



**American Petroleum Institute
Workforce Challenges
Survey Results**

May 2005

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Workforce Challenges: Survey Results

Technology and Human Resources

Because oil and gas are exhaustible fossil fuels, there is often a tendency to view the industry as fundamentally constrained by the characteristics of those fuels. Certainly, industry cannot freely choose where to operate; it must go where the resource is. It cannot freely choose how much to produce, since the rate of production is heavily governed by properties of the resource, and the total amount ultimately produced is fixed by nature. Finally, the industry's history has frequently been punctuated by periods of concern that such exhaustion was both imminent and unavoidable.

Given these constraints and perceptions, the importance of the oil and gas industry for the world's economy is often underestimated, and its future role portrayed as limited, passive and in decline. Actually, nothing could be further from the truth.

- First, energy has played a key role in past economic development worldwide. There is virtually no country that has been able to sustain economic growth without increasing energy consumption. Furthermore, because of the key importance of transportation to development, and the importance of oil to transportation, oil consumption has also often been an essential ingredient of development.
- Second, there is no indication that the role of oil and gas will decline significantly in the foreseeable future. While production from some older regions (such as parts of the United States) are expected to decline, demand is likely to continue growing with economic activity. In fact, most estimates expect that sustaining a 3% rate of economic growth over the next several decades will require major expansion of world oil supplies, of more than 50%, and an even greater expansion of natural gas (IEA 2004).
- Third, there is no characteristic of the resource base itself that has prevented industry from sustaining this growth in the past, or constrain it from meeting these future challenges. A few numbers make the point. In 1950, proved reserves of oil worldwide stood at 76 billion barrels. In the next 53 years, the world actually produced about 960 billion barrels of oil, well over 10 times the reserves estimated in 1950. Perhaps even more remarkably, by the end of 2003 estimated remaining reserves stood at over 1.1 trillion barrels, enough to continue producing at 2003 rates for still another 43 years even if no new reserves were added.

The key to this spectacular past performance and optimistic future prospects has not been any actual expansion of the resources in the ground, but rather the sustained application of new technologies to those resources. This technology has:

- expanded the frontiers of the fields we have long known about, by increasing the share of the in-place resources recoverable from those fields
- allowed us to more reliably identify new fields in previously unknown or inaccessible locations
- successfully reduced the need for tradeoffs between energy development and environmental quality, by sharply reducing the footprint of development activity

Sustaining this growth into the future will rely even to a greater extent on technology, as the share of unconventional resources in the energy mix increases.

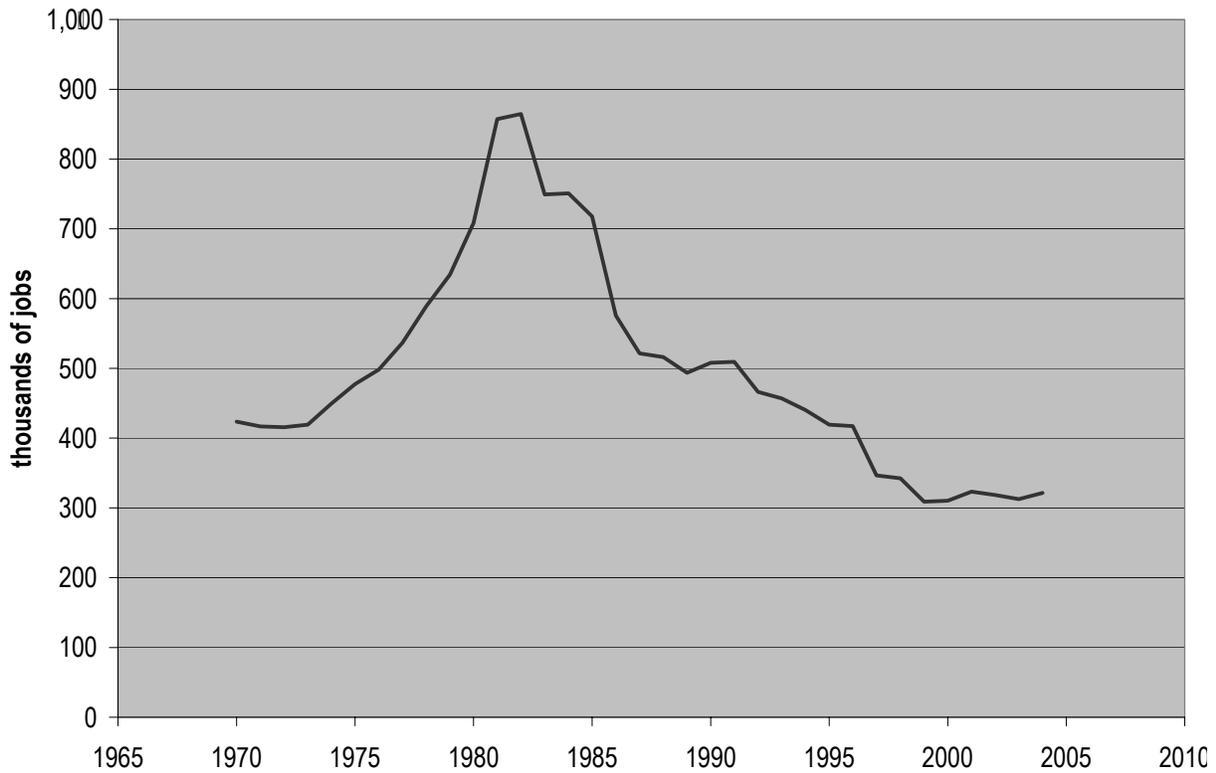
Given this critical dependence on technology to sustain industry growth, it is human resources that offer a potentially more binding threat to industry expansion than physical resources or their characteristics. Increasingly, however, there has been a perception of several disturbing trends in the availability of the human resources that have been critical in sustaining industry's progress in the past.

In particular, there are four broad trends in United States markets that have generated concerns in recent years.

- First, there has been a dramatic decline in overall industry employment since the early 80s, with demographic consequences for industry hiring needs. As seen in Figure 1, total industry employment peaked at over 860,000 jobs in 1982, before falling precipitously in the 80s and 90s¹. Over half a million petroleum jobs were lost between 1982 and 2000. This sharp drop was accomplished by sustained layoffs which gave the industry a reputation of an unreliable employer, and sharply curbed entry into the industry by nearly a full generation.
- Second, there has been a corresponding drop in undergraduate enrollments in professions particularly essential to the continued advance of petroleum technology, such as petroleum engineering. Enrollments in United States universities now stand at about 1,500, which is down 85% from its 1982 peak (Mensch 2003).
- Third, there has been a decline in the general educational emphasis on areas particularly relevant to technological progress, such as math and science. Recent studies reveal that while United States fourth graders perform well in math and science relative to peers in other industrial countries, this performance deteriorates in the middle and higher grades (Patrick Gonzales and Kastberg 2004).
- Fourth, there has at least been a growing perception that the petroleum industry is an unattractive industry in which to pursue a professional career, in part because of its past contraction as well as its recent price volatility.

¹ From United States Bureau of Labor Statistics (2005). Includes employment in extraction of oil and gas, support activities, and refining.

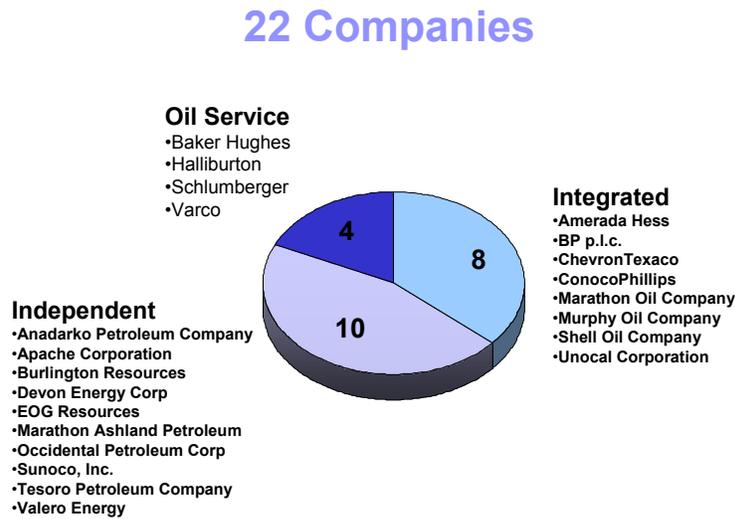
Figure 1. United States Petroleum Industry Employment



API Employment Survey

In order to both quantify these trends and perceptions and begin to develop strategies for addressing them, API commissioned the current study in the Fall of 2004. Twenty-two companies, representing a broad cross section of the United States industry, participated in the study, as seen in Figure 2. The sample contained integrated companies, independent producers, and service companies. Total employment by the sample companies totaled 254,683, or about 17% of total United States industry employment. Participants were asked a number of questions covering their perception of the most serious workforce-related problems they face, characteristics of their current labor force, their hiring needs for the next five years, and their concerns about meeting these needs. The questionnaire, along with instructions and definitions, is presented in Appendices A and B.

Figure 2. Study Participants



Findings

Perhaps the most significant result of the survey stems from its coverage being limited to the next five years. Because of this limited horizon, it is intended to pick up imminent concerns. While the four trends described above have been long term, the survey revealed a series of concerns that suggest that the cumulative effects of these trends are now perceived as having consequences for industry manpower in the short term.

In particular, the survey revealed five key issues as the top concerns faced by the sample firms, as shown in Figure 3. The first concern was the demographics which has resulted from the industry's prolonged period of consolidation, which has stifled new entry into the workforce and contributed to a "graying" of that workforce as average ages have risen. Each of the other concerns is also driven principally by the experience of prolonged industry contraction.

Figure 3. Key Issues Revealed by Survey

Top 5 Workforce Issues

(Scale: 1=Not at all, 2=Low, 3=Medium, 4=High, 5=Extremely High)

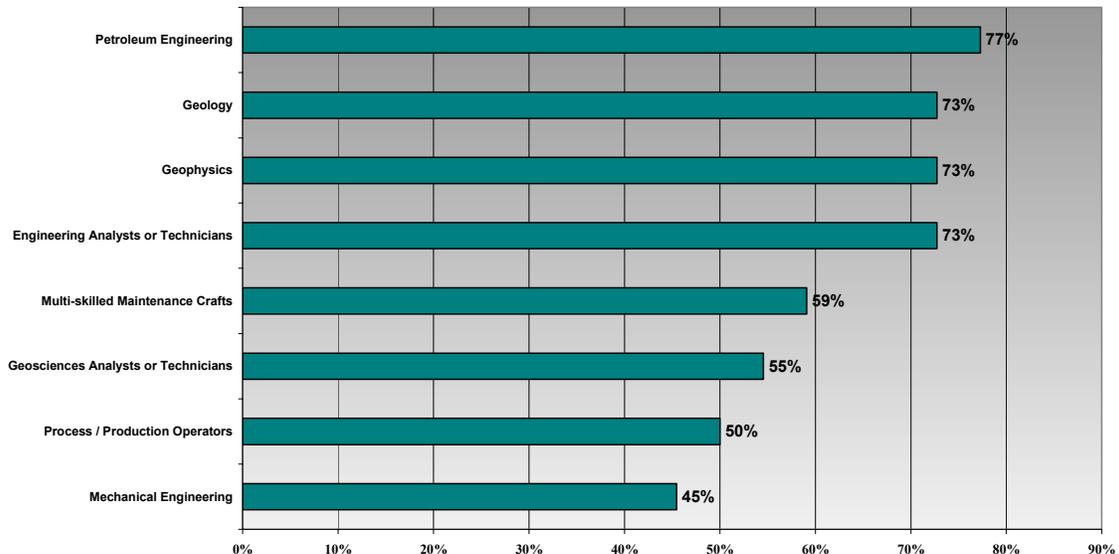
Issues	Average Score
Age Demographics	4.5
Recruiting Challenges	4.1
Skill Pool Management	3.9
Attraction & Awareness of Youth to Energy Industry	3.6
Image of the Energy Industry	3.6

Because of the critical and growing role played by technology in this industry, these concerns are especially acute with respect to the most technically demanding professions. In particular, eight skill sets were identified most frequently as posing the greatest challenges, as seen in Figure 4.

Figure 4. Key Technical Skills Revealed by Survey

Top 8 Scarce Skills

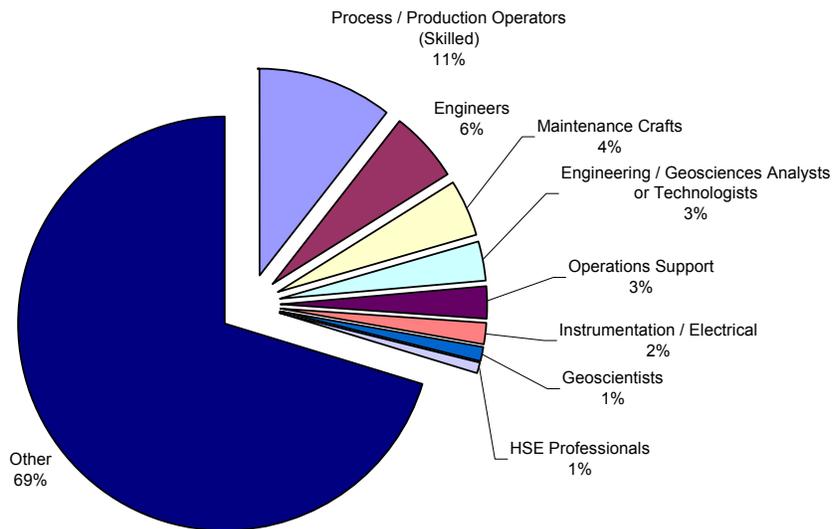
Percent of Companies Who Project Supply Shortages



Share of Current Labor Force

The importance of these key technological careers is seen in the composition of the sample firms' workforce. As seen in Figure 5, these key professions comprise nearly a third of the sample firms' workforce.

Figure 5. Key Skills as Share of Sample Firm Workforce



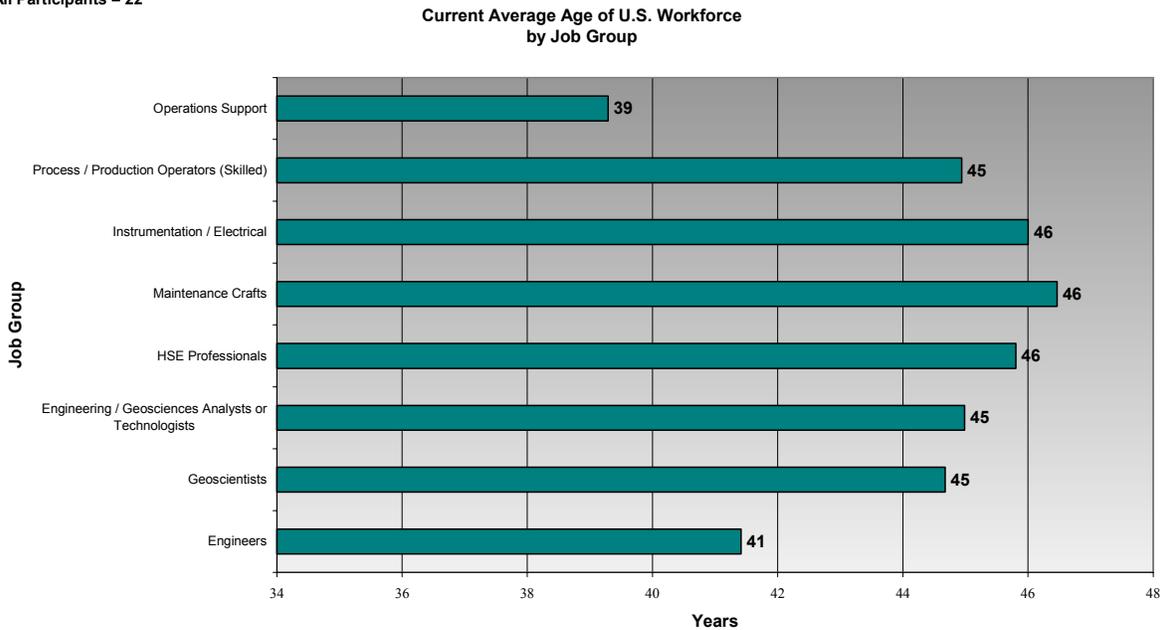
Average Age

Because of the protracted period of industry contraction, the average age of the industry workforce has increased. Overall, according to the Society of Petroleum Engineers, the industry average age is 51 in North America.² The average age in the 8 professions in the survey varied between 39 to 46 years, as seen in Figure 6.

² Statement by Mark Rubin, Executive Director SPE, quoted in "Opportunity Gushes," *US News and World Report*, March 8, 2004.

Figure 6. Average Age in Key Technical Positions, Sample Firms

All Participants = 22

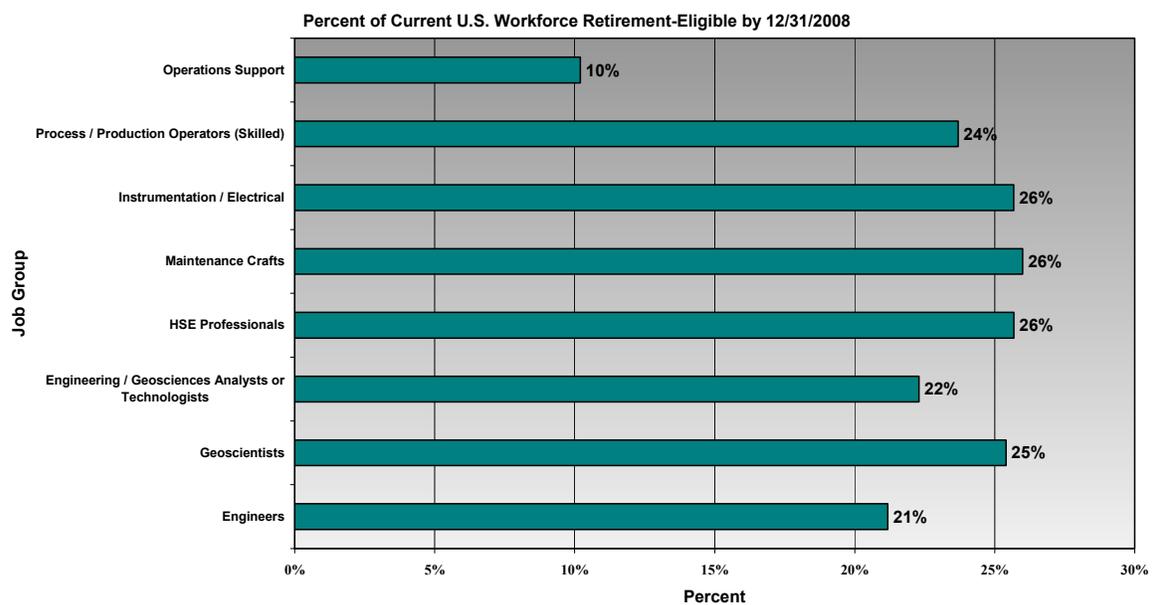


Retirement Eligible

As a consequence of the current industry demographics and typical early retirement options, nearly a quarter of the employees in the eight scarce skills in the sample companies are estimated to be eligible for retirement before 2009, as seen in Figure 7.

Figure 7. Share of Key Technological Workforce Retirement Eligible

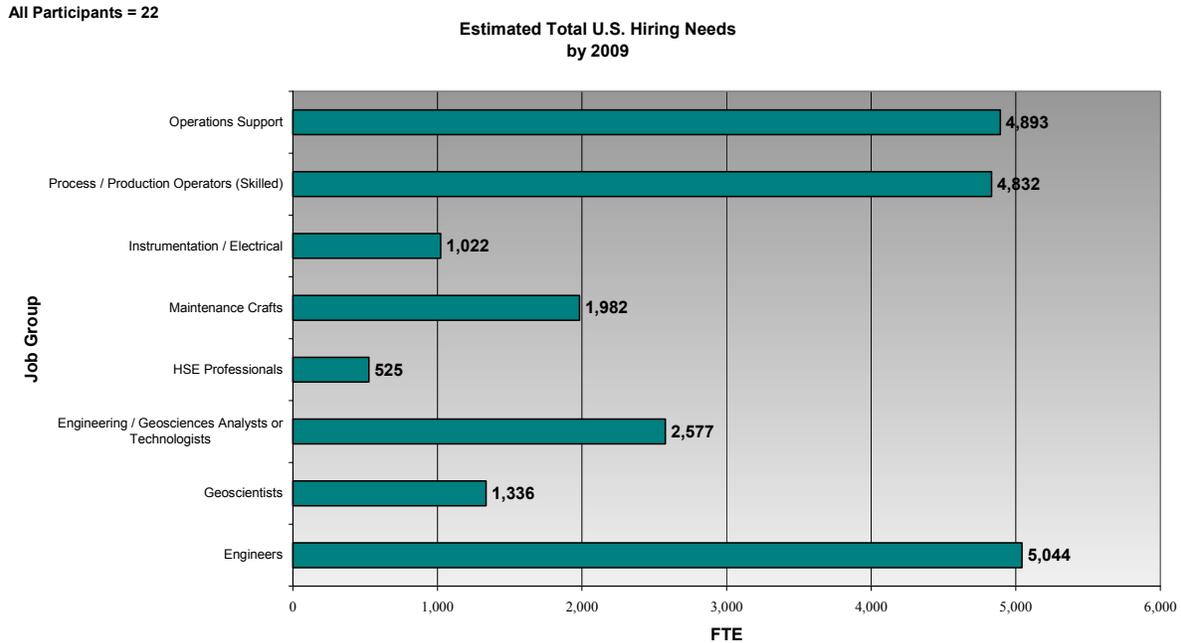
All Participants = 22



Future Requirements

To replace these workers, and to satisfy increasing technological requirements of future operations, the survey indicated that over the next five years, the sampled firms expect to hire over 22,000 new workers in these eight technical skill categories, as seen in Figure 8. Over 6,000 of these new hires are expected to be engineers and geoscientists.

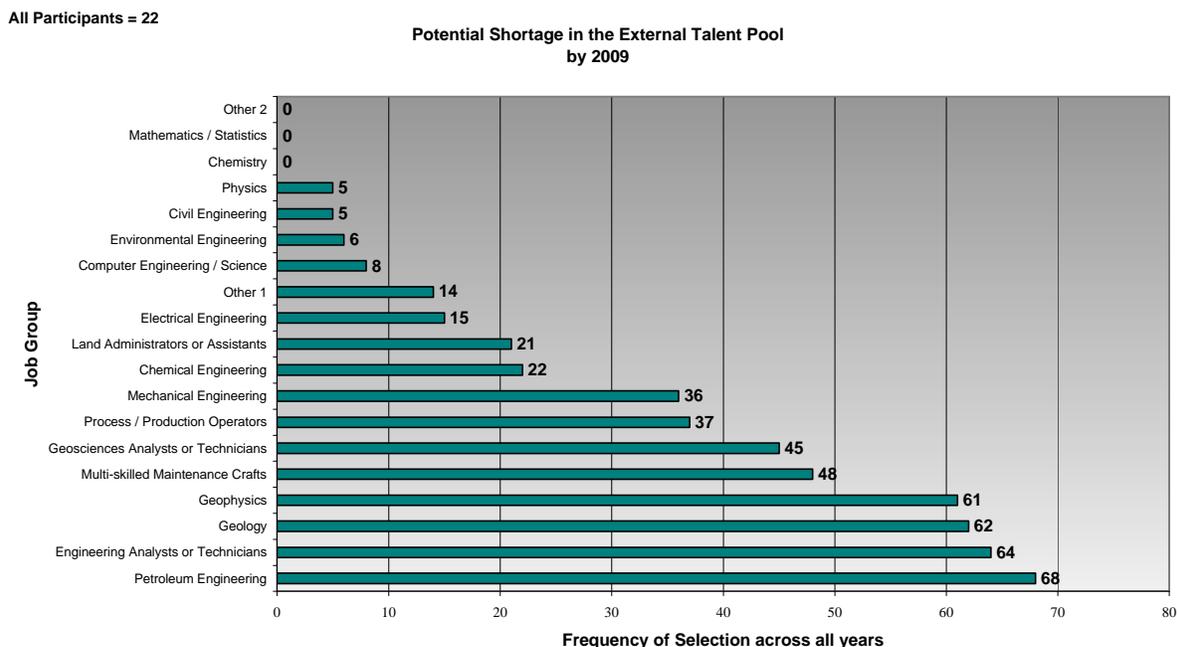
Figure 8. Key Technical Skills Hiring Needs by 2009, Sample Firms



Recruiting Difficulty

While these results suggest an unprecedented imminent reliance of the sample firms on recruiting from an external pool of talent in these key areas, the broad trends cited earlier promise to make this effort increasingly difficult. As seen in Figure 9, perceptions of shortages in the external talent pool were cited for virtually all major skill categories in the technical workforce. The most frequently cited shortages were perceived to be in the supply of geoscience and petroleum engineering graduates. These concerns are understandable given the numbers presented above. For example, the sample firms, who represent only 17% of the industry, expect to need over 5,000 engineers in the next five years. As mentioned above, in 2003 there were only 1,500 students enrolled in petroleum engineering programs in the United States.

Figure 9. Perceptions of Shortages in External Talent Pool



Summary

Between now and 2030, sustaining a moderated rate of global economic growth is estimated to require more than a 50% increase in energy supply, with about two thirds of this growth in the form of oil and gas. The oil and gas industry faces a number of challenges in meeting these demands, but the greatest of these challenges is neither the scarcity of the resource nor the hostile conditions in which it is increasingly found. In the future, as in the past, industry has routinely pushed back these barriers with technology fueled by the human capital of its dynamic workforce. But there have been a number of concerns about the continued vitality of this mechanism in the past several decades, as the average age of that workforce has increased, and a growing share has become eligible to retire. For over two decades, the industry has been in a persistent state of contraction that has reduced demand for new entrants into the industry in a number of key technical fields. It has also removed the incentives required to develop the required pool of new talent, and resulted in a severe atrophy of that pool.

This survey of a cross section of United States companies suggests that the consequences of these trends are both severe and imminent. The survey documents that the combined effects of demographics and increasing technical skill requirements is likely to pose major challenges to both recruiting and managing the workforce over the next five years. If all of the anticipated needs over that period could be satisfied, about a third of the key technical positions would turn over in just five years. But the feasibility of this replacement is problematic, as revealed by a broad concern over shortages in all of the key technical skills.

REFERENCES

International Energy Agency (2004). *World Energy Outlook 2004*

Mensch, A. (2003). *Petrotechnicals: the Real Scarce Resource*. Plano, Texas, Petrostrategies.

Patrick Gonzales, J. C. G., Lisette Partelow, Erin Pahlke, Leslie Jocelyn, David and a. T. W. Kastberg (2004). " Highlights From the Trends in International Mathematics and Science Study (TIMSS) 2003(NCES 2005-005)."

US Bureau of Labor Statistics (2005). *National Employment, Hours and Earnings*.

APPENDIX A
SURVEY ON PETROLEUM INDUSTRY

Survey on Petroleum Industry Key Workforce Issues

Company Name: _____

Contact Person: _____

Total US
employment
(Company Size)

Full Time Equivalent (FTE)

Address: _____

Telephone: _____ Fax: _____

E-mail: _____

Please check the box that most appropriately describes your company _____

- My Company is an *integrated oil & gas company*
- My Company is an *independent oil & gas company*
- My Company is an *oil service company*
- My Company is an *oil equipment manufacturer*
- My Company does not fit any of the above-mentioned criteria

Please return your completed survey by September 3, 2004 to:

American Petroleum Institute
Statistics Department
1220 L Street, NW, Washington, DC 20005-4070
Attn: Hazem Arafa
Tel: (202) 682-8506 Fax: (202) 962-4730
E-mail: arafa@api.org

Assurance of Confidentiality: Any information provided by survey participants in this survey is confidential and will remain confidential. Therefore, individual survey responses will not be released, shared or published. Rather, survey results will be compiled and published in an industry aggregate report. Individual data will only be available to API employees who have a need to know for purposes of completing the report. Comments provided by participants that appear in the final report will remain anonymous. At the conclusion of the survey, at the election of each participant, individual responses will be destroyed or returned to the participant.

Survey on Petroleum Industry
 Key Workforce Issues
 U.S. Operations: Company Data

Company:

Workforce Data by Job Groups								
	Number of U.S. Employees (FTEs) as of 12/31/2003	Percent of Current U.S. Workforce Retirement-Eligible by 12/31/2008	Current Average Age of U.S. Workforce (years)	Estimated U.S. Hiring Needs (FTEs)				
				2005	2006	2007	2008	2009
Job Groups								
Engineers								
Geoscientists								
Engineering / Geosciences Analysts or Technologists								
HSE Professionals								
Maintenance Crafts (excludes instrumentation / electrical)								
Instrumentation / Electrical								
Process / Production Operators (skilled)								
Operations Support (entry level labor / general labor)								

**Survey on Petroleum Industry
Key Workforce Issues
U.S. Operations: Staffing Challenges**

Company:

Step 1						Step 2
Listed below are challenges related to attracting, developing, and retaining staff in the energy industry. From your company's current view or perspective, please rate these items, using the scale 1-5 at the right, on the importance of each issue.	Importance					After you have rated all 14 challenges, please select the top 4 challenges that are most important to your company by placing a check in the boxes in the column below.
	1	2	3	4	5	
Challenges	Not At All	Low	Medium	High	Extremely High	
Age Demographics (aging workforce, not enough talent in 7-10 years)	<input type="radio"/>	<input type="checkbox"/>				
Attraction & Awareness of Youth to Energy Industry (junior high to high school)	<input type="radio"/>	<input type="checkbox"/>				
Cost Management (including managing outsourcing, offshoring)	<input type="radio"/>	<input type="checkbox"/>				
Cycles of the Industry (repeating cycles of hiring / downsizing)	<input type="radio"/>	<input type="checkbox"/>				
Education System (K-12, preparedness of future workforce pool)	<input type="radio"/>	<input type="checkbox"/>				
Image of the Energy Industry	<input type="radio"/>	<input type="checkbox"/>				
Immigration Issues / Restrictions	<input type="radio"/>	<input type="checkbox"/>				
Labor Relations Issues	<input type="radio"/>	<input type="checkbox"/>				
Recruiting Challenges (identifying and locating the right talent)	<input type="radio"/>	<input type="checkbox"/>				
Skill Pool Management (staff development, career paths)	<input type="radio"/>	<input type="checkbox"/>				
Soft Skills (e.g., communications, interpersonal, problem-solving)	<input type="radio"/>	<input type="checkbox"/>				
Staff Attrition Rate (turnover rate)	<input type="radio"/>	<input type="checkbox"/>				
Technical Skills / Competency Gaps	<input type="radio"/>	<input type="checkbox"/>				
Workforce Diversity	<input type="radio"/>	<input type="checkbox"/>				

Survey on Petroleum Industry
Key Workforce Issues

Company:

U.S. Operations: Scarce Skills by Discipline

Please identify by specific discipline where you see potential shortages (or particularly difficult challenges) in the external talent pools. Place a check under the year(s) you anticipate the challenges apply.

Disciplines	2005	2006	2007	2008	2009
Chemical Engineering	<input type="checkbox"/>				
Chemistry	<input type="checkbox"/>				
Civil Engineering	<input type="checkbox"/>				
Computer Engineering / Science	<input type="checkbox"/>				
Electrical Engineering	<input type="checkbox"/>				
Environmental Engineering	<input type="checkbox"/>				
Geology	<input type="checkbox"/>				
Geophysics	<input type="checkbox"/>				
Mathematics / Statistics	<input type="checkbox"/>				
Mechanical Engineering	<input type="checkbox"/>				
Petroleum Engineering	<input type="checkbox"/>				
Physics	<input type="checkbox"/>				
Technical Support	2005	2006	2007	2008	2009
Engineering Analysts or Technicians	<input type="checkbox"/>				
Geosciences Analysts or Technicians	<input type="checkbox"/>				
Land Administrators or Assistants	<input type="checkbox"/>				
Operations & Maintenance	2005	2006	2007	2008	2009
Process / Production Operators	<input type="checkbox"/>				
Multi-skilled Maintenance Crafts	<input type="checkbox"/>				
Other	2005	2006	2007	2008	2009
	<input type="checkbox"/>				
	<input type="checkbox"/>				

Company:

Survey on Petroleum Industry
Key Workforce Issues

U.S. Operations: Current Actions / Best Practices

Building upon the workforce challenges listed under the tab "Challenges", briefly describe at least 2 examples of actions (or potential best practices) that your company has taken to address identified workforce challenges. Indicate if you partnered and/or used external resources and if you are still actively involved.

For your convenience, the following is the list of challenges previously noted:

Age Demographics	Labor Relations Issues
Attraction & Awareness of Youth to Energy Industry	Recruiting Challenges
Cost Management	Skill Pool Management
Cycles of the Industry	Soft Skills
Education System	Staff Attrition Rate
Image of the Energy Industry	Technical Skills / Competency Gaps
Immigration Issues / Restrictions	Workforce Diversity

Workforce challenge being addressed:	Current Action / Best Practice
Example: Technical Skills / Competency Gaps -- How to increase technical skills and job knowledge of operations staff	Example: Partnered with local community college to develop new training plan and secured state incumbent worker training grant. Yes, still actively involved.

Do you have any additional comments or suggestions?

Thank You !

APPENDIX B
DEFINITIONS AND INSTRUCTIONS

Scope of Survey: The petroleum industry requires a highly skilled workforce able to adapt to constant technological innovations. Recognizing this, the Department of Labor has identified the energy sector as a High Growth Job Initiative. The American Petroleum Institute is sponsoring this survey to identify those areas where industry believes there will be a demand for workers and the skill sets required for those workers. The key group jobs to be addressed are engineering, geosciences, crafts and operators. The survey covers your entire U.S. workforce under your operational control.

Assurance of Confidentiality: Any information provided by survey participants in this survey is confidential and will remain confidential. Therefore, individual survey responses will not be released, shared or published. Rather, survey results will be compiled and published in an industry aggregate report. Individual data will only be available to API employees who have a need to know for purposes of completing the report. Comments provided by participants that appear in the final report will remain anonymous. At the conclusion of the survey, at the election of each participant, individual responses will be destroyed or returned to the participant.

The following are general guidelines for completing this survey. Please follow these guidelines as closely as possible, and provide on a separate sheet any responses that do not conform to the business sectors or measure definitions as described in these survey instructions. Also provide comments detailing any performance highlights or anomalies. If you are entering your responses on the Excel workbook, you may include “notes” or “comments” in the corresponding “cell.”

IMPORTANT

Please enter information on every cell of the survey sheets.

- **If you collect the information and it is available, but have no amount to report, enter “0” (zero).**
- **If the information requested is applicable to your operation, but do not collect the data, enter “no data” or “ND.”**
- **If the information requested is not applicable to your operation, enter “not applicable” or “NA.”**

Definition of Company Description

- **Integrated Oil & Gas Company:** A company that has upstream as well as downstream operations. Examples include ExxonMobil, BP, or ChevronTexaco, etc.
- **Independent Oil & Gas Company:** A company that has either upstream or downstream operations, but not both. Examples include Anadarco, Sunoco or Murphy.
- **Oil Service Company:** A company that provides products and/or services to the oil and gas industry. Usually a combination of labor, equipment, and/or other support services. Examples include Haliburton or Schlumberger.
- **Oil Equipment Manufacturer:** A company that specializes in the sale and distribution of equipment to the oil and gas industry.
- **Other:** Any other Oil and gas related business not defined above.

Company Workforce Definitions

Job Groups Definitions:

- **Engineers:** Disciplines and titles vary. Examples include Petroleum, Chemical, Mechanical, and Electrical.
- **Geoscientists:** Examples include Geologists, Geophysicists, and Petrophysicists.
- **Engineering/Geosciences Analysts or Technologists:** Examples include Engineering / Geological Analysts or Technicians, Exploration Analysts, Geophysical Technologists, and Inspectors (Non-engineering degreed).
- **HSE Professionals:** Safety administrators, safety consultants, etc.
- **Maintenance Crafts:** Includes Mechanics, Pipefitters / Boilermakers, Welders, and Carpenters but excludes instrumentation / Electrical.
- **Instrumentation/Electrical:** Technicians.
- **Process/Production Operators (skilled):** Examples include Process Technicians, Production Technicians, and Lease Operators.
- **Operations Support:** Examples include Entry Level Labor, General Labor, and Roustabouts.

“Scare Skills” Definitions:

Disciplines	Type of roles	Process Engineer	Maintenance Support Engineer	Project Engineer	Research Engineer/Scientists	Geoscientist	Petrophysicist	Reservoir Engineer	Well Engineer	Production Engineer	Field Engineer
Chemical Engineering	✓		✓	✓	✓		✓	✓	✓	✓	✓
Chemistry					✓						
Civil Engineering			✓	✓	✓				✓	✓	✓
Computer Engineering/Science					✓						
Electrical Engineering			✓	✓	✓	✓	✓				✓
Environmental Engineering					✓						✓
Geology					✓	✓	✓				
Geophysics					✓	✓	✓				
Mathematics/Statistics					✓						
Mechanical Engineering			✓	✓	✓			✓	✓	✓	✓
Petroleum Engineering					✓		✓	✓	✓	✓	
Physics					✓	✓	✓				

Technical Support

- Engineering Analysts or Technicians
- Geosciences Analysts or Technicians
- Land Administrators or Assistants

Operations/Maintenance

- Process/Production Operators
- Multi-skilled Maintenance Crafts

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