



SUMMARY

POSTSECONDARY EDUCATION AND STEM EMPLOYMENT IN THE UNITED STATES

An Analysis of National Trends with a
Focus on the Natural Gas and Oil Industry

Prepared by:
energy **API**[®]

AMERICAN PETROLEUM INSTITUTE



POSTSECONDARY EDUCATION AND STEM EMPLOYMENT IN THE UNITED STATES

An Analysis of National Trends with a Focus on the Natural Gas and Oil Industry¹

This report aims to contribute new knowledge to our understanding of the role that postsecondary education – including bachelor’s degrees, associate’s degrees and credentialing programs – plays in meeting the increasing demands of the Science, Technology, Engineering, Mathematics (STEM) workforce.

Distribution Rights

This summary was prepared by the American Petroleum Institute and is based on the RAND Corporation Study Postsecondary STEM Education and Employment in the United States: An Analysis of National Trends with a Focus on the Natural Gas and Oil Industry, by Matthew D. Baird, Robert Bozick and Mark Harris (2017).

Jobs that require STEM skills and training currently comprise 20 percent of all jobs in the U.S. economy. Current projections anticipate that the STEM economy will grow about 9 percent between 2014 and 2024—faster than the growth rate projected for all other occupations. With this expansion and the growing demand for workers to fill STEM jobs, business leaders are putting pressure on—and in some cases, providing investments in—universities, community colleges and technical schools to develop programs that are tailored to specific STEM occupations, with an eye toward preparing students for high-growth occupations.

As an industry that supports 7.6 percent of the U.S. economy and 10.3 million American jobs, many of which are STEM jobs, the oil and natural gas industry has a great interest in better understanding and promoting the relationship between STEM education and employment. Diversity is a key component of that relationship. Looking forward, IHS projects the industry to have close to 707,000 job opportunities filled by Blacks and Hispanics, and more than 290,000 filled by women.



Considering the substantial future workforce needs of America's oil and natural gas industry and its efforts to attract and retain the best available talent, education and workforce training—and STEM education in particular—are vital to the projected industry growth that will keep the U.S. at a competitive advantage and provide the energy we all depend on.

In addition to the millions of jobs already supported by the industry, IHS projects that through 2035 nearly 1.9 million direct job opportunities will be available in the oil and natural gas and petrochemical industries.²



STEM READINESS

STEM competencies are critical to the oil and natural gas industry. According to IHS, the oil and natural gas and petrochemical industries are projected to have nearly 1.9 million direct job opportunities available through 2035. A significant number of these positions will require strong skills in the STEM disciplines across all education levels. In fact, holding a STEM bachelor's degree nearly doubles the likelihood of working in the oil and natural gas industry.

Fifty-seven percent of the industry's job opportunities are in skilled or semi-skilled positions that require a high school diploma and some-post secondary training. Thirty-two percent of job opportunities are projected to be available in management and professional positions which typically require a bachelor's degree.

“THE INADEQUATE SUPPLY OF QUALIFIED AND SKILLED TALENT IS THE SECOND-BIGGEST THREAT TO U.S. COMPANIES’ ABILITY TO MEET REVENUE OR BUSINESS PERFORMANCE TARGETS.”

(Randstad U.S. Workplace Trends Report, June 2016)





A KEY ELEMENT IN ACHIEVING A GROWING LEVEL OF WOMEN AND MINORITIES TO FILL WORKFORCE NEEDS IN THE INDUSTRY IS TO INCREASE THE NUMBER OF THESE INDIVIDUALS WHO OBTAIN THE EDUCATION AND TRAINING NEEDED FOR THE AVAILABLE POSITIONS.

Oil and Natural Gas Degrees

One aim of this report is to better understand the trends in educational attainment in fields that prepare students, either directly or indirectly through transferable skills, for employment in the oil and natural gas industry. “Industry-specific” and “industry-related” disciplines are disciplines that provide students with skills that are directly applicable to the oil and natural gas industry, including fields such as petroleum, chemical, mechanical, civil, and construction engineering; geosciences; and cartography.

Bachelor’s degrees awarded in oil and natural gas fields account for about 2.5% of all bachelor’s degrees. Women and minorities are less likely to graduate with degrees in fields that lead most directly to oil and natural gas jobs.

Over the 2003-2015 period, only about 1% of women who earned a bachelor’s degree received it in an oil and natural gas field, compared to about 5% of men.

- Men accounted for about 80% of all bachelor’s degrees earned in oil and natural gas fields, and 94% of associate’s degrees earned in skilled and semi-skilled industry related fields over the 2003–2015 period.
- Asians have both more graduates in and a greater percentage of oil and natural gas bachelor’s degrees than any other minority racial/ethnic group: 3.7% of Asians (49,679) who earned a bachelor’s degree received it in an oil and natural gas field, compared to 2.2% of Hispanics (38,276), 2.2% of American Indians (3,044), and 1.4% of Blacks (27,832). 341,751 White students graduated with bachelor’s degrees in these fields, 2.5% of all White bachelor’s degree earners.

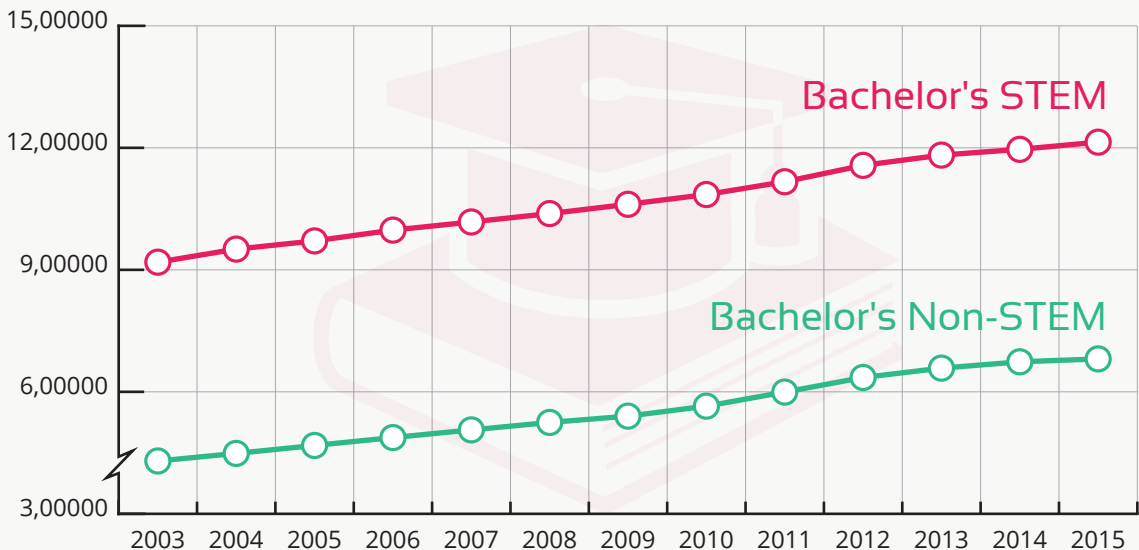
STEM Bachelor's Degrees

The number of overall bachelor's degrees and the number of STEM bachelor's degrees both increased substantially over the past decade. **With their increasing prevalence in share of degrees, STEM bachelor's degrees account for about 36% percent of all bachelor's degrees awarded annually.**

Disaggregating these trends by gender and race/ethnicity is critical to understanding the potential labor pool and evaluating gaps. In both absolute and relative numbers, women and racial/ethnic minorities are less likely to earn STEM degrees and to enter STEM employment. Without stronger support for these traditionally underrepresented groups, the STEM economy in general, and the oil and natural gas industry in particular, may fail to optimize the pool of potential workers required to sustain growth and innovation.

- Women earn more bachelor's degrees overall, but men and women earn about the same number of STEM bachelor's degrees. In 2015, 31% of all bachelor's degrees awarded to women were in STEM fields, compared to 42% for men – an 11 percentage point difference.
- Over time, minority groups are increasing their degree attainment. Total bachelor's degree attainment increased 40% from 2003-2015. Attainment by Hispanics increased by 145%, Blacks by 55%, and Asians by 47%, while Whites increased at 22%.
- However, the share of bachelor's degrees in STEM fields varies considerably by race/ethnicity. In 2015, 50% of all bachelor's degrees awarded to Asians were in STEM fields, 38% to Hispanics and 31% to Blacks. For Whites, 34% of degrees awarded were in STEM; for American Indians, 33% of degrees awarded were in STEM.

STEM BACHELOR'S DEGREE ATTAINMENT 2003-2015



STEM Associate's Degrees

The role of associate's degrees, occupational certifications and occupational licenses in the STEM economy is significant as a substantial number of jobs available to workers with sub-baccalaureate degrees require STEM skills and training. A recent report by the Brookings Institution refers to this sub-baccalaureate segment of the labor market as the "second STEM" or "hidden STEM" economy:

*"These workers today are less likely to be involved in invention, but they are critical to the implementation of new ideas and advise researchers on feasibility of design options, cost estimates, and other practical aspects of technological development."*³

In fact, Carnevale et al. (2013) shows that associate's degrees in STEM fields earn more on average than several groups of bachelor's degree majors.⁴ It is estimated that nearly half of all STEM jobs do not require a four-year degree and that a third of all STEM jobs are in blue collar occupations.⁵

The opportunities for employment in blue collar occupations in the oil and natural gas and petrochemical industries are tremendous – more than 1 million jobs through 2035, according to IHS. These jobs typically require a high school diploma and some on-the-job training. Postsecondary vocational training, such as associate's degrees or certificates, can increase the competitiveness of potential applicants for

- or retention in many of these positions.
- While the number of associate's degrees awarded increased by 60% over the past decade, the number of associate's degrees awarded in STEM fields only increased by 25%.
 - While men and women earned about the same number of STEM bachelor's degrees, men earn substantially more STEM associate's degrees than women: In 2015, men earned 88,422 STEM associates degrees while women earned 54,507.
 - The share of associate's degrees that are in STEM fields varies somewhat by race/ethnicity. Asians and Hispanics have the highest share of earned associate's degrees in STEM fields (22% and 16%, respectively), followed by American Indians (15%), Whites (13%), and Blacks (11%).
 - Possession of a certification/license is associated with improved employment outcomes. Those with a certification/license were more likely to be employed and when employed, earn higher wages when compared with those lacking a certification/license.
 - The benefits of holding a certification/license are strongest for those lacking a high school diploma, women and Hispanics. These findings suggest that earning a certification/license is a possible avenue for improving employment outcomes for these traditionally under-represented groups, particularly in STEM jobs.

- For all sub-baccalaureate levels of education, having a certificate or license approximately doubles the likelihood of being employed in an STEM occupation. This is a significant impact that may be related to the likelihood of STEM occupations to require licenses, especially at sub-baccalaureate levels.

Which major an individual chooses matters when transitioning into the oil and natural gas industry. STEM bachelor's degrees increase the likelihood of working in the oil and natural gas industry: STEM bachelor's graduates have a 5.0% likelihood of working in the oil and natural gas industry, almost double the rate of non-STEM bachelor's graduates (2.7%). Earning a degree in a field specific or related to oil and natural gas (many of which are STEM fields) increases the likelihood of working in the industry by three to seven times compared to all college graduates. The industry has a substantial need for these skill-sets, and is thus more likely to hire from graduates in STEM and oil and natural gas related majors.

Working in the Oil and Natural Gas Industry

3.2%

of all working-age population individuals are employed in the oil and natural gas industry.

EARNING A BACHELOR'S DEGREE IN A STEM FIELD ALMOST DOUBLES THE LIKELIHOOD OF WORKING IN THE OIL AND NATURAL GAS INDUSTRY, HIGHLIGHTING THE INDUSTRY'S NEED FOR STEM WORKERS.

HIGHLIGHTS

- Earning a degree in a STEM field or field related to the industry significantly increases the likelihood of working in the oil and natural gas industry.
- Oil and natural gas jobs pay significantly higher wages, true overall as well as across gender and race/ethnicity groups.
- While the wage gap between men and women is approximately the same in and out of the oil and natural gas industry, there is greater wage parity in the oil and natural gas industry among those with STEM bachelor's degrees and for those in STEM occupations.
 - *For example, men with STEM bachelor's degrees in the overall economy earn about \$7.42/hour more than women with STEM bachelor's degrees, compared to a gap of \$2.74/hour in the oil and natural gas industry.*

Understanding the pathways that are more likely to lead to working in the industry provides some direction on where to start addressing race and gender gaps in the workforce: **The rate at which women and minorities attain employment in the industry is related in part to their chosen field of study.** Over the 2003-2015 period, men outnumbered women nearly 4 to 1 in earning degrees specific or related to the industry, and Whites outnumbered minorities by nearly 3 to 1. In order to be able to fill the industry's workforce needs over the coming years, more women and minority students need to be recruited into STEM fields, particularly those fields that have direct applicability to high demand jobs in the oil and natural gas industry.

However, men are currently much more likely than women, and Whites continue to be much more likely than minorities, to be employed in the industry, regardless of degree attainment. In fact, for men, having a STEM degree increases the likelihood of working in oil and natural gas by 3.6 percentage points; for women there is an increase as well, but it is substantively negligible (0.9 percentage points).

Gender differences are stronger than race/ethnicity differences in oil and natural gas employment, with all race/ethnicity groups among men overall far outpacing the likelihood of any of the race/ethnicity groups among women to work in the industry.

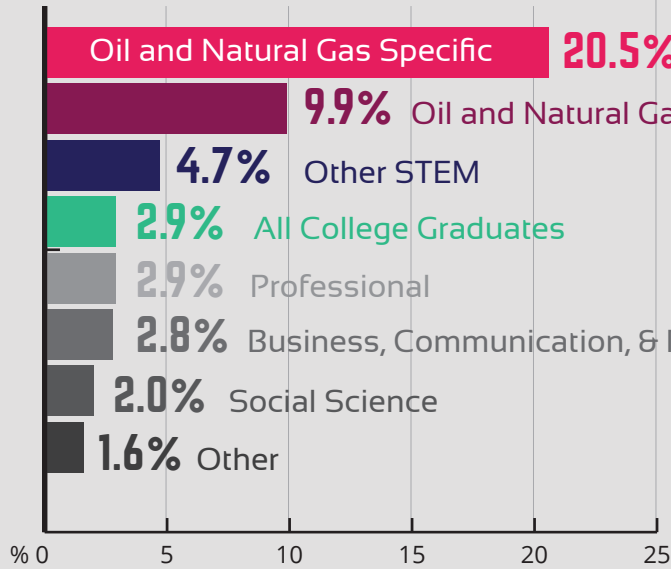
Though the differences among race/ethnicity groups are not as stark as gender differences, the gaps still persist.

EMPLOYMENT STATUS IN THE ONG INDUSTRY⁷

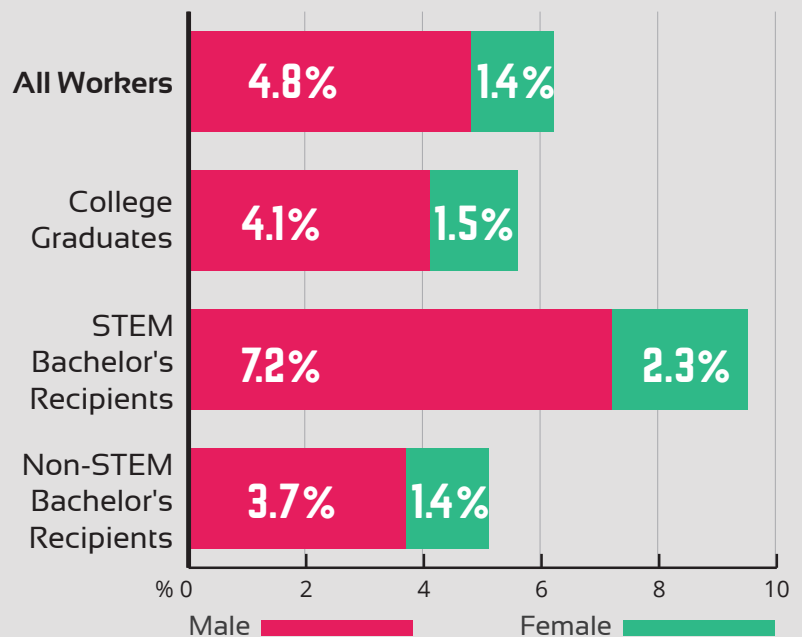
	Overall	Bachelor's Graduates	Type of Bachelor's Degree		Difference
			STEM	Non-STEM	
Employed in the ONG Industry					
Men	4.8%	4.1%	7.2%	3.7%	3.6***
Women	1.4%	1.5%	2.3%	1.4%	0.9***
White	3.6%	3.2%	5.5%	2.8%	2.6***
Black	2.2%	1.7%	3.1%	1.3%	1.5***
Hispanic	2.9%	3.2%	4.7%	3.1%	1.6***
Asian	2.4%	2.5%	3.7%	2.1%	1.6***
American Indian	2.2%	1.8%	3.7%	1.7%	2.0*
Total	3.2%	2.9%	5.0%	2.7%	2.3***

NOTE: *** p < 0.01, ** p < 0.05, * p < 0.10.

EMPLOYMENT IN OIL AND NATURAL GAS INDUSTRY, BY BACHELOR'S DEGREE MAJOR



OIL AND NATURAL GAS INDUSTRY EMPLOYMENT STATUS, BY GENDER



Almost without exception, across all education levels, degree majors, gender and race/ethnicity groups, and occupation types, those who work in the oil and natural gas industry earn more than those who do not.

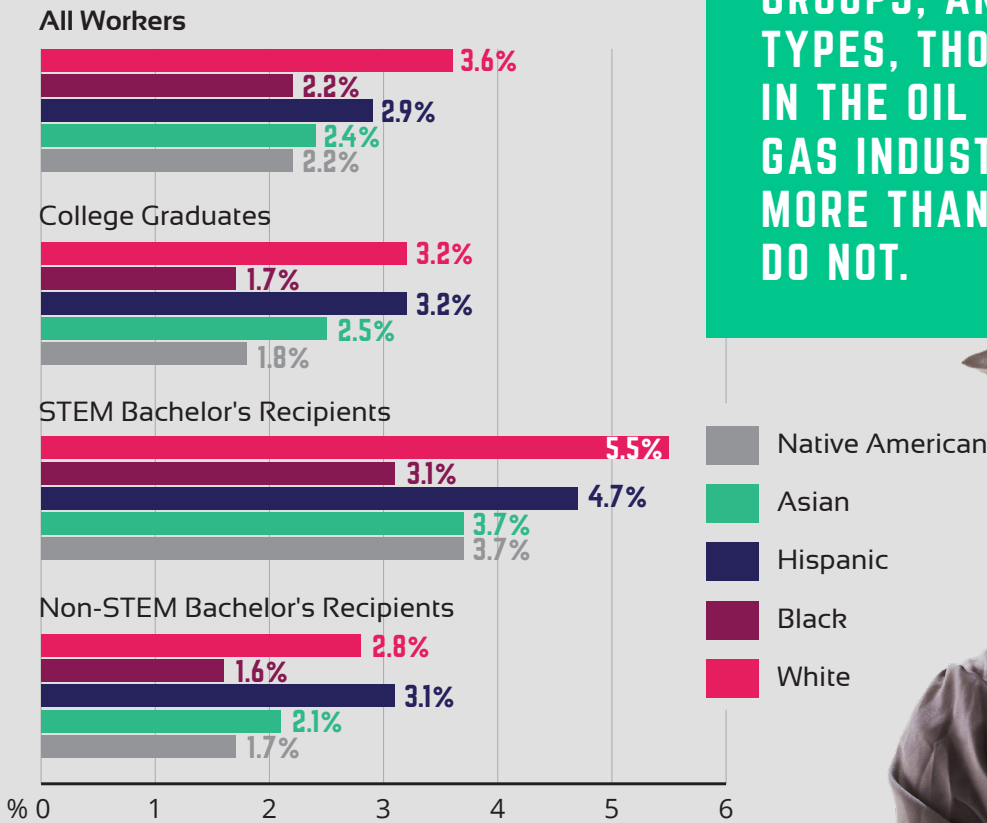
- Oil and natural gas STEM occupation workers have the highest average wages among all the different groups examined, and graduates with degrees in oil and natural gas majors earn the highest on average.

Oil and natural gas industry jobs pay significantly higher hourly wages, which is true overall as well as across gender and race/ethnicity groups. The average wage within the oil and natural gas industry is \$30.46/hour, compared to \$25.47/hour outside of the industry.

- While the wage gap between men and women is approximately the same in and out of the oil and natural gas industry, there is greater wage parity in the oil and natural gas industry among those with STEM bachelor's degrees and those in STEM occupations.
- For example, men with STEM bachelor's degrees in the overall economy earn about \$7.42/hour more than women with STEM bachelor's degrees, compared to a gap of \$2.74/hour in the oil and natural gas industry.

ALMOST WITHOUT EXCEPTION, ACROSS ALL EDUCATION LEVELS, DEGREE MAJORS, GENDER AND RACE/ETHNICITY GROUPS, AND OCCUPATION TYPES, THOSE WHO WORK IN THE OIL AND NATURAL GAS INDUSTRY EARN MORE THAN THOSE WHO DO NOT.

O&G INDUSTRY EMPLOYMENT STATUS, BY RACE



The Value of STEM

While having a STEM bachelor's degree strongly increases the likelihood of working in a STEM occupation, it may not necessarily lead to working in a STEM occupation. This is a consistent finding in the STEM research literature. Job choices are greatly influenced by many factors. For minorities in particular, individuals with good STEM credentials are aggressively recruited by many industries including those which may not be directly STEM related. **About 40.5% of STEM bachelor's graduates end up working in STEM occupations.** In addition, STEM bachelor's degrees strongly increase the likelihood of working in the oil and natural gas industry. The oil and natural gas industry has a need for these skill-sets, and is thus more likely to hire from STEM major graduates. There is a large increase in wages on average for having a STEM degree as well as for working in a STEM occupation. Both are highly rewarded in the economy. This is true for both men and women, and across all race/ethnicity groups.

GENDER DIFFERENCES

Only around 30% of women with STEM degrees work in STEM occupations, while around 50% of men do. In fact, men with non-STEM bachelor's degrees are slightly more likely to work in a STEM occupation than women with a STEM bachelor's degree.

This disparity is of concern both for reasons of efficiency and equality. There may be efficiency concerns if women are choosing not to work in STEM occupations for reasons unassociated with productivity or preferences (e.g., there are efficiency losses in the economy if women choose not to work in STEM occupations because of discomfort with a male-dominated occupation, a lack of role-models, or actual sexism in hiring practices). There may be equality concerns if those types of barriers effectively discourage women from higher paying jobs or industries.



RACE/ETHNICITY DIFFERENCES

The differences in STEM employment and STEM wages differ across race/ethnicities, with Blacks, Hispanics, and Native Americans not as likely to enter STEM employment. Minorities have lower transition rates from STEM degrees to STEM employment as well as lower wages, including within STEM occupations.

Though minorities receive a wage increase from working in STEM occupations, this does not close the race gap. Minorities are paid less than Whites on average in STEM occupations, a trend that persists even when a minority and a White individual have equal credentials, i.e., degrees. In many cases minorities in STEM occupations are paid less on average than White and Asian workers in non-STEM occupations, despite the wage premium for STEM work.

Gender differences for STEM occupations are stronger than race/ethnicity differences, although both persist. In fact, the race/ethnicity group among men that has the lowest rate of STEM graduates working in STEM occupations (Black male graduates, 37.8%) is higher than the percentage for all but one of the race/ethnicity groups among women (Asian female graduates, 46.0%).

Opportunities Ahead

Both the changing demographics of the country and the future workforce needs of the oil and natural gas industry demand that we pay attention to the challenges women and minority communities face in degree attainment, particularly in STEM fields, and to the employment and wage gaps that continue to persist. Research like this report provides the foundation for meaningful conversations about where we are, where we need to be, and how to get there.

The challenges highlighted in this report can help focus our attention and efforts as we work to build the workforce of the future and to develop the strategies necessary to address the gaps. It is a business imperative that we better understand our current and future workforce challenges, the training and education necessary to fill those jobs, and how to improve diversity and inclusion to attract and retain the best available talent.

It is also the right thing to do.

The STEM challenges and opportunities are real. Fortunately, the future is bright in this industry and the opportunities are tremendous. **With nearly 1.9 million employment opportunities available all across the country and at every education level and occupation category, America's oil and natural gas industry is well positioned to be a driving force for economic paths to the middle class for decades to come.**

EMPLOYMENT STATUS IN A STEM OCCUPATION⁸

	Overall	Bachelor's Graduates	Type of Bachelor's Degree		Difference
			STEM	Non-STEM	
Employed in a STEM Occupation					
Men	27.7%	33.1%	49.1%	30.7%	18.4***
Women	14.9%	24.3%	29.7%	23.7%	6.0***
White	23.9%	30.1%	41.3%	38.4%	12.9***
Black	13.3%	24.4%	30.9%	23.9%	7.1***
Hispanic	14.9%	24.9%	34.7%	24.3%	10.4***
Asian	32.9%	44.5%	55.2%	40.0%	15.2***
American Indian	15.8%	20.8%	34.3%	20.1%	14.3***
Total	21.6%	29.4%	40.5%	27.9%	12.6***

HOURLY WAGES⁹

	Overall	Type of Occupation		Difference
		STEM	Non-STEM	
Men	\$28.42	\$33.18	\$26.35	\$6.83***
Women	\$22.56	\$31.10	\$20.73	\$10.37***
White	\$27.97	\$33.86	\$25.80	8.06***
Black	\$20.31	\$26.97	\$19.08	7.89***
Hispanic	\$18.88	\$24.22	\$17.79	6.42***
Asian	\$32.06	\$40.91	\$26.74	14.17***
American Indian	\$19.57	\$24.43	\$18.46	5.98***
Total	\$25.67	\$31.98	\$23.63	\$8.36***

NOTE: *** p < 0.01, ** p < 0.05, * p < 0.10.



References

1. This research was commissioned by the American Petroleum Institute (API) and undertaken jointly by RAND Labor and Population and RAND Education. Both units at RAND have built an international reputation for conducting objective, high-quality, empirical research to support and improve policies and organizations around the world. This research is part of RAND Labor and Population and RAND Education's collaborative efforts to promote workforce development at home and abroad by conducting cutting edge research that helps public and private sector decision makers understand how to keep workers productive, knowledgeable, and engaged. API is the only national trade association that represents all segments of America's innovation-driven oil and natural gas industry. Its more than 625 members — including large integrated companies, exploration and production, refining, marketing, pipeline, marine shipping and support businesses, and service and supply firms — provide most of the nation's energy and are backed by a growing grassroots movement of more than 43 million Americans. Industry also supports 10.3 million U.S. jobs and 7.6 percent of the U.S. economy, delivers \$85 billion a day in revenue to our government and, since 2000, has invested more than \$3 trillion in U.S. capital projects to advance all forms of energy.
2. IHS, "Minority and Female Employment in the Oil and Natural Gas and Petrochemical Industries, 2015-2035," March 2016
3. Rothwell (2013). "The Hidden STEM Economy." The Brookings Institute.
4. Carnevale, A. P., Rose, S. J., & Cheah, B. (2013). "College payoff: Education, occupations, lifetime earnings." Georgetown University Center on Education and the Workforce.
5. Rothwell (2013). "The Hidden STEM Economy." The Brookings Institute.
6. All estimates are produced using regression procedures that control for gender, race/ethnicity, age, marital status, the presence of dependents, and county of residence. The methodology for these regressions is found in Appendix C of the full report.
7. Authors' analysis of ACS data. Results are weighted so that the estimates generalize to all noninstitutionalized individuals aged 18–65 in the United States in 2015 who were not currently in school. All estimates are regression-adjusted to eliminate the potential confounding effects of gender, race/ethnicity, age, marital status, the presence of dependents, and county of residence.
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**“...EVERY PLACE WE GO,
EVERY PLACE WE LOOK,
ENERGY IS
THE FOUNDATION
THAT UNDERPINS ALL OF WHAT WE DO...”**

JACK N. GERARD,
President and CEO, API

