil and natural gas R&D within the U.S. Department of Energy. All that remains is the $50 million allocated from royalty receipts under the Energy Policy Act of 2005 for ultra-deep water and unconventional hydrocarbon development.[20]

IOGCC recently published persuasive data in its 2006 Report: Marginal Wells: Fuel for Economic Growth. The report clearly demonstrates that both marginal oil and natural gas wells "are the model of conservation and economic development." As the report notes, 17 percent of the oil and 9 percent of the natural gas produced onshore in this country come from marginal wells. Research is critical to the survival and productivity of marginal wells. Federal and state governments and universities play a crucial role in the research and development programs which help find new methods for producing domestic energy. Independent oil and natural gas companies drill 85 percent of wells in the United States, including most marginal wells. They do not have the funds to support major research and development programs. The shrinking number of major and multinational companies has meant that today's number of active companies supporting consortia funding for domestic university research programs has been cut in half. Without federal support for fossil energy, the productivity of marginal wells is threatened. As the IOGCC report points out, without the production from marginal wells active in 2005, our oil imports would have increased by 6.7 percent. Moreover, if all marginal wells were abandoned, the country would realize a loss of $11.9 billion and nearly 292,000 jobs.

Nevertheless, over the past five years, some interesting research has occurred. DOE's Office of Fossil Energy has made headway in developing policies and technologies to assure supplies of clean, affordable energy. DOE's Natural Gas STAR initiative is focused on reducing emissions of methane and includes more than 100 partner companies and endorsements by 11 major industry trade associations. Likewise, DOE's Office of Natural Gas and Petroleum Technology has provided funding to a global partnership to reduce gas flaring and venting associated with the extraction of crude oil by capturing the gas and channeling it to productive uses. With 900 of the next 1,000 U. S. power plants slated to use natural gas, such unconventional recovery technologies will become

[19] "Filling the Strategic Petroleum Reserve: the Royalty In Kind Initiative, Office of Fossil Energy, U.S. Department of Energy, October 4, 2006
[20] "Who Will Fund America's Energy Future?" IOGCC, Dr. William F. Lawson, 2006

increasingly important economically, even as they improve the environment.[21] Finally, although the initial results are perhaps desultory, five DOE grant initiatives administered through the Ground Water Protection Council (GWPC) focus on the development and use of databanks to reduce the time and expense of regulatory compliance. For example, more than 250 wells in North Dakota have been reworked and brought back online through horizontal drilling using readily available well information. Not only did North Dakota operators realize cost savings estimated at $75 million, but production was maintained where a few years ago such wells would have been plugged or shut in.[22]

The United States is one of the world's most mature hydrocarbon-producing regions, but environmental concerns have constrained or removed public lands rich in oil and gas from exploration and development. The DOE has selected three research projects to demonstrate ways to minimize environmental impact in a program known as LINGO (Low-Impact Natural Gas and Oil). LINGO projects have developed web-based software to enable small, independent E&P companies to generate development plans to recover tight gas shales in environmentally sensitive ecosystems while avoiding adverse impacts to air and to subsurface aquifers by using horizontal drilling techniques and eliminating venting. The third project is slated with the IOGCC for development of a "best practices" guide to viable approaches for minimizing environmental impact. IOGCC project partners include ALL Consulting, Devon Energy Corp. and the state oil and natural gas agencies of California, Nebraska, Montana and North Dakota.[23]

Unfortunately, with the elimination of federal funding it is uncertain whether these fledgling programs will be able to continue, much less to evolve sufficiently to realize their full potential. Further, with politicians still rooted in the rhetoric of the 1970s and '80s, it is clear that education and awareness of the significance of the domestic oil and natural gas industry to our domestic economy, to our standing in the global economy, and to our accustomed way of life will need to begin at the top.

Various federal departments have made progress in building a favorable partnership with industry. The Bureau of Land Management and the Minerals Management Service had both addressed royalty regulations in ways designed to offer incentives. The Internal Revenue Service revised rules applicable to depreciation and amortization. The Department of Commerce established an emergency oil and gas guaranteed loan fund. The Department of Energy and its various sub-agencies have developed and promoted robust internship programs.[24]

State Actions

The task force appropriately noted that states also have critical roles in managing regional energy resources through regulatory and incentive structures, as well as funding for research infrastructure and professional and vocational education

- Governor appoints a specific staff or cabinet member to staff the issue
- Governor alerts state employment agency and workforce development entities, state oil and natural gas regulatory agency, and state university system and department of education
- Organize state/industry public relations campaign on importance of industry, high-tech nature using support from industry tax contributions

[21] "Federal/State Programs," Climate Vision, Private Sector Initiatives, August, 2005
[22] "Technical Achievements of Five DOE Grant Initiatives," Ground Water Protection Council, 2005 Annual Report
[23] "DOE Initiative Targets Ultra-Low Environmental Impacts of Oil and Gas Recovery," National Energy Technology Laboratory, June 8, 2006
[24] "State Incentives to Maximize Oil and Gas Recovery," Investments in Energy Security, IOGCC, 2006

- Create an industry/ education partnership with internship programs, continuing education credits for teachers, working with career counselors, funding research
- Educate industry on ways to improve employee retention programs
- Promote linkages to other associations (trucking, utilities, etc.) and utilization of the IOGCC Web site career center
- Outreach to U.S. Government officials and advance issue through member organizations, such as the Western Governors Association

Progress in this sector has been stronger overall. Of the IOGCC's 37 state members, 30 reported positive activity toward improving the business investment climate for the petroleum industry in their state.[25]

Alabama, Alaska, New Mexico, North Dakota, Oklahoma and Texas reported the largest amount of activity, combining incentives and tax reductions designed to stimulate exploration, horizontal drilling, capture of vented gas, and bringing wells back into production. Wyoming, Oklahoma, Kansas, Virginia and Alabama also reported significant activity funding demonstration, research or database development projects.

According the Hart's E&P Magazine, the oil and natural gas industry will need nearly 30,000 new petroleum engineers by 2009 to replace retiring workforce as well as meet growth demand in the industry. Students entering the workforce with petroleum engineering degrees can expect favorable employment options. Graduates with a bachelor's degree in petroleum engineering can expect an average beginning salary of $61,516, while their counterparts in geosciences can see starting salaries around $45,600, according to the National Association of Colleges and Employers.

The role of educating and preparing new generations of petroleum engineers, geoscientists and skilled workers occurs at state universities and vocational training facilities.

Universities wishing to strengthen their engineering programs might wish to review the development of the Bagley College of Engineering at Mississippi State University. In 1998, the college was ranked 49th in research expenditures by the National Science Foundation. It currently ranks in the top 10 percent. The college offers a broad array of engineering degrees ranging from aerospace to mechanical. These are complemented by enhancement programs designed to equip students with career-building skills. Beyond that, the College engages in a wide variety of service and outreach programs designed to attract minority and women students at the high school level and below. The fall 2004 enrollment statistics identified an enrollment of 1,884 students in undergraduate engineering programs and 426 enrolled in graduate programs, with women representing 18 percent of total enrollment and minorities 10 percent. Once students are enrolled, student advisors work to retain students in the field, offering access to summer programs, internships and research projects.

In Oklahoma, the esteemed Mewbourne School of Petroleum Engineering at OU has seen enrollment jump from 98 in 2003 to 224 in 2006. Like Mississippi State, OU has engaged in an aggressive campaign to attract new students by securing corpo-

[25] "State Incentives to Maximize Oil and Gas Recovery," Investments in Energy Security, IOGCC and The Energy Council, 2006

rate grants, establishing scholarships and internship programs. Corporate partners in Texas and Oklahoma have not only provided financial support for university programs, but have benefited students with the establishment of internships and summer jobs.

Further, many states are beefing up their technical training programs specifically addressing skill development for the petroleum industry. Arkansas, Kansas, New Mexico and Oklahoma have programs recently initiated, some using state or federal workforce development pilot program funds to train lease operators, safety engineers, well service crews and other petroleum field technical skills. Older programs in California, Alaska, and Colorado are experiencing increased interest. More involvement with state workforce programs could assist this educational trend.

For states seeking to keep unemployment rates low and improve their average income profile, jobs in the engineering sciences are desirable jobs. Moreover, for producing states, these are jobs that import people to the state. In a recent news story, The Oklahoma Employment Security Commission noted that the state's jobless rate had fallen to 3.5 percent, the lowest level since 1990. Energy jobs accounted for 2.5 percent of the state's non-farm employment, with 39,900 employed in the energy sector. And, as some states have experienced, a healthy energy industry can help absorb job losses in other weakening sectors, such as manufacturing.

On the outreach measurement, some states have made significant progress in working with the energy industry to proactively develop workforce initiatives. One example lies in my home state of North Dakota.

With an unemployment rate of 3.3 percent and one of the nation's highest out-migration rates, the petroleum industry experienced poor returns on traditional recruitment efforts. In the fall of 2004, North Dakota invited the industry to participate in its workforce program, Job Service North Dakota, operated by the state employment agency, by forwarding all their job openings. Job Service North Dakota then partnered with the North Dakota Petroleum Council to provide more profiled information about oil field positions. Job postings were aggressively marketed on Web sites and through a media blitz. The agency targeted persons recently laid off in the manufacturing sector as well as people from construction, agriculture and the armed forces who were underemployed. The campaign extended into neighboring states and collaborated with the national agency, America's Job Bank. Approximately 77 percent of the positions posted were filled within the first three months of the program.

Similarly, the Oklahoma Corporation Commission established a special recruitment program to assist people impacted by the closing of the Oklahoma City General Motors plant. Partners included the

energy industry and vocational trainers. The commission hosted an event designed to bring skilled workers together with employers to fast track the hiring process. The state's Workforce Initiative also tapped energy industry HR departments to identify the skills needed in their various job sectors to assist vocational and technical training programs, to improve competency levels, and to support recruiting efforts.

Industry Actions

The task force recognized that it would be industry's role to commit funding and to initiate action both collegially within the industry and in outreach to the other sectors. It called upon industry to provide the data, technology and training opportunities on a larger scale to stimulate the development of the workforce of the future.

- ♦♦♦ Executives alert HR professionals of the need for sustained effort
- ♦♦ Seek support and attention of state and federal officials
- ♦♦♦ Dedicate financial resources to support state/industry public relations, public education, and scholarship/internship programs
- ♦ Organize an industry team within the state to formulate long-term solutions
- ♦♦♦♦ Provide summer jobs, outreach to high school and college students, partner with specific organizations/schools
- ♦ Participate with the IOGCC electronic career resource center on the Web
- ♦♦♦♦ Develop scholarships and grant programs for employees to extend their education

Industry support for university programs such as scholarships, endowed chairs and the like is widespread. Industry partners are also active in research programs developed by or at universities with federal or state funding. Debi Bradley, industry and alumni liaison with OU's Mewbourne School of Petroleum and Geological Engineering, identified that 124 students are on internships with local energy companies.[26] The popularity of summer job or internship programs has soared. Sophomores can make $4,000 a month, while juniors and seniors make $5,600. From the students' perspective, internships not only help fund their college expenses, but they receive valuable training in the various aspects of their chosen field. From the companies' perspective, they are recruiting qualified people familiar with their culture and operations.

Many experts believe that the industry's poor image also affects choices students make about careers. The IOGCC called for a national energy education program. While that has not come to fruition, others have begun to step into the breach. The first state level program was created in 1994 in Oklahoma. The Oklahoma Energy Resources Board (OERB) builds the industry's image through its program of outreach by industry professionals to elementary, middle and high schools around the state. It also has restored more than 2,400 abandoned oil field sites. Former executive director Mike Terry noted in a speech to the American Petroleum Institute that public surveys revealed significant improvements in annual surveys among respondents'

[26] Stephen A. Martin: "As Engineering Market Booms, Students Find Slick Internships," OU Daily, June 13, 2006

perceptions of the importance of the oil and natural gas industry to the state and its overall image.

Public outreach programs developed by the Kansas Independent Oil & Gas Association have earned national recognition. They have creatively used web-based resources, events, presentations and curriculum packets. In Oklahoma, the OERB has developed public education outreach programs for Oklahoma schools. The program offers a wide variety of opportunities, including science fairs, school projects, curriculum materials and more.

In Oklahoma, the state's new History Center features the largest outdoor interpretive exhibit in the United States and the only state collection featuring derricks. According to Oklahoma Historical Society Director Bob Blackburn, the 18 acre, 215,000 square foot learning center envisioned the state's history in oil and natural gas exploration and development one of the primary elements. The collection includes photo archives, historical records and artifacts of a breadth and depth that is unparalleled. "This collection was made possible by the generosity and involvement of the oil and gas industry, from funding to collection contributions. Donors and supporters have included large companies like Devon, Chesapeake, and Andadarko as well as private individuals from Tulsa and Perry who contributed the first portable rotary rig and a Ft. Worth Spudder." OERB funded the development of a teacher's curriculum unit. Blackburn estimates that 60,000 children have visited the center's oil and gas exhibits and projects that number to rise to 100,000 within the next three years.

Additionally, companies are not only reinvesting in their assets, but also in their communities. Many, following the recommendations of the task force, have provided significant support, both in terms of funding and in promoting volunteerism among employees, toward community needs such as adopting schools, mentoring young students and supporting conservation and beautification efforts at the community level.

Conclusion

In the three years since the task force's final report, much has been accomplished and much more has been learned about the nature of the challenges still facing the industry and the country. Most significantly, the workforce issue must be understood in the context of the macro environment. Similarly, the domestic oil and natural gas industry must also be understood in this context. And, it is up to industry and its related professional organizations to take on this task and communicate it effectively to our nation and our nation's leaders.

The imperatives for action in the next three to five years include new directions in public policy, education and resource development and management.

Next Steps

Federal Sector: This sector is not only the largest resource owner and chief regulator, but a significant beneficiary of our nation's energy resources. Afflicted by political cycles in the same way as the industry is afflicted by market cycles, it must nevertheless craft a consistent public policy cognizant of the impact of a dynamic domestic energy industry on jobs, tax revenues, balance of trade, the federal deficit and affordable, secure supplies of energy to meet our nation's needs over the long-term.

- Continue funding initiatives to build databases that make well information readily available and reduce time and expense of regulatory compliance; reduce administrative delays and duplication; and responsibly open access to existing reserves
- Establish consistent funding to support academic and applied research focused on maximizing our nation's energy resources while protecting and improving our environment
- Develop and fund national education standards to improve math and science competency among students of all ages and backgrounds, establish incentive programs to encourage state and local government, industry and private support

State Sector: This sector must continue to provide the educational, research and business infrastructure required to support a healthy energy industry. Together with other stakeholders, it must take the lead in encouraging and developing robust education programs and collaborative initiatives in workforce development.

- Continue funding support for university research programs and collaboratively seek matching funds from outside sources, both public and private
- Continue to develop workforce initiatives designed to assist in industry recruiting and technical training
- Develop and fund state educational standards to improve math and science competency among students of all ages and backgrounds, establish scholarships and incentive programs to encourage private and local government support
- Build awareness among the public and national leadership about the significance of the energy industry to the state, its contributions to the economy and the opportunities for communities and individuals
- Partner in the development of processes to fast track the transfer of knowledge from research to commercial use to maximize resource development and utilization while benefiting and protecting the environment

Industry: As well as continuing to support and partner with entities in the other sectors, industry must step forward to give voice to its needs and potentials in securing the future of our nation, our states and

- Develop awareness building communications that tell the "story" of the oil and natural gas industry in terms of professional development, environmental stewardship, opportunities for innovation
- Partner in the development of processes to fast track the transfer of knowledge from research to commercial use to maximize resource development and utilization while benefiting and protecting the environment
- Continue the development of mentoring, internship and other workforce development programs
- Collaborate with government and academia to recruit, train and retain professional and skilled workers

Governor John Hoeven, IOGCC 2006-07 chairman

John Hoeven was born in Bismarck, N.D. He earned a bachelor's degree from Dartmouth College in 1979 and a master's degree in business administration from Northwestern University in 1981. Hoeven served as executive vice president of First Western Bank in Minot from 1986 to 1993. From 1993 to 2000, he served as president and CEO of the Bank of North Dakota, during which time the bank's assets grew from $900 million to $1.6 billion.

In December of 2000, Hoeven was elected governor and began working to build North Dakota's future by focusing on six pillars of growth: education, economic development, agriculture, energy, technology and quality of life. Under his leadership, North Dakota has expanded and diversified its economy, adding many new jobs and businesses. In 2003, North Dakota led the nation in personal income and wage growth, and in 2005, its rate of growth in per capita personal income was second. When much of the nation struggled through a recession and reported budget deficits, North Dakota continued to grow and diversify its economy.

In his second term as governor, Hoeven remains committed to enhancing the state's business climate, holding the line on taxes and promoting North Dakota's targeted industries, which are agriculture, energy, technology, advanced manufacturing and tourism. He proposed new initiatives for research and additional investments in education. These include continued increases for teacher compensation and expanded funding for Centers of Excellence, an initiative that combines education and economic development to create higher-paying jobs and new business opportunities for North Dakota citizens.

Hoeven directed the development of a multi-resource energy program for the state, with incentives in each energy sector, as well as a conservation component. North Dakota is the sixth largest energy producing and exporting state in the nation and Hoeven has worked to advance the state's traditional energy resources, like lignite coal, oil and gas, while promoting renewable energy opportunities, such as wind, ethanol and biodiesel.

Hoeven previously was IOGCC chairman in 2003, when he focused on the personnel shortage in the petroleum industry and how to attract new workers. He organized a Blue Ribbon Task Force to find solutions, which led to the award-winning publication Petroleum Pros.

He also has previously served as chair of the Midwestern Governors Association, the National Governors Association's Health and Human Services Committee and Natural Resources Committee and the Governors' Ethanol Coalition.

Hoeven and his wife Mical (Mikey) have two children, Marcela and Jack.

About the IOGCC

The Interstate Oil and Gas Compact Commission is a multi-state government agency that promotes the conservation and efficient recovery of our nation's oil and natural gas resources while protecting health, safety and the environment.

The IOGCC consists of the governors of 37 states (30 members and seven associate states) that produce most of the oil and natural gas in the United States, as well as seven international affiliates. Chartered by Congress in 1935, the organization is the oldest and largest interstate compact in the nation.

The IOGCC assists states in balancing interests through sound regulatory practices. These interests include: maximizing domestic oil and natural gas production, minimizing the waste of irreplaceable natural resources, and protecting human and environmental health.

The IOGCC also provides an effective forum for government, industry, environmentalists and others to share information and viewpoints, allowing members to take a proactive approach to emerging technologies and environmental issues. For more information visit www.iogcc.state.ok.us or call 405-525-3556.

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