

Evidence That There is a Significant STEM Workforce Shortage

A Panel Presentation to the
**Armed Forces Communications &
Electronics Association (AFCEA)
Critical Issues Symposium 2014**

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The Alliance for Science & Technology Research in America

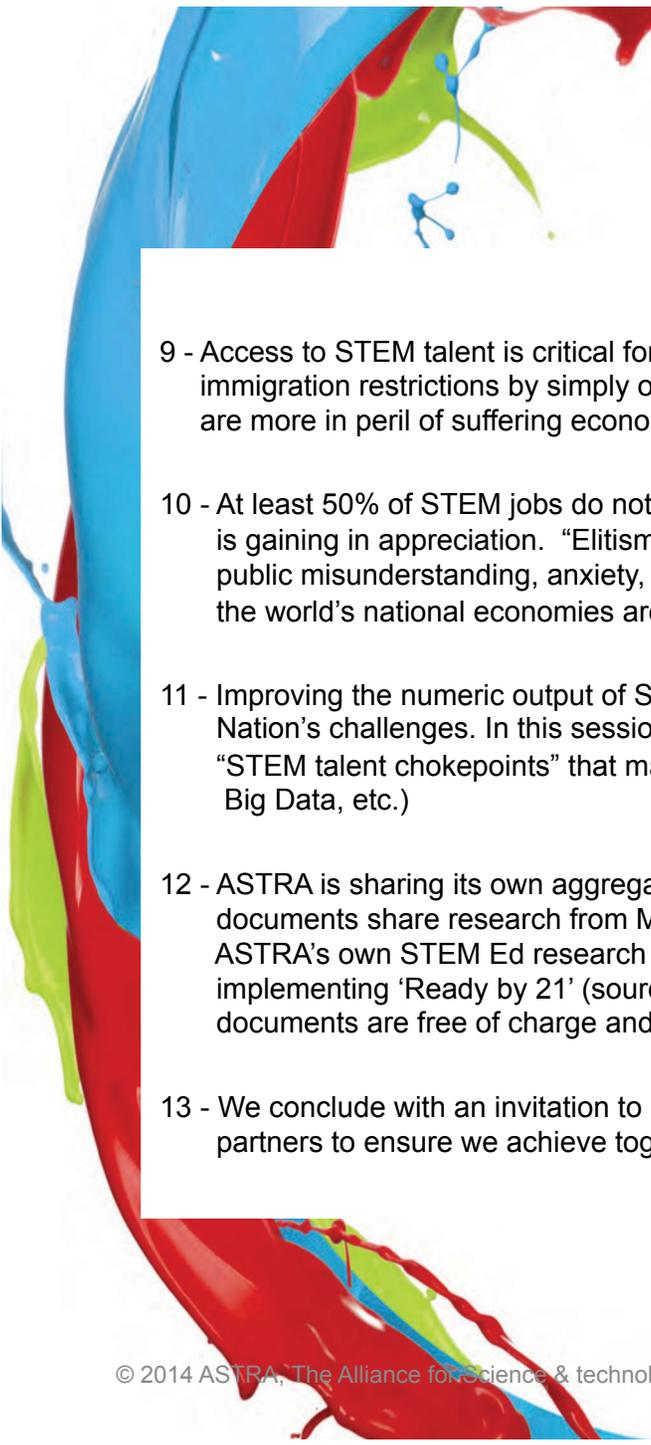


Abstract

The evidentiary basis establishing a shortage of U.S. STEM workers is problematic. It's marred by lack of agreement over the definition of what "STEM" means in terms of the job market. Flawed data availability makes statistical analysis of the STEM ecosystem and art, not a science.

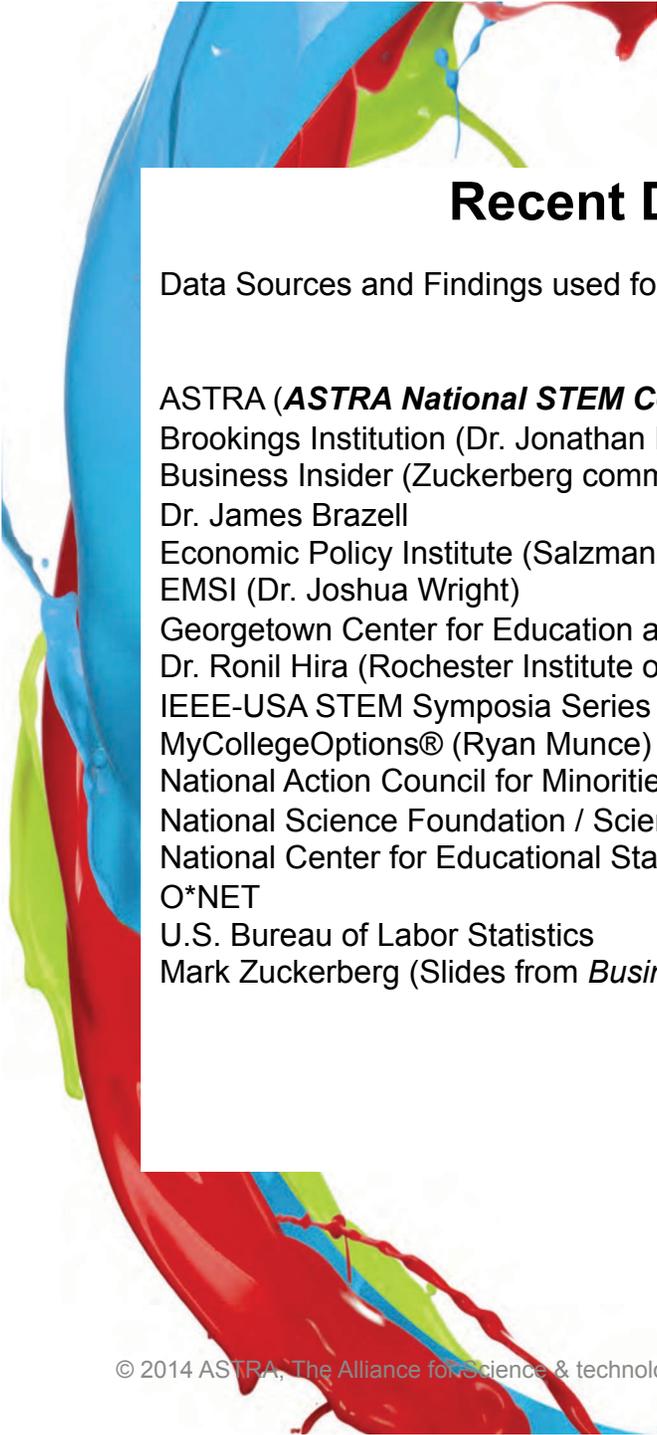
Key points from ASTRA Research:

- 1 - There's not a monolithic "STEM Talent or STEM Job Market". Supply & Demand for STEM talent fluctuates. Unemployment rates also fluctuate throughout STEM and STEM-related professions.
- 2 - The actual number of STEM and STEM-related jobs is vastly understated (e.g. BLS = 8 million +, ASTRA = 15 million + Brookings = 26 million +).
- 3 - There's evidence of worker shortages in Computer Sciences & Mathematics areas, not so in Architecture and Engineering, Life Sciences or Social Sciences.
- 4 - What matters to most communities, employers and individuals is local supply and demand for STEM and STEM-related talent — the STEM "community" needs to include (communicate with) more individuals who are affected by STEM policy...
- 5 - At least 20% of all U.S. jobs require high levels of knowledge in at least one STEM field.
- 6 - Place matters — STEM workforce issues are most relevant when dealing with local labor market needs.
- 7 - Discussion about "shortages" is distracting. Policy makers need to focus upon fixing STEM curriculum and skills acquisition, STEM teacher training, and taking advantage of the EdTech Revolution that is transforming education generally and making education more accessible and responsive to the career needs of students, workers and employers alike.
- 8 - The U.S. is squandering its status as the global center of STEM education and may regret not taking advantage of the world's best minds by restricting access to U.S. employment for foreign STEM workers — the role of foreign-born STEM talent in creating America's new economy and their ROI to the U.S. are vastly unappreciated by the general public and policy makers (In Silicon Valley, 50%-plus of new U.S. STEM-related companies are created by foreign-born U.S.-based individuals).



Abstract

- 9 - Access to STEM talent is critical for maintaining U.S. innovation capacity. U.S.-based Industry is responding to STEM immigration restrictions by simply off-shoring operations, or re-locating completely. Small and medium-sized companies are more in peril of suffering economic damage than larger ones due to short-sighted policies.
- 10 - At least 50% of STEM jobs do not require a 4-year degree and the role of 2-year and high school vocational programs is gaining in appreciation. “Elitism” and failure to understand the role STEM plays throughout the economy leads to public misunderstanding, anxiety, and / or fear of STEM education and innovation at the exact time when a vast part of the world’s national economies are catching up with the U.S. model for economic success.
- 11 - Improving the numeric output of STEM degrees in specific disciplines from our education system remains one of the Nation’s challenges. In this session we explore the problem itself, and discuss evidence-based facts that point to future “STEM talent chokepoints” that may impede U.S. economic growth (Manufacturing, Energy, Cyber Security, Apps Jobs, Big Data, etc.)
- 12 - ASTRA is sharing its own aggregated research through **STEM Report Cards** for each State and D.C. These documents share research from MyCollegeOptions®, the National Action Council on Minorities in Education (NACME), ASTRA’s own STEM Ed research including its **EdTech Revolution in Education 2013 Report** with implications for implementing ‘Ready by 21’ (source: National Collaboration for Youth) strategies to shape the Future. These documents are free of charge and can be accessed at store.usinnovation.org
- 13 - We conclude with an invitation to participants to join ASTRA’s Global Community of STEM Innovation Practice as partners to ensure we achieve together what no one organization can do alone.



Recent Data Sources & Findings of Note

Data Sources and Findings used for this presentation:

ASTRA (**ASTRA National STEM Census 2014** (summarized), **ASTRA State STEM Report Cards** Series)

Brookings Institution (Dr. Jonathan Rothwell, **The Hidden STEM Economy**)

Business Insider (Zuckerberg comments)

Dr. James Brazell

Economic Policy Institute (Salzman, Kuehn, Lowell)

EMSI (Dr. Joshua Wright)

Georgetown Center for Education and Workforce (Dr. Anthony Carnevale *et al*)

Dr. Ronil Hira (Rochester Institute of Technology, IEEE-USA)

IEEE-USA STEM Symposia Series (STEM Metrics)

MyCollegeOptions® (Ryan Munce)

National Action Council for Minorities in Engineering, Inc. (NACME)

National Science Foundation / Science & Engineering Indicators 2014 (SEIND)

National Center for Educational Statistics (NCES) (STEM Analysis)

O*NET

U.S. Bureau of Labor Statistics

Mark Zuckerberg (Slides from *Business Insider*)

STEM Jobs Conundrum:

- How many jobs?
- How to define?
- STEM versus “STEM-Related”
- Flawed public data

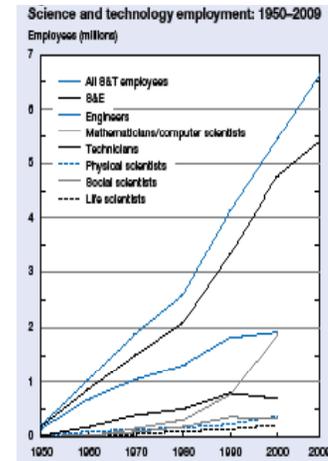
STEM Jobs Overview

STEM JOBS by Sector: Where will the STEM Jobs be in 2018?

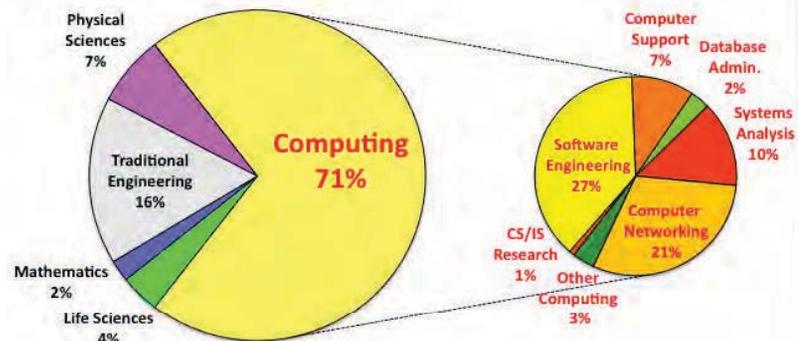
The overall U.S. Science & Technology (S&T) Workforce exceeded **7.4 million workers** in 2012 and it will continue to grow significantly through 2018, to an estimated **8,654,000** STEM workers.

Science & Engineering Occupations are projected to **grow at more than double the rate (20.6%)** of the overall U.S. labor force (10.1%) through 2018. These projections do not include occupations for which STEM degree holders use their STEM skills but are not considered by the Bureau of Labor Statistics to be “Strictly defined” STEM occupations. The total also includes individuals with STEM degrees as well as **more than 1 million** individuals with technical expertise and skills-specific training that may not have formal STEM degrees (see **Top 97 STEM-Related jobs** section below).

By 2018, the bulk of STEM jobs will be in **Computing (71%)** followed by **Traditional Engineering (16%)**, **Physical Sciences (7%)**, **Life Sciences (4%)** and **Mathematics (2%)**. The breakdown of Computing Jobs is shown in the second schematic below:



Percentage of New STEM Jobs by Sector Through 2018



Data Source: US-BLS Employment Projections, 2008-2018 (http://www.bls.gov/emp/ep_table_102.pdf).



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STEM Jobs by State:

- Severe undercounting
- Is educational system producing sufficient STEM talent?

STEM Jobs by State

Where will the STEM Jobs be in 2018 by State?



STEM Jobs will continue to expand as the U.S. economy recovers from the Great Recession. The U.S. Bureau of Labor Statistics estimates that at least **8,654,000 U.S. STEM jobs will exist in 2018**. It has projected the estimated number of STEM jobs by State. At issue is whether or not the U.S. educational system can produce sufficient new workers to fill such jobs, and if not, what employers can do to find suitable talent.

Projected STEM Jobs Need by State in 2018 and Ranking by Total Number of Jobs		
STATE RANK 2018	STATE	PROJECTED 2018 STEM JOBS
23	Alabama	110,000
47	Alaska	20,000
18	Arizona	166,000
36	Arkansas	52,000
1	California	1,148,000
14	Colorado	232,000
22	Connecticut	116,000
41	Delaware	31,000
27	District of Columbia	94,000
4	Florida	411,000
16	Georgia	211,000
42	Hawaii	29,000
40	Idaho	41,000
6	Illinois	348,000
21	Indiana	123,000
32	Iowa	72,000
30	Kansas	80,000
31	Kentucky	74,000
33	Louisiana	69,000
44	Maine	25,000
13	Maryland	241,000
9	Massachusetts	300,000
10	Michigan	274,000
17	Minnesota	188,000
38	Mississippi	46,000
20	Missouri	143,000

Projected STEM Jobs Need by State in 2018 and Ranking by Total Number of Jobs		
STATE RANK 2018	STATE	PROJECTED 2018 STEM JOBS
44	Montana	25,000
37	Nebraska	48,000
34	Nevada	54,000
39	New Hampshire	43,000
12	New Jersey	269,000
35	New Mexico	53,000
3	New York	477,000
15	North Carolina	229,000
51	North Dakota	15,000
11	Ohio	274,000
29	Oklahoma	81,000
24	Oregon	109,000
7	Pennsylvania	314,000
43	Rhode Island	26,000
28	South Carolina	85,000
49	South Dakota	18,000
24	Tennessee	109,000
2	Texas	758,000
26	Utah	101,000
48	Vermont	19,000
5	Virginia	404,000
8	Washington	303,000
44	West Virginia	25,000
19	Wisconsin	155,000
50	Wyoming	16,000
TOTAL STEM JOBS		8,654,000

Source: U.S. Bureau of Labor Statistics, 2011

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ASTRA's STEM Jobs Census by Occupation 2014:

- At least 15 million STEM and STEM-related jobs
- Largest STEM-related jobs surprise the “STEM Establishment”
- SOC breakdown belies key myths
- STEM and STEM-related jobs are everywhere

ASTRA's
STEM Jobs
Census by
Occupation 2014

What are the STEM & STEM-Related Jobs by Occupation in 2014?



SOC*	STEM or STEM-Related Job Description	2014 Jobs
13-2011	Accountants and Auditors	1,683,255
11-9199	Managers, All Other	1,681,417
25-1099	Postsecondary Teachers	1,473,473
13-1199	Business Operations Specialists, All Other	1,015,981
35-1012	First-Line Supervisors of Food Preparation and Serving Workers	939,613
49-3023	Automotive Service Technicians and Mechanics	806,563
35-2012	Cooks, Institution and Cafeteria	460,876
27-1024	Graphic Designers	418,474
11-9021	Construction Managers	469,314
11-3021	Computer and Information Systems Managers	356,688
19-3031	Clinical, Counseling, and School Psychologists	345,044
17-2051	Civil Engineers	306,325
13-1041	Compliance Officers	254,420
17-2141	Mechanical Engineers	266,738
13-2099	Financial Specialists, All Other	239,305
13-1051	Cost Estimators	224,995
17-2112	Industrial Engineers	224,600
11-9041	Architectural and Engineering Managers	198,838
11-3051	Industrial Production Managers	174,337
17-2071	Electrical Engineers	171,319
17-2199	Engineers, All Other	167,747
17-1011	Architects, Except Landscape and Naval	161,750
17-3023	Electrical and Electronics Engineering Technicians	150,678
17-2072	Electronics Engineers, Except Computer	141,902
49-3011	Aircraft Mechanics and Service Technicians	128,757
19-1042	Medical Scientists, Except Epidemiologists	104,578
19-2041	Environmental Scientists and Specialists, Including Health	96,154
29-1031	Dietitians and Nutritionists	90,707
51-3092	Food Batchmakers	101,584
17-3011	Architectural and Civil Drafters	102,771
17-2061	Computer Hardware Engineers	86,767
19-2031	Chemists	87,465
17-2011	Aerospace Engineers	83,409

SOC*	STEM or STEM-Related Job Description	2014 Jobs
15-2031	Operations Research Analysts	77,224
45-3011	Fishers and Related Fishing Workers	86,373
19-4021	Biological Technicians	75,813
17-3022	Civil Engineering Technicians	74,830
17-3029	Engineering Technicians, Except Drafters, All Other	70,678
17-3026	Industrial Engineering Technicians	69,088
19-4099	Life, Physical, and Social Science Technicians, All Other	63,511
19-4031	Chemical Technicians	62,915
19-3039	Psychologists, All Other	59,679
17-2081	Environmental Engineers	54,054
17-1022	Surveyors	50,058
51-9011	Chemical Equipment Operators and Tenders	55,986
51-2023	Electromechanical Equipment Assemblers	50,756
11-9121	Natural Sciences Managers	50,931
19-2042	Geoscientists, Except Hydrologists and Geographers	62,772
17-2171	Petroleum Engineers	43,234
17-3027	Mechanical Engineering Technicians	48,817
19-4091	Environmental Science and Protection Technicians, Including Health	35,836
19-3099	Social Scientists and Related Workers, All Other	36,711
45-4022	Logging Equipment Operators	46,587
51-8091	Chemical Plant and System Operators	38,412
19-1021	Biochemists and Biophysicists	29,999
17-2041	Chemical Engineers	33,397
19-1029	Biological Scientists, All Other	33,831
19-4093	Forest and Conservation Technicians	34,616
15-2041	Statisticians	28,055
17-2031	Biomedical Engineers	22,426
19-1031	Conservation Scientists	28,115
17-2161	Nuclear Engineers	27,010
29-2051	Dietetic Technicians	26,233
53-6051	Transportation Inspectors	26,235
15-2011	Actuaries	23,150

SOC*	STEM or STEM-Related Job Description	2014 Jobs
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	24,495
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	24,618
17-2131	Materials Engineers	23,395
17-3025	Environmental Engineering Technicians	20,400
29-2033	Nuclear Medicine Technologists	21,355
19-1022	Microbiologists	20,456
19-1023	Zoologists and Wildlife Biologists	21,026
19-4011	Agricultural and Food Science Technicians	21,071
19-1013	Soil and Plant Scientists	19,338
19-2012	Physicists	19,223
19-1012	Food Scientists and Technologists	17,292
45-4011	Forest and Conservation Workers	16,374
25-9021	Farm and Home Management Advisors	15,180
43-9111	Statistical Assistants	15,502
19-2021	Atmospheric and Space Scientists	10,988
19-1032	Foresters	11,364
17-3021	Aerospace Engineering and Operations Technicians	10,124
19-4051	Nuclear Technicians	8,505
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	8,535
19-2043	Hydrologists	8,169
17-2121	Marine Engineers and Naval Architects	8,014
19-2032	Materials Scientists	8,100
45-4021	Fallers	10,348
33-3031	Fish and Game Wardens	6,651
19-1041	Epidemiologists	5,429
19-3032	Industrial-Organizational Psychologists	5,534
15-2021	Mathematicians	4,151
45-2021	Animal Breeders	4,155
45-4023	Log Graders and Scalers	3,721
17-2021	Agricultural Engineers	2,892
19-2011	Astronomers	2,563
15-2091	Mathematical Technicians	1,449
Total (including unlisted categories) =		15,143,595

*SOC = Standard Occupational Classification

Source: ASTRA Global STEM & Innovation Data Project and EMSI occupation employment data are based on final EMSI industry data and final EMSI staffing patterns 2011/14



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STEM Wages:

- \$28.48 per hour average
- Suggests the “Pipeline” is more complex in types and locations for talent development — e.g. community colleges, on-job training, and apprenticeships

Highest
Paying STEM
Jobs — 2014

What are the 70 Highest Paying STEM & STEM-Related Jobs in 2014?



Rank	SOC	Description	# 2014 Jobs	Median Hourly Earnings
1	17-2171	Petroleum Engineers	43,234	\$63.59
2	11-9041	Architectural and Engineering Managers	198,838	\$59.55
3	11-3021	Computer and Information Systems Managers	356,688	\$55.91
4	11-9121	Natural Sciences Managers	50,931	\$55.64
5	19-2012	Physicists	19,223	\$51.37
6	17-2011	Aerospace Engineers	83,409	\$49.87
7	15-2021	Mathematicians	4,151	\$48.73
8	17-2061	Computer Hardware Engineers	86,767	\$47.64
9	17-2161	Nuclear Engineers	27,010	\$46.53
10	19-2011	Astronomers	2,563	\$46.37
11	17-2041	Chemical Engineers	33,397	\$45.36
12	15-2011	Actuaries	23,150	\$45.04
13	19-2042	Geoscientists, Except Hydrologists and Geographers	62,772	\$44.59
14	17-2072	Electronics Engineers, Except Computer	141,902	\$44.07
15	19-2021	Atmospheric and Space Scientists	10,988	\$42.91
16	19-2032	Materials Scientists	8,100	\$42.81
17	19-3032	Industrial-Organizational Psychologists	5,534	\$42.39
18	17-2121	Marine Engineers and Naval Architects	8,014	\$42.36
19	17-2071	Electrical Engineers	171,319	\$42.15
20	11-3051	Industrial Production Managers	174,337	\$42.00
21	17-2031	Biomedical Engineers	22,426	\$41.81
22	17-2131	Materials Engineers	23,395	\$40.94
23	17-2199	Engineers, All Other	167,747	\$40.66
24	17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	8,535	\$40.39
25	19-1021	Biochemists and Biophysicists	29,999	\$39.07
26	17-2081	Environmental Engineers	54,054	\$38.89
27	17-2141	Mechanical Engineers	266,738	\$38.59
28	19-3039	Psychologists, All Other	59,679	\$38.48
29	17-2112	Industrial Engineers	224,600	\$37.95
30	19-1042	Medical Scientists, Except Epidemiologists	104,578	\$37.22
31	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	24,618	\$36.97
32	17-2051	Civil Engineers	306,325	\$36.75
33	19-3099	Social Scientists and Related Workers, All Other	36,711	\$36.65
34	15-2041	Statisticians	28,055	\$36.33
35	19-2043	Hydrologists	8,169	\$36.24
36	17-2021	Agricultural Engineers	2,892	\$35.58

Rank	SOC	Description	# 2014 Jobs	Median Hourly Earnings
37	19-1029	Biological Scientists, All Other	33,831	\$34.86
38	15-2031	Operations Research Analysts	77,224	\$34.58
39	19-2031	Chemists	87,465	\$34.52
40	29-2033	Nuclear Medicine Technologists	21,355	\$33.98
41	19-4051	Nuclear Technicians	8,505	\$33.23
42	19-1022	Microbiologists	20,456	\$31.79
43	19-3031	Clinical, Counseling, and School Psychologists	345,044	\$31.64
44	19-1041	Epidemiologists	5,429	\$31.51
45	13-1199	Business Operations Specialists, All Other	1,015,981	\$31.24
46	25-1099	Postsecondary Teachers	1,473,473	\$30.98
47	53-6051	Transportation Inspectors	26,235	\$30.62
48	19-2041	Environmental Scientists and Specialists, Including Health	96,154	\$30.54
49	13-1041	Compliance Officers	254,420	\$29.95
50	17-3021	Aerospace Engineering and Operations Technicians	10,124	\$29.60
51	17-1011	Architects, Except Landscape and Naval	161,750	\$29.31
52	13-2011	Accountants and Auditors	1,683,255	\$29.16
53	17-3029	Engineering Technicians, Except Drafters, All Other	70,678	\$28.70
54	17-3023	Electrical and Electronics Engineering Technicians	150,678	\$27.84
55	29-1031	Dietitians and Nutritionists	90,707	\$27.75
56	13-1051	Cost Estimators	224,995	\$27.56
57	19-1023	Zoologists and Wildlife Biologists	21,026	\$27.56
58	15-2091	Mathematical Technicians	1,449	\$27.32
59	19-1012	Food Scientists and Technologists	17,292	\$27.07
60	11-9021	Construction Managers	469,314	\$26.75
61	17-1022	Surveyors	50,058	\$26.75
62	19-1031	Conservation Scientists	28,115	\$26.39
63	49-3011	Aircraft Mechanics and Service Technicians	128,757	\$26.24
64	51-8091	Chemical Plant and System Operators	38,412	\$26.15
65	19-1013	Soil and Plant Scientists	19,338	\$26.13
66	19-1032	Foresters	11,364	\$26.05
67	13-2099	Financial Specialists, All Other	239,305	\$25.15
68	17-3027	Mechanical Engineering Technicians	48,817	\$25.04
69	17-3026	Industrial Engineering Technicians	69,088	\$24.56
70	11-9199	Managers in STEM and STEM-related Occupations, All Other	1,681,417	\$23.47
Total U.S. STEM & STEM-Related Jobs			15,143,595	\$28.48



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Official STEM Job Projections by Type & Sector

- Archaic taxonomy
- Skills focus is important

STEM Jobs by Type & Sector 2018

STEM Job Projections by Type & Sector for 2018

The economy of 2018 will be propelled by STEM Knowledge. STEM Knowledge includes: **Production and Processing, Computers and Electronics, Engineering and Technology, Design, Building and Construction and Mechanical** know-how. Key trends for 2018 will see the continuing explosion of jobs in **Cybersecurity and Big Data (Cloud Computing)**. While there is strong emphasis on elite STEM workers with advanced degrees, **more than one-third** of STEM jobs in 2018 will be held by workers with less than a Bachelor's degree. Our Career and Technical Education systems will be hard pressed to fill the STEM pipeline.

Bureau of Labor Statistics Projections of Employment & Job Openings in S&E and Other Selected Occupations 2008 - 2018 (thousands)

Occupation		BLS National Employment Matrix 2008 Estimate	BLS Projected 2018 Employment	Job Openings from Growth & Net Replacements 2008 - 2018	10-year Growth in Total Employment (%)	10-year Job Openings % of 2008 Employment
STEM Jobs	All Occupations	150,932	166,266	50,929	10.1%	33.7%
	All S&E Occupations	5,571	6,717	2,321	20.6%	41.7%
	Computer / Mathematical Scientists	3,101	3,895	1,353	25.6%	43.6%
	Life Scientists	279	354	144	26.7%	51.4%
	Physical Scientists	278	317	123	16.1%	44.6%
	Social Scientists	343	400	170	16.5%	49.4%
	Engineers	1,572	1,750	531	11.3%	33.8%
	S&E-related Occupations					
	S&E Managers	522	589	186	13.0%	31.8%
	S&E Technicians	855	925	298	8.2%	34.9%
	Computer Programmers	427	414	80	-2.9%	18.8%
	Healthcare Practitioners & Technicians	7,491	9,091	3,139	21.4%	41.9%
	Selected Other Occupations					
	Non-STEM	Postsecondary Teachers	1,699	950	553	15.1%
Lawyers		759	858	240	13.0%	31.7%

Source: Occupational Employment Statistics (OES) employment data do not cover employment in agriculture, private household, or among self-employed individuals and therefore do not represent total U.S. employment. Source: BLS, Office of Occupational Statistics and Employment Projections, special tabulations (2011) of 2008 - 18 National Industry Occupational Employment Projections.

Employers Seek Hot Tech Skills that are In-Demand

Many employers seek employees with technical skills that can easily be used from one task to another — or from one industry to another. Hot Tech Skills that can bolster hiring chances include:

1. **Social Media** (Facebook, Twitter, Google+, LinkedIn, YouTube, Flickr, Digg, Prezi)
2. **Video** (WebEx, Skype, GoToMeeting, videoconferencing, video chat)
3. **Software Programs** (Demonstrating the ability to learn software proves one's ability to learn new technologies and new systems — highly desirable to employers)
4. **HTML** (familiarity with HTML enables employees to do simple trouble-shooting and computer tasks)
5. **SEO** (Search Engine Optimization — useful for web designers and marketers)

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Locality Matters:

- Links directly with growing income disparity
- STEM “Haves and Have Not’s” may skew policy perceptions

STEM Clusters

Hottest STEM Job Markets Today

STEM skills propel economic growth, innovation and a competitive economy. The linkages between a robust innovation “ecosystem” and an available STEM talent pool are evident from this snapshot of the top U.S. Metropolitan areas for STEM workers in S&E occupations. Stem Jobs build America’s future. Many of the STEM Clusters listed have important academic and research and development (R&D) infrastructures, significant entrepreneurial activities and robust small business communities associated with their recent growth.



Metropolitan Areas with Largest Proportion of Workers in STEM Occupations, by Occupation Category, May 2010

Metropolitan Area	Percentage of workforce			Workers Employed (1)	
	S&E Occupations	STEM Occupations	All Occupations	S&E Occupations	STEM Occupations
U.S. Total	4.4	5.8	127,097,1609	5,549,980	7,427,360
San Jose-Sunnyvale-Santa Clara, CA	15.4	19.2	857,160	131,890	164,640
Huntsville, AL	13.7	17.5	202,410	27,780	35,500
Boulder, CO	13.6	15.9	152,100	20,640	24,220
Corvallis, OR	12.4	17.4	32,770	4,050	5,700
Durham, NC	11.8	15.1	266,990	31,590	40,260
Framingham, MA NECTA* Division	11.4	14.8	154,760	17,710	22,960
Lowell-Billerica-Chelmsford, MA-NH NECTA Division	11.1	14.7	113,630	12,630	16,660
Washington-Arlington-Alexandria, DC-VA-MD-WV, Metropolitan Division	10.0	12.7	2,289,200	243,350	291,730
Bethesda-Frederick-Gaithersburg, MD Metropolitan Division	9.9	12.5	551,550	54,820	68,860
Seattle-Bellevue-Everett, WA Metropolitan Division	9.7	12.3	1,346,300	131,130	164,980
Kennewick-Pasco-Richland, WA	9.2	12.6	96,390	8,830	12,100
Bloomington-Normal, IL	8.8	11.4	85,760	7,570	9,750
College Station-Bryan, TX	8.8	11.1	92,510	8,110	10,230
Palm Bay-Melbourne-Titusville, FL	8.6	11.3	189,730	16,400	21,480
Boston-Cambridge-Quincy, MA NECTA Division	8.4	10.7	1,658,000	139,620	177,930
Olympia, WA	8.4	10.3	93,910	7,870	9,640
Kokomo, IN	8.4	10.9	37,790	3,160	4,120
Fort Collins-Loveland, CO	8.0	10.0	125,100	10,070	12,500
Austin-Round Rock, TX	8.0	10.4	759,910	60,600	79,210
Colorado Springs, CO	7.9	9.5	240,000	19,050	22,700

NECTA* = New England City and Town Area.

(1) Excludes metropolitan statistical areas where S&E proportions were suppressed. Larger metropolitan areas broken into component metropolitan divisions, such as Washington, D.C. Difference among employment estimates may not be statistically significant. Occupational Employment Statistics (OES) employment data do not cover employment in agriculture, private household, or among self-employed individuals and therefore do not represent total U.S. employment

Source: BLS, Occupational Employment Statistics Survey (May 2010).



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Diversity & Equity Vitally Important to U.S. Future:

- Gender Gap
- Ethnic disparities

STEM Jobs Diversity

Diversity Within the STEM Jobs Market is Increasing

Diversity within the STEM Jobs markets **continues to increase** as the U.S. becomes a more diverse nation. Women were historically very underrepresented in STEM jobs, but since the 1990's **the number of women in each STEM occupational area has risen**. Growth has been strongest in the biological and related sciences, and the **rate of growth for women outstrips that of men** in most STEM occupations. There were 230,000 more female Computer and Mathematical scientists in the STEM workforce in 2008 than there were in 1993, making this sector the largest area of women's career growth. But because the rate of growth in this area is extensive, women's share of this occupation has been **declining, from 31% to 26%** between 1993 and 2008. Women in **Engineering have increased from 9% to 13%** and in the **Physical Sciences from 21% to 30%**.

Percent of Workers in S&E Occupation by Race / Ethnicity and Year: 1993 - 2008

Race / Ethnicity		1993	1995	1997	1999	2003	2006	2008
STEM Jobs	Asian	9.1	9.6	10.4	11.0	14.2	16.1	16.9
	American Indian / Alaska Native	0.2	0.3	0.3	0.3	0.3	0.4	0.3
	Black	3.6	3.4	3.4	3.4	4.3	3.9	3.9
	White	84.1	83.9	82.9	81.8	75.2	73.2	71.8
	Native Hawaiian / Other Pacific Islander	NA	NA	NA	NA	0.3	0.5	0.4
	Two or More Races	NA	NA	NA	NA	1.4	1.4	1.7

NA = not available

Before 2003, respondents could not classify themselves in more than one racial / ethnic category. Before 2003, "Asian" included Native Hawaiians and other Pacific Islanders. *Source:* National Science Foundation, National Center for Science & Engineering Statistics, Scientists and Engineers Statistical Data System (SESTAT) (1993 - 2008), <http://sestat.nsf.gov>

Age Distribution of Workers in S&E Occupations, by Gender and Race / Ethnicity and year: 2008 (Percent)

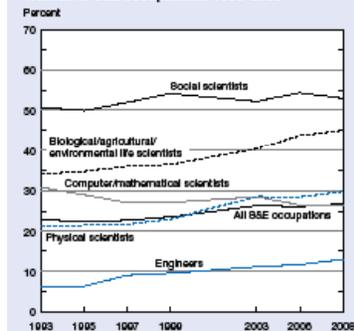
Gender and Race / Ethnicity		< 30 years	30 - 50 years	> 50 years
Gender	All Occupations	14.1	59.3	26.7
	Male	12.9	58.6	28.4
	Female	17.2	61.0	21.9
Race / Ethnicity	Asian	17.8	67.7	14.5
	American Indian / Alaska Native	8.7	70.5	20.8
	Black	12.5	65.8	21.8
	White	12.6	56.6	30.8
	Native Hawaiian / Other Pacific Islander	24.8	65.3	9.9
	Two or More Races	29.8	53.6	16.6

Source: National Science Foundation, *Science & Engineering Indicators 2012*

Before 2003, respondents could not classify themselves in more than one racial / ethnic category. Before 2003, "Asian" included Native Hawaiians and other Pacific Islanders.

Source: National Science Foundation, National Center for Science & Engineering Statistics, Scientists and Engineers Statistical Data System (SESTAT) (1993 - 2008), <http://sestat.nsf.gov>

Women in S&E occupations: 1993-2008



NOTE: National estimates not available from scientists and Engineers Statistical Data System (SESTAT) in 2001.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, SESTAT (1993-2008), <http://sestat.nsf.gov>.

Science and Engineering Indicators 2012



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What's Gone Wrong with the STEM Education System in the U.S.?:

- Are we comparing apples to apples?
- STEM topics as part of core curriculum
- STEM Teacher Training
- STEM engagement at earlier ages and with credible mentors
- After School and other Specialized In-school STEM training

STEM Jobs & Global Competitiveness

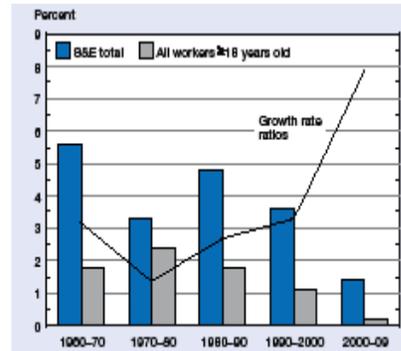
Global Competitiveness: U.S. Students Fall Short in STEM Scores While 3 Million STEM Jobs Go Unfilled

STEM Jobs are vital to a robust and competitive U.S. economy. 80% of the fastest growing occupations in the U.S. require STEM adequacy, but the U.S. is currently not graduating enough students who are able to fulfill this growing need.

As the rest of the world catches up with the U.S. in terms of STEM talent development, leaders across the country have mobilized to find solutions to the nation's STEM workforce dilemma. And the U.S. continues to cultivate foreign nationals with STEM skills to immigrate.

STEM workers are less likely to experience job loss. And they enjoy significantly higher mobility and opportunities. But because of the mismatch between talent development and employer demand, as many as 3 million STEM jobs have gone unfilled. U.S. companies are locating their operations overseas due to a lack of available STEM talent within the U.S.

Average Annual Growth Rates of S&E Occupations and Total U.S. Workforce: 1960 - 2009



Source: National Science Foundation, National Center for Science & Engineering Statistics, special tabulations as found in *Science & Engineering Indicators 2012*



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The **Programme for International Student Assessment (PISA)** continues to show erosion in U.S. student competence in Science and Mathematics. The U.S. ranked 32nd in Math in the recent PISA rankings, and 23rd in Science scores. In 1970, the U.S. produced more than half of the world's science and engineering doctorates, but our share has now fallen below 10%

2009 (latest)		2009 (latest)	
Mathematics Literacy Scale 2009	SCORE	Science Literacy Scale 2009	SCORE
COUNTRY	SCORE	COUNTRY	SCORE
Shanghai-China	600	Shanghai-China	575
Singapore	562	Hong Kong-China	549
Hong Kong-China	555	Finland	554
Korea, Republic of	546	Singapore	542
Finland	541	Japan	539
Switzerland	534	Korea, Republic of	538
Japan	529	New Zealand	532
Canada	527	Canada	529
Netherlands	526	Estonia	528
New Zealand	519	Australia	527
Belgium	515	Netherlands	522
Australia	514	Germany	520
Germany	513	Switzerland	517
Estonia	512	United Kingdom	514
Iceland	507	Slovenia	512
Denmark	503	Poland	508
Slovenia	501	Ireland	508
Norway	498	Belgium	507
France	497	Hungary	503
Slovakia	497	United States	502
Austria	496	Czech Republic	500
Poland	495	Norway	500
Sweden	494	Denmark	499
Czech Republic	493	France	498
United Kingdom	492	Iceland	496
Hungary	490	Sweden	495
Luxembourg	489	Austria	494
United States	487	Portugal	493
Ireland	487	Slovakia	490
Portugal	487	Italy	489
Spain	483	Spain	488
Italy	483	Luxembourg	484
Greece	466	Greece	470
Israel	447	Israel	455
Turkey	445	Turkey	454
Chile	421	Chile	447
Mexico	419	Mexico	416

STEM Workforce is Aging:

- Prolongation of STEM careers occurring due to increase in longevity, Great Recession
- Exacerbates “skills gap”

STEM Jobs & Aging Workforce

Retirements: Crisis in Supply of STEM Workers Means Increasing STEM Skill Shortages

An increasing number of STEM workers are over age 50, and their retirement plans will drastically affect the supply of STEM workers through 2018. According to the National Science Foundation, full-time work rates among older S&E degree holders decline quickly as workers age into their late 50's. By age 65, only about one-quarter of the S&E workforce with degrees at the master's or bachelor's level work full time. This phenomenon has profound consequences — especially for federal government STEM jobs requiring security clearance, since foreign nationals are not permitted access to most types of classified scientific R&D information.

Chart 1: Age distribution among employed individuals with highest degree in S&E, by degree field: 2008 (latest)

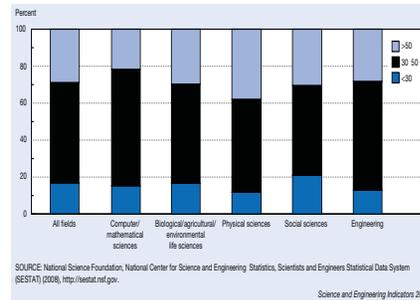


Chart 2: Age distribution of employed individuals with highest degree in S&E, by degree level and broad occupational area: 2008 (latest)

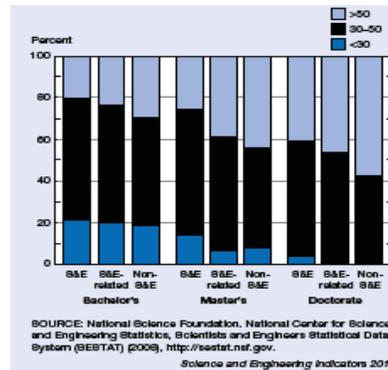


Chart 3: Older individuals with highest degree in S&E who work full time, by age and degree level: 2008 (latest)

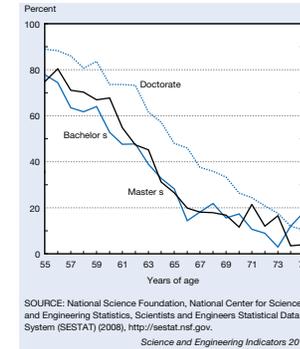
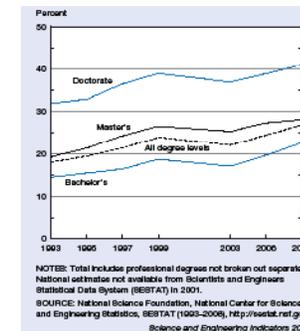


Chart 4: Workers older than age 50 in S&E occupations, by highest degree level and year: 1993 - 2008 (latest)



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Policy Focus on Manufacturing Jobs:

**STEM Focus:
Manufacturing**

600,000 Jobs in Manufacturing Go Unfilled, Many in STEM

STEM job skills are especially needed in America's changing manufacturing sector. Top executives say that access to a highly skilled and flexible U.S. workforce is even more important than other top priorities — including product innovation, increasing market share, and supply-chain integration. High unemployment in the U.S. is not making it easier to fill manufacturing positions, particularly in the areas of skilled production and production support. According to the the Deloitte / Manufacturing Institute paper *Boiling point? The skills gap in U.S. manufacturing (2011)*, "There's no way around it: respondents report, on median, that 5% of their jobs remain unfilled simply because they can't find people with the right skills."

The study also finds:

- Translated to raw numbers, this means that as many as **600,000 manufacturing jobs are going unfilled**, a remarkable fact when the country is facing an unemployment rate that hovers around 7.9% (10/12)
- The national education curriculum is not producing workers with the basic skills they need – a trend not likely to improve in the near term.
- Eighty-three percent of companies** indicate a moderate to serious shortage of skilled production workers and 69% of companies expect this shortage to worsen over the next three to five years.
- Retaining, hiring and developing a skilled manufacturing workforce will become more difficult as an older and more mature workers retire. This "talent crunch" is especially true for scientists and design engineers whose retirements will affect new manufacturing processes and production development.

Chart 1: If a skills shortage has been identified in your company, please indicate how this shortage trend has impacted each of the following areas during the past five years:

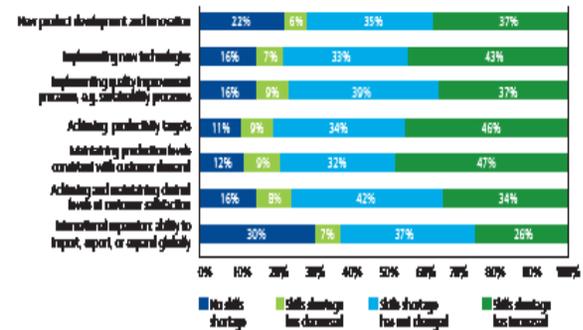
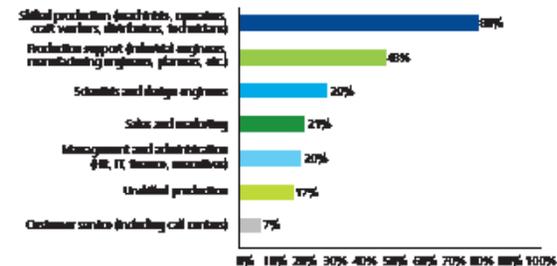


Chart 2: In which workforce segments do you anticipate the greatest hiring challenges during the next 3 - 5 years?



Source: Copyright 2011 Deloitte Development LLC and The Manufacturing Institute



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Energy Jobs

- Significant job creation — more than 1 million since 2002
- 308,000 indirect jobs created by the boom

STEM Focus:
Energy Jobs

New Demands for STEM Skills: Energy Jobs

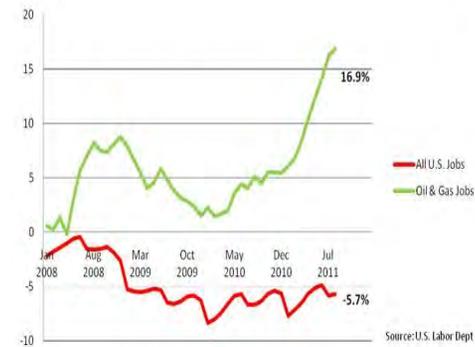
An especially bright spot in the U.S. economy in spite of the Great Recession is the energy boom taking place in both fossil fuels and renewable energy resources. "Since 2002, the exploration of natural gas deposits embedded in shale, followed by oil drilling that began in earnest late in the decade, has **created more than 1 million jobs**, says Moody's Analytics economist Chris Lafakis. That's out of 2.7 million the whole country created."

"Only about a quarter of employment growth driven by the shale boom has happened at energy companies, Moody's found. **Another 308,000 have been "indirectly" created by the boom** — those include the ones at transportation companies or equipment firms, Lafakis said. More than half a million are "induced" jobs — created to serve the needs of the other half-million people, once oil and gas brings more wealth to their towns."

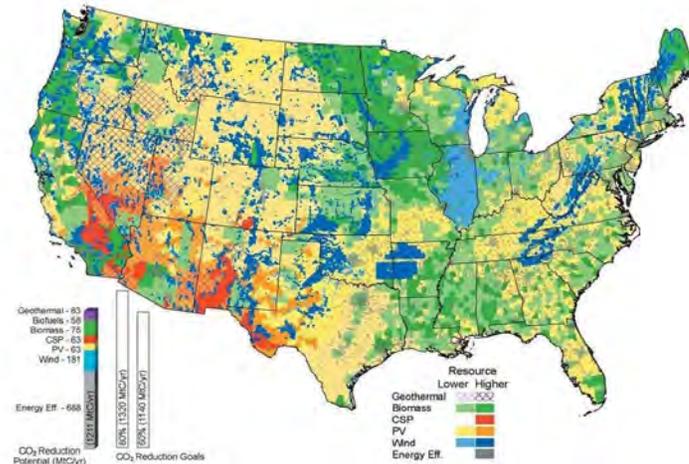
Similarly, the Administration's emphasis upon "Green Jobs" has inspired new investments in solar, wind, geothermal, biomass and other industries across many areas of the U.S.

Significant STEM job creation is occurring throughout the energy sector.

Change in Number of Energy Sector Jobs
January 2008 through July 2011



Potential Effects of Green Energy Jobs by
Technology, Carbon Reduction, and Location 2012



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Cloud Computing:

- Microsoft predicts more than 14 million new jobs worldwide by 2015
- NYC top job producer for Cloud Computing — Washington D.C. leads in percentage growth (+70%) by 2015

STEM Focus:
Computing

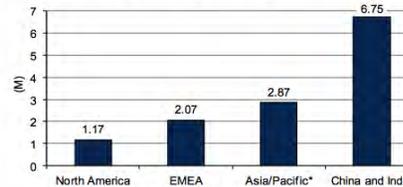
New Demands for STEM Skills: Cloud Computing

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). Cloud computing entrusts remote services with a user's data, software and computation.

According to Microsoft, "Spending on public and private IT cloud services will generate **nearly 14 million jobs worldwide from 2011 to 2015.**" Microsoft's research, commissioned by the firm IDC, finds that "IT innovation created by cloud computing could produce \$1.1 trillion a year in new business revenues."

A breakdown of Cloud Computing Jobs by region shows that **North America will only contribute about 1.7 million of these jobs to the global total of 12.86 million, or just over 13 percent.**

Cloud Computing Jobs by Region: Total Cumulative Jobs Generated by Cloud Computing worldwide at Year-End 2015



* Except China and India
Source: IDC, 2012

Cloud computing can have a major impact on STEM job creation in the U.S. and provides a major opportunity for young STEM students for small business creation, entrepreneurship, and economic opportunities.

Cloud Computing's Role in U.S. Job Creation	
Total Cloud-Related Jobs in USA 2012 - 2015	
2012	664,000
2013	775,000
2014	920,000
2015	1,009,000

Rank 2012	Metropolitan Area	2012	2015	% Growth
1	New York City	60,028	99,420	65%
2	Los Angeles	31,742	52,960	66%
3	Chicago	22,988	37,868	64%
4	Dallas	14,415	23,780	64%
5	Houston	13,063	21,550	64%
6	Philadelphia	12,287	20,341	65%
7	Atlanta	11,995	20,023	66%
8	Boston	11,982	20,341	65%
9	Washington, D.C.	11,872	20,203	70%
10	Phoenix	8,477	14,005	65%
11	Minneapolis	8,018	13,259	65%
12	Detroit	7,558	12,481	65%
13	Denver	6,403	16,702	67%

Did you Know This About Cloud Computing Jobs?

New York City leads the way in total job numbers, with 99,000 new cloud-related jobs by 2015 — a **65% increase from 2012.**

Washington, D.C. is the City with the largest percentage growth by 2015 — **70%**

Los Angeles, Chicago and Dallas will have more than **114,000** cloud-related jobs by 2015.

Source: <http://www.thecloudinfographic.com>



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STEM Skills and the “App” Economy:

- **150,400 App jobs in computer and mathematical positions created 466,000 overall jobs by late 2011**
- **Is educational system producing sufficient STEM talent for App Economy?**
- **For individuals wishing to participate in App Economy Where are access points and what skills needed?**

**STEM Focus:
Computing**

New Demands for STEM Skills: The Amazing “App” Economy

According to TechNet, using data provided by the Conference Board and South Mountain Economics LLC, the explosion in mobile technology applications — so-called “apps” — will foster explosive job creation for the foreseeable future. Many of these are STEM-related jobs.

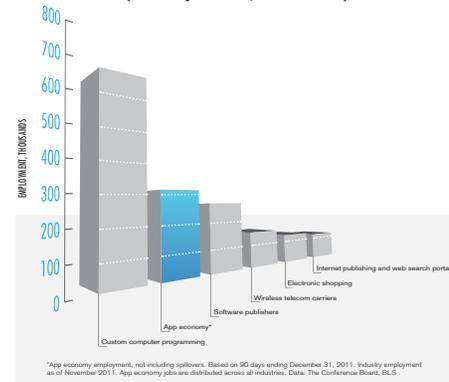
As of Dec. 2011, an estimated **150,400 App jobs in computer and mathematical positions had created about 466,000 overall jobs** in the aggregate by late 2011, with growth accelerating. “For the purpose of this study, we use a conservative multiplier of 1.5. Based on this multiplier, every app economy job generates another 0.5 jobs in the rest of the economy... it suggests that in the aggregate, **roughly 466,000 jobs** have been created by the App Economy since the iPhone was introduced in 2007,” estimates TechNet.

TechNet continues, “By one estimate, the App Economy generated almost **\$20 billion in revenue in 2011**. This includes app downloads, in-app revenues, sales of virtual goods, and sales of physical goods and services” *Other highlights:*

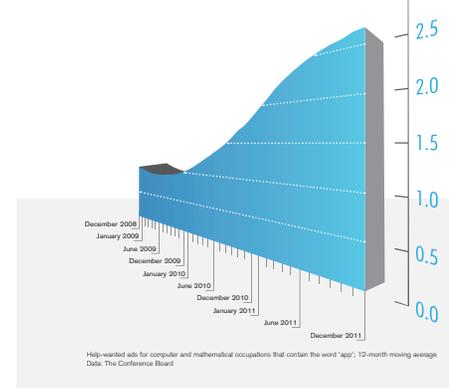
- One study of app-related jobs focused only on Facebook. Three academics estimated that “the number of employees employed by third party developers [of Facebook apps] to be **53,434**.” Then they calculated a range of spillover effects into the national economy, leading them to conclude that “a conservative estimate of the employment impact of developers building apps on the **Facebook Platform in the United States in 2011 is 182,744 full time jobs**.”

- That assumption implies that there are roughly **311,000 jobs in App Economy firms**, not accounting for spillover effects into the rest of the economy. These include tech jobs, which require app-related skills, and the corresponding non-tech jobs.”

**Sizing the App Economy
(Jobs by Sector, thousands)**



**Growth of the App Economy
(December 2008 = 1)**



Source: TechNet, *Mobile Technology/Apps - Where the Jobs Are: The App Economy*. 2012. See <http://www.technet.org/wp-content/uploads/2012/02/TechNet-App-Economy-Jobs-Study.pdf>



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STEM Skills & Big Data Jobs:

- High compensation
- 120,000 new Big Data-related jobs in 2013?
- Of about 42,000 public and private high schools in U.S., only 2,100 offer Advanced Placement coursework and subsequent AP exams in computer science

STEM Focus:
Computing

New Demands for STEM Skills: Big Data

In information technology, big data means a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools. The challenges include capture, curation, storage, search, sharing, analysis, and visualization. **Average pay for IT jobs with Big Data is now \$88,909.** The lucrative market for Big Data will be worth **\$518 Billion** for the Federal IT Market alone between 2013 - 2018. See chart below:

According to NCWIT, the National Center for Women & Information Technology:

"... There are over **42,000 public and private high schools** in the United States, but currently **only 2,100** of these schools offer Advanced Placement coursework (and subsequent AP exams) in computer science. That's a reduction of **25 percent** in just the last five years. And in the vast majority of schools that do offer computer science, these courses do not count toward graduation, with only nine states permitting computer-science studies to satisfy core science or mathematics requirements.

NCWIT continues, "Experts project that in the next year alone, **120,000 jobs will be created** that will require a degree in computer science. And as Brad Smith, a Microsoft executive, pointed out at a recent panel discussion, approximately **3.7 million jobs** in STEM-related fields are currently unfilled, due largely to a shortage of qualified workers. Getting the US workforce trained and ready for these job opportunities has to start now, and according to Smith, it has to start in high schools.

According to *USA Today*: Jobs site [Glassdoor.com](http://www.glassdoor.com) currently lists **17,699 jobs in Big Data**. Demand for tech jobs remains high across the board: engineers, designers, ethical hackers and apps makers. Career site [Dice.com](http://www.dice.com) lists more than **84,000 tech jobs in North America**, up 2% from a year ago. The fastest-growing areas from a year ago are **iPhone-related skills (78%)**, **cloud computing (68%)**, **mobile applications (42%)** and **Android-related skills (42%)**.

Demand for tech workers is expected to grow at a **19% clip** through 2020 — in line with an insatiable need for college graduates with degrees in the field — according to the U.S. Department of Labor. And the annual pay is good, at an **average \$88,909**, says job-search site [Indeed.com](http://www.indeed.com).

Video-games maker EA hopes to hire **5,000 engineers in the areas of gaming, data management and commerce** by the end of the decade in the USA, China and India. It currently employs **9,000**. Even manufacturing is thirsting for jobs. It has nearly doubled to **more than 170,000** today from two years ago, based on data from [CareerBuilder](http://www.careerbuilder.com) and [Demand Portal](http://www.demandportal.com). Most in demand: programmers, machinists and computer-assisted technicians."

Source: <http://www.usatoday.com/story/money/business/2012/10/01/hot-tech-jobs-demand/1593105/>



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Source: [marketresearchmedia.com](http://www.marketresearchmedia.com)

Local Data is Vital:

- Aggregated Data irrelevant for economic development, curriculum development and other critically important policy-related concerns
- Are local educational systems producing sufficient STEM talent to meet needs of expanding STEM economy?

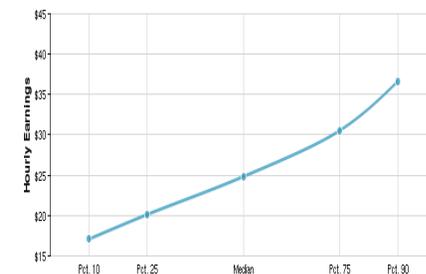
Yuma County
Arizona
STEM Jobs

STEM Jobs at the County Level Example: Yuma County, Arizona

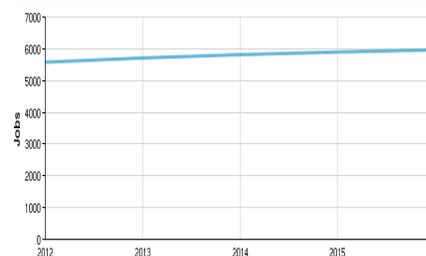


Private data analysis companies, like Economic Modeling Specialists International (EMSI) keep detailed statistics on STEM jobs at the county and local level. Most importantly, such data captures the vitality of STEM jobs held by self-employed individuals who are not counted in most Federal data sets. Representative data shown here can be generated for most county and metropolitan areas in the U.S. Linking local employment data with local community colleges and high schools is a high priority for organizations like STEMconnector / ASTRA. For Yuma County, Annual STEM Jobs Openings for 2012 were 271 positions. 46% of STEM jobs were in the 45 - 64 year age cohort.

Yuma County Percentile STEM Earnings		
\$17.09/hr	\$24.83/hr	\$36.62/hr
10th Percentile Earnings	Median Earnings	90th Percentile Earnings



Yuma County Growth For STEM Occupations: Significant Growth of 6.9% Ahead			
5,578	5,965	386	6.9%
2012 Jobs	2016 Jobs	Change (2012-2016)	% Change (2012-2016)



Source: EMSI — Economic Modeling Specialists International
www.economicmodeling.com

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Yuma County Workers in Selected S&E Occupations 2012 - 2016

STEM Occupation (SOC)	2012 Jobs	2016 Jobs	Change	% Change
Zoologists and Wildlife Biologists (19-1023)	14	14	0	0%
Forest and Conservation Workers (45-4011)	14	14	0	0%
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors (17-2111)	13	13	0	0%
Transportation Inspectors (53-6051)	22	23	1	5%
Postsecondary Teachers (25-1099)	388	400	12	3%
Chemical Equip. Operators and Tenders (51-9011)	18	15	-3	-17%
Industrial Engineers (17-2112)	62	62	0	0%
Architectural and Civil Drafters (17-3011)	25	24	-1	-4%
Chemical Technicians (19-4031)	34	46	12	35%
Mechanical Engineers (17-2141)	66	75	9	14%
Mathematicians (15-2021)	2	2	0	0%
Engineers, All Other (17-2199)	83	89	6	7%
Aerospace Engineers (17-2011)	57	61	4	7%
Petroleum Engineers (17-2171)	3	4	1	33%
Clinical, Counseling, and School Psychologists (19-3031)	60	69	9	15%
Architects, Except Landscape and Naval (17-1011)	27	29	2	7%
Chemical Engineers (17-2041)	5	6	1	20%
Biological Scientists, All Other (19-1029)	8	9	1	13%
Industrial-Organizational Psychologists (19-3032)	1	1	0	0%
Statistical Assistants (43-9111)	2	2	0	0%
Chemists (19-2031)	11	18	7	64%

CyberSecurity Jobs:

- Most are IT-related
- Compounded annual growth rate of 13.2 % between 2010 and 2015
- Exploding demand being met through innovative training models, 2-year colleges, corporate programs...
- Does the policy-making apparatus have adequate tools to measure this phenomenon?

STEM Focus:
Computing

New Demands for STEM Skills: Cybersecurity

Cybersecurity Jobs are in great demand, and most of them are IT-related. The objective of computer security includes protection of information and property from theft, corruption, or natural disaster, while allowing the information and property to remain accessible and productive to its intended users.

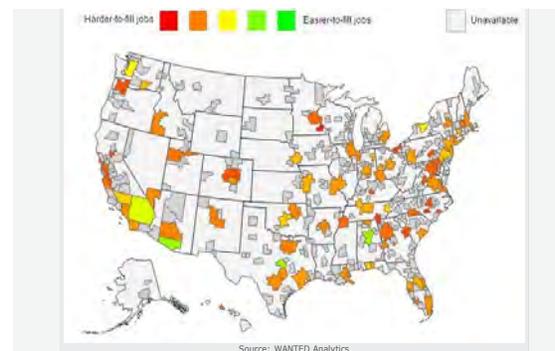
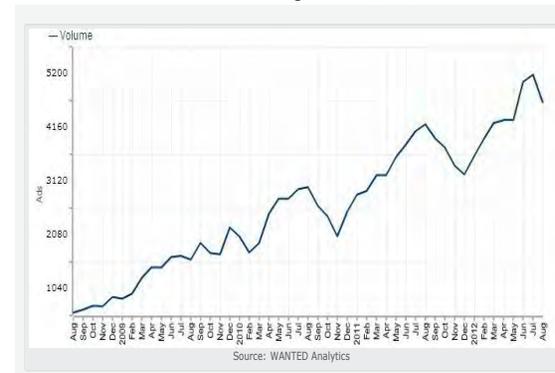
Frost & Sullivan estimates the number of information security professionals worldwide in 2010 to have been approximately **2.28 million**. This figure is expected to increase to almost **4.24 million by 2015**, displaying a Compound Annual Growth Rate (CAGR) of **13.2 percent from 2010 to 2015**.

See Cyber/Information Security - The 2011 (ISC) Global Information Security Workforce Study - Frost & Sullivan https://www.isc2.org/uploaded-Files/Industry_Resources/FS_WP_ISC%20Study_020811_MLW_Web.pdf

Thousands of Cybersecurity jobs are open to STEM graduates. A variety of STEM skills are needed for success in this burgeoning field. The schematics to the right capture the 4-year growth trend in Cybersecurity jobs as documented by WANTED Analytics as well as a map of metropolitan areas ranking them by difficulty in filling the jobs. Fierce competition to fill Cybersecurity jobs is indicated by the darker shades.

Not surprisingly, the National Capital Region has the most intense competition to fill such jobs, many of them associated with government cyberdefense efforts.

Hiring Demand for U.S. Cybersecurity Positions
4 Year Hiring Trend 2008 - 2012



However, each location and region of the US will experience a varying degree of difficulty when recruiting. Companies in Baltimore, Maryland and Washington, DC are currently experiencing some of the most challenging overall recruiting conditions. Fierce competition has emerged as hiring in these areas is growing more quickly than the local talent supply can support. Job ads in this area remain online for an average of 7 weeks. In comparison, the *Hiring Scale* also shows that Tucson, Arizona and Killeen-Fort Hood, Texas are likely to see the least difficulty in recruiting for these positions. A larger talent supply compared to the hiring demand by employers in these 2 areas means that Recruiters are likely to fill open cyber security positions faster than average. The average duration of a job ad in these locations is 5 weeks, about one week shorter than the national average.



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ASTRA's State STEM Report Cards

• Free downloads at store.usinnovation.org

Maryland

241,000 Maryland STEM* Jobs to fill for 2018

241,000 = the number of STEM and STEM-related jobs Maryland will need to fill by 2018.* Maryland kids and parents need to know about the potential for rewarding — and high paying careers in STEM. STEM professions and occupations are among the highest paying jobs.

They are also the basis for a successful, globally competitive and innovative Maryland and U.S. economy. During the next decade, overall U.S. demand for scientists and engineers is expected to increase at four times the rate for all other occupations.

Where will Maryland's STEM Jobs be in 2018 by Occupation & Educational Level? (in thousands of jobs)

Occupation	High School Dropouts	High School Graduates	Some College	Associate's Degree	Bachelor's Degree	Graduate Degree	Total
Computer & Mathematical Science	0	7	23	10	53	33	127
Architects & Technicians	0	2	2	1	4	3	11
Engineers & Technicians	0	4	7	5	20	18	54
Life & Physical Scientists	0	1	1	1	8	21	32
Social Scientists	0	0	1	0	3	12	17
Total	0	14	34	17	87	77	241,000

Change in Maryland Jobs by Education Level: 2008 and 2018

Educational Level	2008 Jobs	2018 Jobs	Difference
High School Dropouts	275,000	305,000	30,000
High School Graduates	787,000	863,000	77,000
Postsecondary	1,751,000	1,964,000	213,000

What Percentage of Maryland High school students are interested in STEM Careers?

The Charts * on this page represent Maryland's portion of an in-depth nationwide look at more than 6 million high school students in the MyCollegeOptions* program in 2013. Their college major/career aspirations were used to determine their interest in STEM-related fields, revealing that nearly 30% — more than 1.6 million students — who would like to pursue STEM in their futures. Keeping such students from dropping out of the STEM Talent Pipeline is essential in meeting U.S. STEM workforce demands for the future.

5 Source: MyCollegeOptions.org for more information e-mail shapingthefuture@mycollegeoptions.org

STEM Interest by Self-Identified Ethnicity

STEM Interest by Gender

Declining Support: Federal R&D outlays as Percentage of Federal Budget 1962-2014:

Recipients of Federal R&D Contracts (not Grants) * Formed in Maryland FY 2013* (rounded)

Johns Hopkins University	\$788,829,101
Boeing Corporation	\$321,096,114
Raytheon Corporation	\$260,884,346
Lockheed Martin Corporation	\$214,816,560
Northrop Grumman Corporation	\$212,487,925

Acting Agencies for Maryland R&D Investments During FY 2013*

Department of Defense	\$1,909,539,593
Department of Human Services	\$718,287,061
Department of Transportation	\$637,880,752
Department of Commerce	\$202,604,934
Department of Education	\$30,837,498

Appendix: Evidentiary Proof or not?



The Hidden STEM Economy, Brookings Institute, 6.10.2013

<http://www.brookings.edu/research/reports/2013/06/10-stem-economy-rothwell>

50%

of STEM jobs **do not require** a bachelor's degree.
As a result, STEM knowledge plays a much larger
role in our economy than previously thought:



There are
26 MILLION
STEM jobs in the U.S.

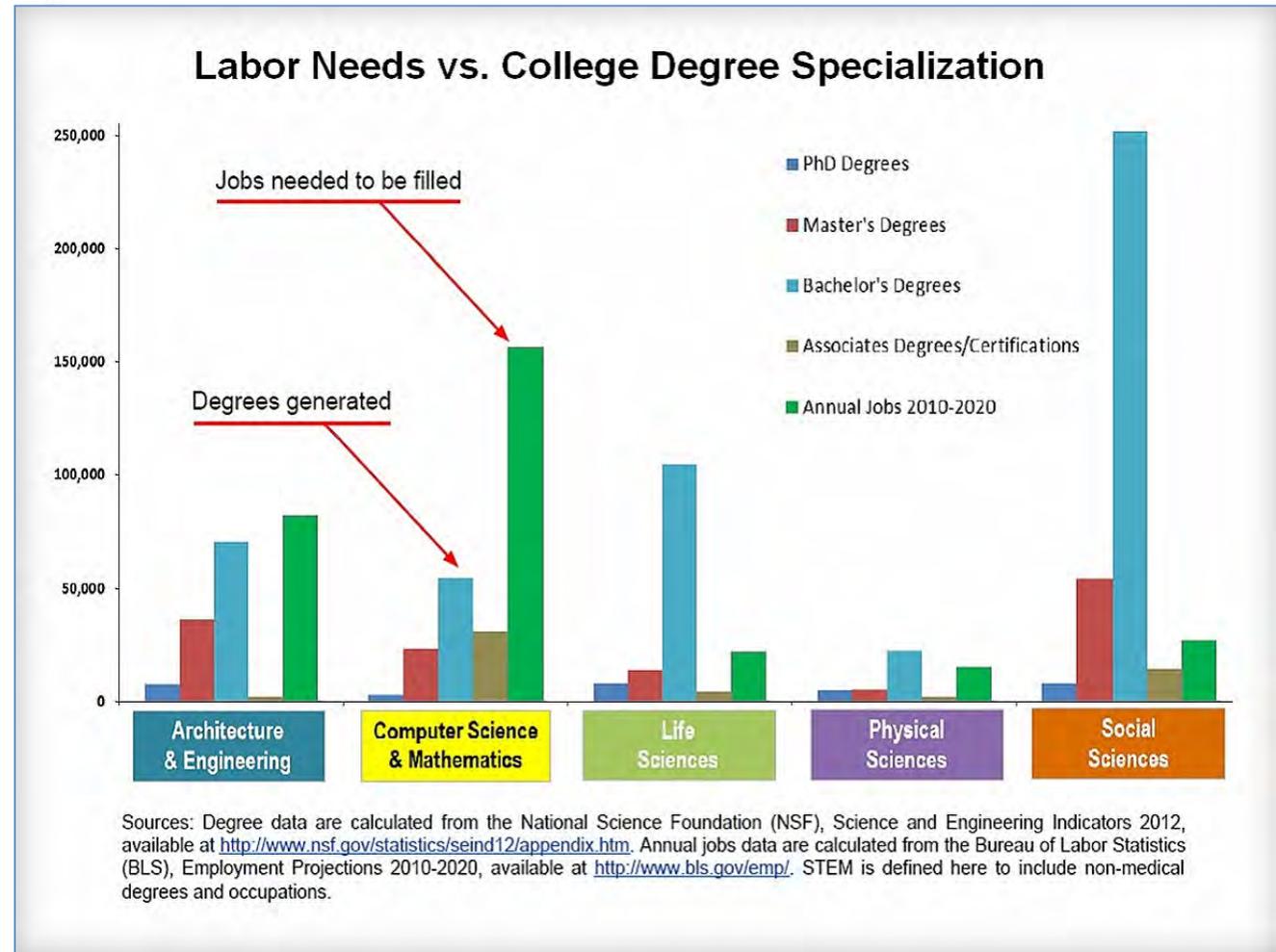


STEM jobs comprise
20%
of all U.S. jobs.

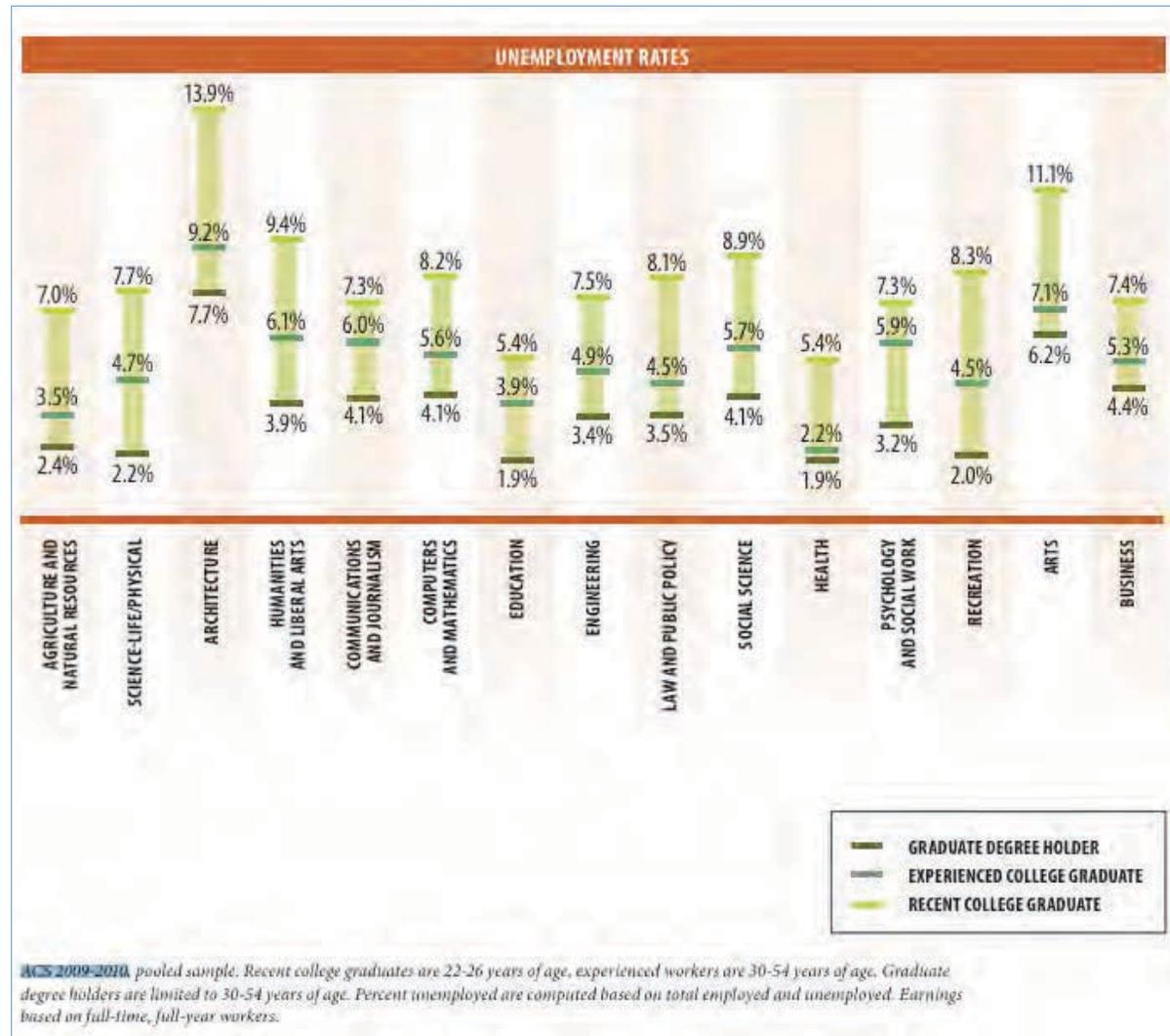


The share of jobs requiring
STEM knowledge has
doubled
since the Industrial
Revolution

Appendix: Evidentiary Proof or not?



Appendix: Evidentiary Proof or not?

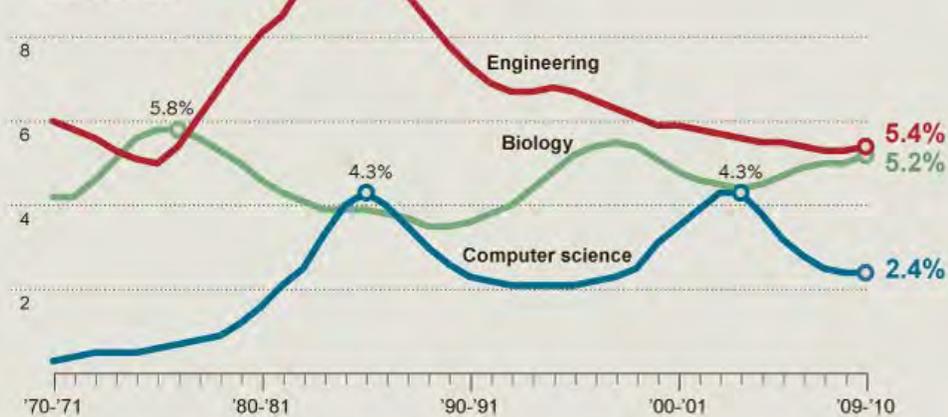


Appendix: Evidentiary Proof or not?

(Less) Popular Science

The three largest fields in science have lost ground in recent decades.

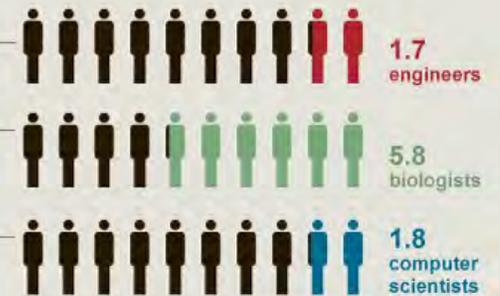
10 PERCENT OF ALL BACHELOR'S DEGREES GRANTED



Source: National Center for Education Statistics

GENDER GAP While women lag in engineering and computer science, they dominate in biology, where pay is lower. Salaries start at \$40,000 to \$50,000, compared with \$55,000 to \$65,000 for the other fields.

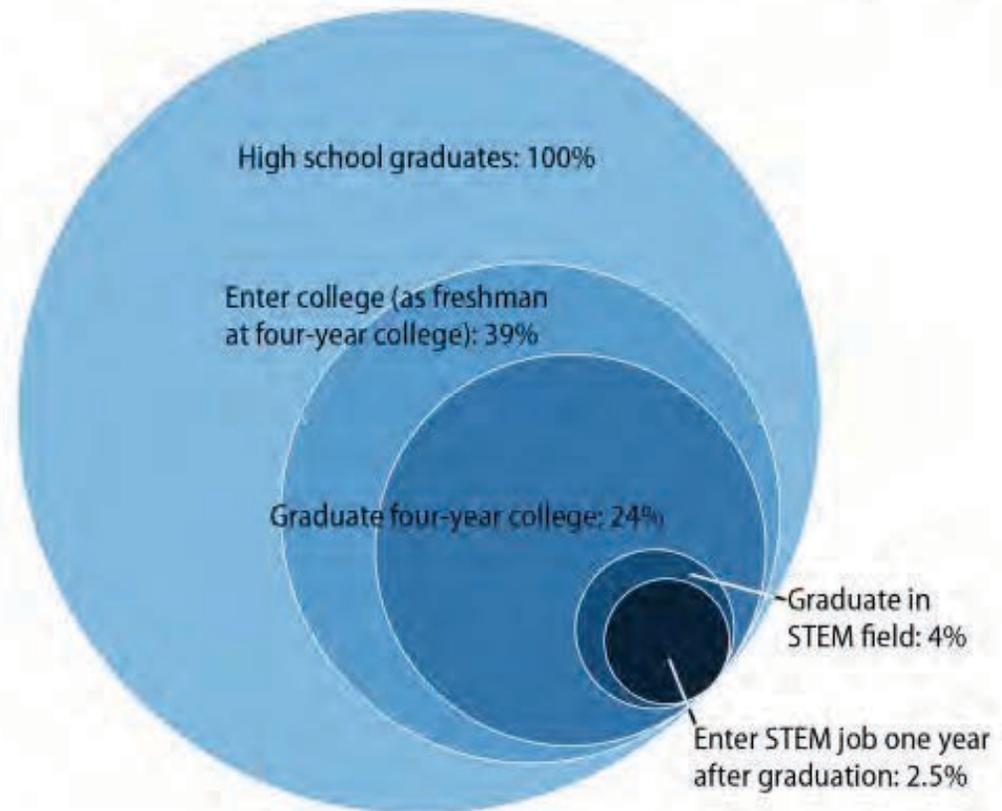
Number of women for every 10 graduates, 2009-10:



THE NEW YORK TIMES

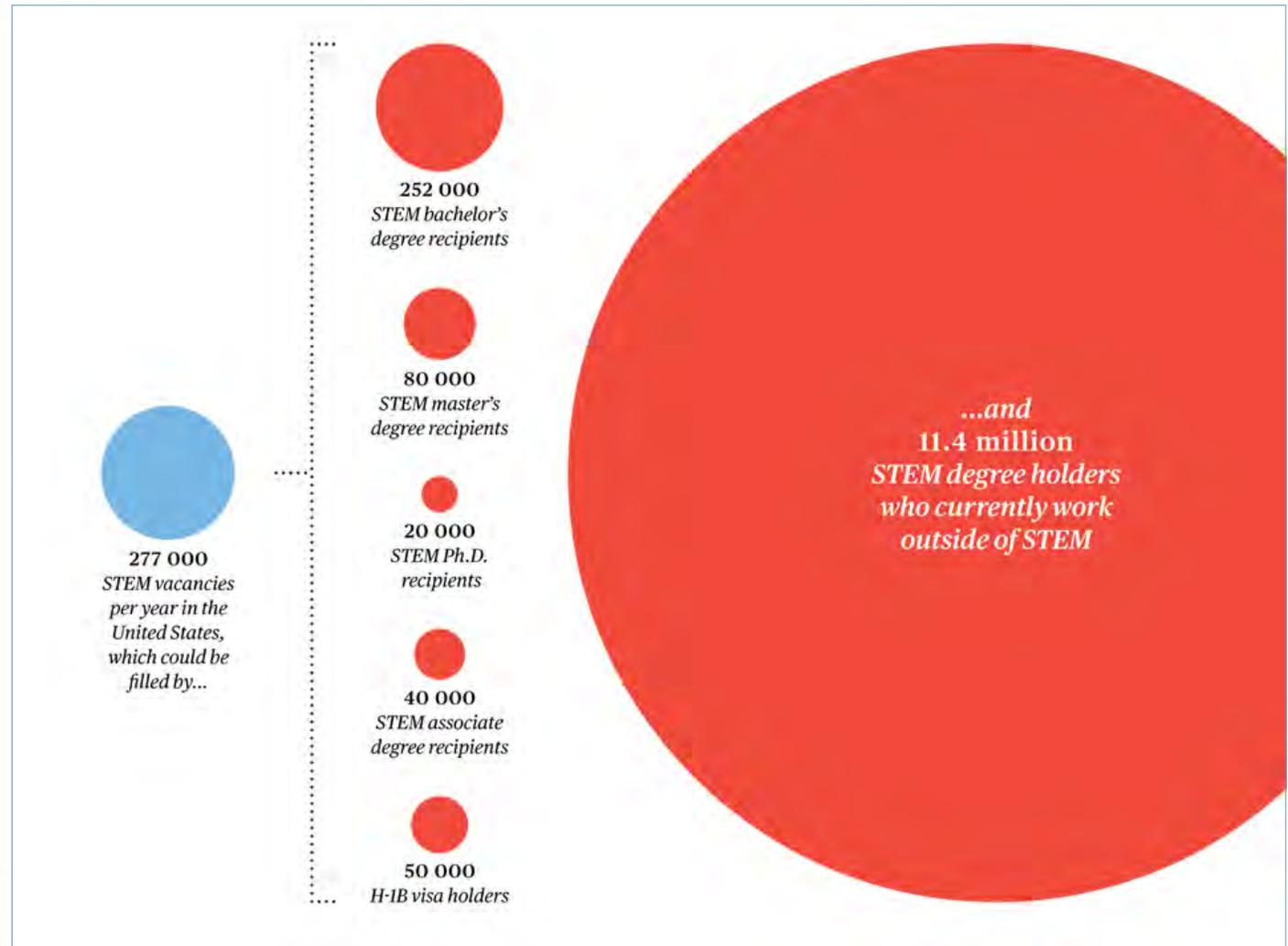
Appendix: Evidentiary Proof or not?

Percent of high school graduates going to college, graduating, and then entering a STEM job



Source: Authors' analysis of National Center for Education Statistics (2009b, 2013)

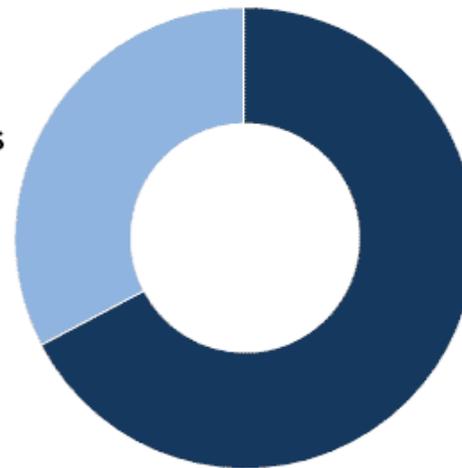
Appendix: Evidentiary Proof or not?



Appendix: Evidentiary Proof or not?

STEM OCCUPATIONS: JOBS ADDED (2010-2013)

**SCIENCE,
ENGINEERING
& MATHEMATICS**
All Other Occupations
113,694



TECHNOLOGY
Computer Occupations
275,615

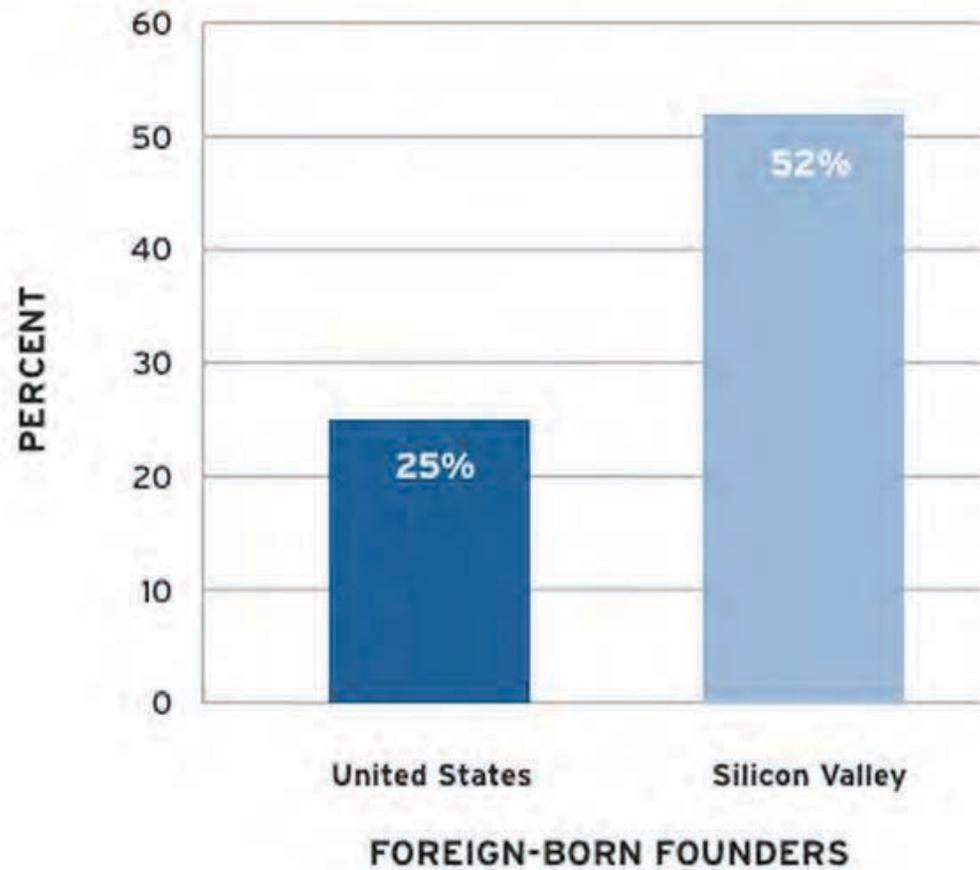
MOST JOB GROWTH AMONG COMPUTER OCCUPATIONS

OCCUPATION	2010 JOBS	2013 JOBS	CHANGE	% CHANGE
Software Developers, Applications	563,695	623,897	60,202	11%
Software Developers, Systems Software	374,359	418,505	44,146	12%
Computer Systems Analysts	483,984	522,889	38,905	8%
Computer User Support Specialists	562,380	598,279	35,899	6%
Network and Computer Systems Administrators	341,331	371,146	29,815	9%

SOURCE: QCEW EMPLOYEES, NON-QCEW EMPLOYEES & SELF-EMPLOYED - EMSI 2013.4 CLASS OF WORKER

Appendix: Evidentiary Proof or not?

Percent of U.S. Tech and Engineering Firms with Foreign-Born Founders



ASTRA: Leadership through Diversity

Key Point # 1

- There isn't a STEM shortage. America is producing more than enough STEM students.
- If there were a STEM shortage, one would expect that the price paid for STEM labor would rise. That hasn't been the case.
- There is, however, a disparity between what STEM majors want to do and what the tech community is offering.

BUSINESS
INSIDER

Appendix: Evidentiary Proof or not?

Key Point # 2

- America isn't making the most of its status as the global hub of higher education.
- America is fortunate that high-talent foreign-born students want to study here.
- We're not capitalizing on that trained high-skill labor.
- Instead, after training the best and brightest of the world we're forcing them back to their home countries.

BUSINESS
INSIDER

BI

Appendix: Evidentiary Proof or not?

Key Point # 3

- American companies should be able to easily hire the best and brightest of the world.
- Instead, the current system forces these businesses to aim for a shockingly brief window to try to hire international talent.
- Companies are willing to put up thousands of dollars to get a foreign-born worker a visa.
- They're not trying to cheat American workers, they're trying to grab talent.

BUSINESS
INSIDER

Appendix: Evidentiary Proof or not?

Key Point # 4

- The solution is to raise the visa cap for skilled foreign-born labor.
- The visa cap should be adjusted annually to ensure that demand for native-born tech applicants remains robust, while also granting companies the leeway to hire who they want.

BUSINESS
INSIDER

Appendix: Evidentiary Proof or not?

There are too many college educated, experienced STEM workers who are trying to find a job; there is not a shortage of them (Economic Policy Institute). **However, current STEM job categorization does not typically include health and medical jobs or the majority of middle and high skill jobs.**

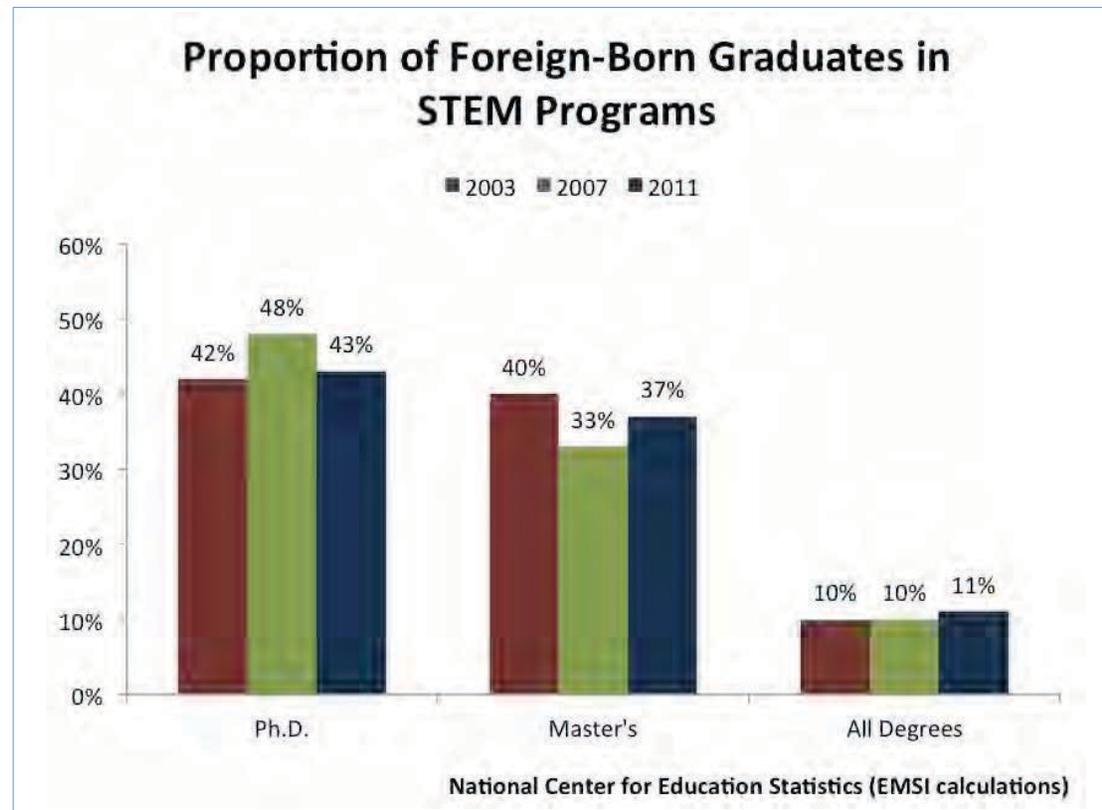
Source: Dr. James Brazell, *The Other Side of the STEM Story*

Appendix: *Evidentiary Proof or not?*

- There is no standard workforce or education definition of STEM in the U.S.
- Today, labor market shortages are for STEM-based skills across many jobs not typically classified as STEM.
- A new approach to analysis is needed to identify how social institutions such as employment are changing as well as what skills give rise to economic innovation and sustainability of democratic ideals.

Source: Dr. James Brazell, *The Other Side of the STEM Story*

Appendix: Evidentiary Proof or not?



ASTRA: Leadership through Diversity



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