The 2018 Status Report on Engineering Education: A Snapshot of Diversity in Degrees Conferred in Engineering
The Association of Public and Land-grant Universities

The Association of Public and Land-grant Universities (APLU) is a research, policy, and advocacy organization dedicated to strengthening and advancing the work of public universities in the U.S., Canada, and Mexico. With a membership of 238 public research universities, land-grant institutions, state university systems, and affiliated organizations, APLU’s agenda is built on the three pillars of increasing degree completion and academic success, advancing scientific research, and expanding engagement. The association’s work is furthered by an active and effective advocacy arm that works with Congress and the administration as well as the media to advance federal policies that strengthen public universities and benefit the students they serve.


COVER PHOTOS
FRONT COVER PHOTOS COURTESY OF (LEFT TO RIGHT) FLORIDA A&M UNIVERSITY; THE UNIVERSITY OF WASHINGTON; AND THE UNIVERSITY OF CALIFORNIA, MERCED
BACK COVER PHOTO COURTESY OF THE UNIVERSITY OF VIRGINIA
ACKNOWLEDGMENTS

This project was generously funded by the National Science Foundation (NSF) (Grant number EEC-1734899). Thank you to all participants and contributors for their time, expertise and input!

Note: any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

RESEARCH TEAM

Dr. Eugene L. Anderson, Vice President, Access and Success, APLU

Dr. Krystal Williams, Assistant Professor, Higher Education Program, Department of Educational Leadership, Policy and Technology Studies, The University of Alabama

Dr. Luis Ponjuan, Associate Professor, Educational Administration and Human Resource Development, Texas A&M University

Dr. Henry T. Frierson, Associate Vice President and Dean of the Graduate School, University of Florida

ADVISORY COMMITTEE

Dr. Lesia Crumpton-Young, Vice President-Research and Sponsored Programs, Tennessee State University

Dr. Juan E. Gilbert, Chair, Computer & Information Science & Engineering Department, The University of Florida

Dr. Willie Pearson, Professor of the School of History and Sociology, Georgia Tech

Dr. Karl Reid, Executive Director, National Society of Black Engineers

Dr. Janet C. Rutledge, Vice Provost and Dean of the Graduate School, University of Maryland, Baltimore County

Dr. Aaron Thomas, Director of Native American Research Laboratory, University of Montana

Dr. Zulma Toro, President, Central Connecticut State University
INTERNAL SUPPORT TEAM

Rosalina Escandon, Associate Director, Access and Success, APLU
Porshia Brewer, Staff Associate, Access and Success, APLU

STATISTICAL CONSULTANT

Dr. Brian L. Yoder, Consultant, previously Director of Assessment, Evaluation and Institutional Research, American Society for Engineering Education

REPORT REVIEWERS

Dr. Bryan Cook, Vice President, Data and Policy Analysis, APLU
Howard Gobstein, Executive Vice President and Co-Project Director, Science & Mathematics Teaching Imperative, APLU
Jeff Lieberson, Vice President, Public Affairs, APLU
Dr. Alan R. Mabe, Chief Academic Officer, Senior Vice President for Academic Affairs, APLU
Hanan Saab, Assistant Director for International Issues, APLU

REPORT DESIGNERS AND EDITORS

Gloria Allen, Silhouette Media
Monica Drew, DAS Graphics and Printing, Inc.
Lauren Bush, Editor
EXECUTIVE SUMMARY

Careers in engineering encompass a variety of occupations that spur the creation of new ideas, advance technology, and are essential to a globally competitive economy and national defense. Increasing the number of Americans studying and pursuing careers in engineering is essential to the preceding points. Shortages in meeting employment demands exist in the number of U.S. citizens earning undergraduate and advanced degrees in engineering fields essential to economic growth and national security such as systems engineers, cyber security, software developers, materials science engineering, and Ph.D.'s in nuclear and electrical engineering.

Thanks to funding from the National Science Foundation, the Association of Public and Land-grant Universities examined this topic and published this report which examines recent trends in engineering degrees awarded at national and institutional levels to determine areas of growth among various groups, changes in racial, ethnic and gender diversity in engineering, and which colleges and universities graduate a larger number and proportion of underrepresented groups in specific engineering disciplines.

Data from the Integrated Postsecondary Education Data System (IPEDS) of the U.S. Department of Education National Center for Education Statistics were used primarily from the IPEDS Completion Survey. The survey provides information about degree completion, including degrees awarded by race, gender, field of study and degree level. For this study, survey data from the 2010-11 academic year were compared to completions data from 2015-16.
BASED ON OUR ANALYSIS THERE ARE SIX MAJOR FINDINGS IN THE REPORT WHICH ARE HIGHLIGHTED IN THE SECTIONS BELOW.

1. **Despite large numerical increases for Hispanic and Black students, these two groups along with American Indian/Alaska Native (AIAN) and Native Hawaiian/Pacific Islander (NHPI) students remain significantly underrepresented in engineering at the undergraduate and graduate level.**

   In the most recent five-year period where data were available (2011 to 2016), the change in bachelor’s degrees conferred in engineering outperformed all other major fields of study for all racial and ethnic group, 42 percent compared to 11 percent. The number of engineering bachelor’s degrees earned by Hispanic students increased by 79 percent, a percentage only less than Multi-Racial and Non-U.S. Resident students. The number of engineering bachelor’s degrees conferred to Black students increased 35 percent, the same as Asian students and greater than White students (30 percent). However, both Hispanic and Black engineering graduates remain significantly underrepresented. Hispanic students compose 19 percent of college undergraduates but only 11 percent of all engineering bachelor’s degrees conferred in 2016, an 8-percentage point gap. A gap similar for Black students. Although the overall and engineering numbers for American Indians is very small, they are significantly underrepresented in engineering.

   The lack of diversity at the graduate level in engineering is an even greater problem than at the undergraduate level. The number of engineering master’s and doctoral degrees conferred to Underrepresented Racial and Ethnic Groups (URG) increased from 2011 to 2016 but had little bearing on diversity of engineering graduate degrees. URGs earned only 6.3 percent of engineering master’s degrees and 4.9 percent of engineering doctoral degrees. At the engineering graduate level, American Indian and Native Hawaiian graduates are almost invisible despite earning a significant number of master’s degrees in non-engineering fields of study. Nearly 3,500 American Indian students earned master’s degrees in non-engineering fields of study, but only 71 earned master’s degrees in engineering. Only 23 Native Hawaiian graduates earned master’s degrees in engineering, despite more than 1,500 Native Hawaiian graduates earning master’s degrees in non-engineering fields of study.

2. **From 2010-11 to 2015-16 there was a massive increase in Non-U.S. Resident graduates in engineering at all levels, especially master’s degree where this group is now the majority of master’s degree earners.**

   In 2016, Non-U.S. Resident graduates earned the majority of engineering master’s degrees, 58 percent. The shift to the majority of engineering master’s degree earners occurred dramatically over a relatively short period of time; increasing from 45.6 percent of all engineering master’s degrees in 2011 to 58.1 percent in 2016, a 12.5 percentage point increase in only five years. The rapid growth of Non-U.S. Resident graduates is a critical topic. Based on the data, it does not appear that the rapid growth of Non-U.S. Residents in engineering master’s degree programs crowded out U.S. citizens. In 2016, 12,675 more Non-U.S. Resident students earned engineering master’s degrees than in 2011, which was slightly fewer than the 13,779 more engineering master’s degrees awarded to all persons by U.S. colleges and universities. Typically, graduate engineering programs do not provide financial assistance to Non-U.S. Resident students, thus these students...
provide important talent that benefits engineering programs in numerous ways. Another factor affecting the diversity of graduate engineering programs is the labor market demands for persons with a bachelor’s degree in engineering. As Carnevale, Smith and Melton found, there are significant financial benefits to STEM baccalaureate graduates both in STEM and non-STEM careers.iii

Additionally, Non-U.S. Residents were heavily concentrated in electrical engineering and related subdisciplines. More than one-third of all engineering master’s degrees earned by Non-U.S. Residents were in electrical engineering, 10,163 degrees in 2016. Another 3,994 degrees were earned by Non-U.S. Residents in computer engineering (2,388 degrees) and software engineering (1,606 degrees). Non-U.S. Residents earned 78 percent of software engineering master’s degrees, 77 percent of electrical engineering master’s degrees, and 77 of percent computer engineering master’s.

3 The gender disparity transcends URG and majority groups in similar ways with women earning fewer degrees than men, even though in 2015-2016, the majority of degree earners in all fields of study combined are female.

Women earned the majority of all bachelor’s degrees within each racial and ethnic group, except in engineering, the percentage of degrees by women ranged from 26.8 percent among Multi-Racial graduates to 19.4 percent for White graduates. This disparity between women and men in engineering is further exemplified by the difference in where engineering ranks among all major fields of study for bachelor’s degrees conferred. Engineering was the second largest field of study among bachelor’s degrees conferred to White males in 2016, behind only business. The same is also true for Asian American males. However, for Hispanic males, engineering was the fourth largest field of study and among African American males, engineering ranked tenth. Engineering ranked significantly lower among female graduates in 2016. Among White, Hispanic and African American females, engineering was the eighteenth largest field of study. Among Asian American females engineering ranked eighth. Like the baccalaureate level, the gender disparity at the graduate level remains a significant issue. Among U.S. residents, women earn the majority of all master’s degrees, but less than 30 percent of engineering master’s degrees.

4 At the institutional level there is a high concentration of each URG in a small number of institutions which contrast with a large number of institutions with little to no racial or ethnic diversity in their engineering programs.

The top 10 producers of engineering bachelor’s degrees to Hispanic students conferred 25 percent of all engineering bachelor’s degrees to Hispanic graduates. Among Black students, the top 10 producers conferred one of five engineering bachelor’s degrees to Black graduates. The top nine producers of engineering bachelor’s degrees conferred to American Indian/Alaska Native (AIAN) students conferred 26.8 percent of engineering bachelor’s degrees to AIAN graduates. Among Native Hawaiian/Pacific Islander (NHPI) students, 16 top producers conferred 37.1 percent of engineering bachelor’s degrees to NHPI graduates. At the opposite end are a significant number of engineering programs with very few or no URG students—156 colleges and universities conferred less than 5 percent of their bachelor’s degrees in engineering to URG students in 2016. Eighty-one percent of these schools are smaller engineering schools or programs that awarded less than 100 degrees to all groups combined.
Historically Black Colleges and Universities (HBCUs) and Hispanic Serving Institutions (HSIs) continue to play an important role in educating Black and Hispanic students in engineering.

Of the 533 colleges and universities with engineering undergraduate programs, 27 are HBCUs (5 percent). This small group of institutions conferred 17 percent of all engineering bachelor’s degrees earned by Black students in 2016. Four HBCUs were among the top 10 producers of bachelor’s degrees to Black graduates. Seven of the top 10 producers among small sized engineering programs are HBCUs. Because of the large size of several HSIs, the significance of these institutions to educating Hispanic engineers is substantial. Nine percent of the 533 colleges and universities with engineering undergraduate programs are HSIs, 46 institutions. A third of engineering bachelor’s degrees conferred to Hispanic students in 2016 were from a HSI. Six of the top 10 producers for Hispanic students are HSIs, seven of the top 10 medium sized engineering programs are HSIs, and seven of the top 10 small sized engineering programs are HSIs.

States with majority-minority or emerging majority-minority college age population are failing to educate a large enough share of their URG students in engineering.

There are 7 states (including the District of Columbia) where a majority of 18-24-year-olds are URGs: New Mexico (70 percent), Texas (60 percent), California (56 percent), District of Columbia (55 percent), Nevada (53 percent), Arizona (52 percent), and Florida (51 percent). The gap between URG college age populations and URGs engineering graduates ranges from 30-34 percentage points for each state except Florida where the gap is 20 percentage points. Economic implications for these states could be dampened in coming years with large numbers entering the workforce not having degrees in fields such as engineering that are key to economic growth.

There should be a similar concern for the following 17 states where a third to under half of all 18-24-year-olds are URGs: Mississippi (48 percent), Georgia (48 percent), Louisiana (46 percent), Maryland (46 percent), New Jersey (41 percent), Delaware (41 percent), Hawaii (40 percent), New York (40 percent), South Carolina (40 percent), Illinois (39 percent), North Carolina (39 percent), Alabama (38 percent), Oklahoma (38 percent), Alaska (37 percent), Virginia (35 percent), Colorado (34 percent), and Connecticut (34 percent). In these states with large shares of URGs, only 12 percent of engineering graduates in 2015-16 were URGs. The gap between URG college age population and URG graduates in engineering ranges from 21-34 percentage points.
SECTION 1 SUMMARY
ENGINEERING OUTCOMES BY RACE AND ETHNICITY

An analysis of recent trends in conferred engineering degrees presents a mixed story of limited success and significant problems in representation and diversity. Targeted efforts to broaden participation of traditionally underrepresented groups in engineering appear to be bearing fruit. In the most recent five-year period (2010-11 and 2015-16), the change in conferred bachelor’s degrees in engineering outperformed all other major fields of study for each racial and ethnic group, (42 percent), see figure 33. Despite the significant growth among underrepresented groups in only five years, these URGs remain significantly underrepresented in engineering. Most racial and ethnic minority groups were poorly represented both in engineering schools and the engineering profession. Some instances of numerical changes along with large percentage changes are only making small shifts in the diversity of engineering graduates.

The collective representation of Hispanic, Black, American Indian and Native Hawaiian/Pacific Islander students among engineering bachelor’s degree graduates is significantly lower than their overall representation among all college students.

FIGURE 33. Five year percentage change of bachelor’s degrees in engineering, by race and ethnicity: 2010-11 and 2015-16

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2011 and Fall 2016, Completions component. (This table was prepared May 2018).
Hispanic students compose 19 percent of college undergraduates but only 11 percent of all conferred bachelor’s degrees in engineering during 2015-16, a gap of eight percentage points. A similar gap exists among Black students, 13 percent of college undergraduates are Black but only 4 percent of all engineering bachelor’s degrees were conferred to Black students. Although the overall and engineering numbers for AIAN students is very small, they are also significantly underrepresented in engineering; AIAN students made up 0.8 percent of undergraduate enrollment in 2015-16 and earned only 0.3 percent of engineering bachelor’s degrees.

In addition to the continued underrepresentation of all racial and ethnic minorities with the exception of Asian Americans, women across every racial and ethnic group remain greatly underrepresented. Despite receiving the majority of all bachelor’s degrees within each racial and ethnic group, the percentage of degrees in engineering earned by women ranged from 26.8 percent among Multi-Racial graduates to 19.4 percent for White graduates. The gender disparity in 2015-16 engineering bachelor’s degrees conferred is noteworthy because of a number of reasons.

**FIGURE 34. Percentage distribution of engineering bachelor’s degrees, by race and ethnicity: 2015-16**

- **Asian American, 11.3%**
- **Non-U.S. Resident, 9.6%**
- **Multi-Racial, 3.7%**
- **Hispanic, 10.7%**
- **Black, 3.9%**
- **AIAN, 0.5%**
- **NHPI, 0.2%**

**White, 60.8%**

*SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2011 and Fall 2016, Completions component. (This table was prepared May 2018).*
First, Hispanic, Black and AIAN women each earn the majority of bachelor’s degrees in all fields of study but the minority of engineering bachelor’s degrees. The percentage gap between these groups is nearly identical (39 vs. 40 percentage points, respectively). Hispanic women earned 60.5 percent of bachelor’s degrees in all fields conferred to Hispanic graduates but only 21.7 percent of engineering bachelor’s degrees. Black women earned 64.1 percent of bachelor’s degrees in all fields conferred to Black graduates but only 24.9 percent of engineering bachelor’s degrees. AIAN women earned 60.7 percent of bachelor’s degrees in all fields conferred to AIAN graduates but only 20.6 percent of engineering bachelor’s degrees.

Next, the overall share of White graduates earning engineering degrees appears exceptional (61 percent). The 30 percent increase in engineering bachelor’s degrees earned by White graduates from 2010-11 to 2015-16 also appears exceptional in comparison to the lack of percentage change in non-engineering bachelor’s degrees conferred during the same time span. However, White graduates have the largest gender gap with women earning about one out of five bachelor’s degrees in engineering conferred to this group. Among all bachelor’s degrees, White women earned more than half of degrees, 56.3 percent.
Due to the very low representation of women among engineering bachelor’s degree graduates, percentage growth can appear large, but the actual numerical change is small. Further research is needed to understand 1) the continued persistence of this gender disparity and 2) the impact of broadening participation efforts with a focus on closing the gender gap.

Findings at the bachelor’s degree level reveal two stories of URG growth and continued underrepresentation. However, findings at the graduate degree level reveal two distinct stories about continued low diversity (racial and ethnic and gender) and rapid growth among Non-U.S. Resident graduates. The number of master’s and doctoral degrees in engineering conferred to URGs increased from 2010-11 to 2015-16 but had little impact on the diversity of engineering graduates (6.3 percent and 4.9 percent, respectively). Moreover, Hispanic graduates only increased the number of engineering master’s degrees by 542 despite earning 5,000 more engineering bachelor’s degrees in 2015-16 vs. 2010-11. Black graduates earned nearly 1,100 more engineering bachelor’s degrees in 2015-16 vs. 2010-11, but only 65 more engineering master’s degrees in 2015-16.
This trend also applies to White and Asian American Graduates. White graduates earned nearly 15,000 more engineering bachelor’s degrees in 2015-16 vs. 2010-11 but only 417 more engineering master’s degrees. Despite earning nearly 3,100 more engineering bachelor’s degrees in 2015-16 vs. 2010-11, Asian American graduates earned 323 fewer engineering master’s degrees in 2015-16. Further research is needed to understand the continued low representation of most URGs at the graduate level of engineering. Clearly, the lack of diversity in graduate engineering programs is directly related to the lack of diversity in undergraduate programs. However, graduate programs appear to benefit from what success is occurring at the undergraduate level in terms of student diversity.

The other notable story to emerge over the most recent five academic-years of data is the rapid growth among Non-U.S. Resident engineering master’s degree graduates (an increase of 74 percent). In 2015-16, Non-U.S. Resident graduates received a majority of engineering master’s degrees, 58 percent. The shift of this group earning the majority of master’s degrees in engineering between 2010-11 and 2015-16 occurred dramatically and over a relatively short period of time 45.6 percent vs. 58.1 percent (an increase of 12.5 percentage points). The relationship between the rapid growth of Non-U.S. Resident graduates and URGs is a critical topic for further study. In most cases, graduate engineering programs do not provide financial assistance to Non-U.S. Resident students. Therefore, these students provide important talent and revenue that
benefits engineering programs in numerous ways. However, for institutions facing funding challenges, enrolling a full-paying Non-U.S. Resident student may be more financially feasible than a URG enrollee needing financial assistance. Another factor affecting the diversity of graduate engineering programs is the labor market demands for individuals with a bachelor's degree in engineering. As Carnevale, Smith and Melton found, there are significant financial benefits to STEM graduates both in STEM and non-STEM careers, “The growing demand for STEM talent allows and encourages the diversion of students and workers with STEM competencies.” They also noted that, “65 percent of bachelor's degree holders in STEM earn more than master's degree holders.” Moreover, “the earnings gaps are smaller in STEM than in other occupations, and compared with other occupations, women and minorities are better compensated in STEM.” This may lead to URG engineering bachelor's degree graduates finding financially and professionally satisfying employment with only a bachelor's degree.

Hidden within this larger trend of rapid growth of Non-U.S. Resident graduates in engineering is the concentration of these students in electrical and related subdisciplines. In 2015-16, Non-U.S. Resident graduates earned 78 percent of all software engineering master's degrees, 77 percent of all electrical engineering master's degrees, and 77 percent electrical engineering master's degrees. Degrees in these three areas are closely linked to demand in the technology industry of the U.S. and abroad. Demand in some career tracks greatly exceeds supply, leading U.S. companies to need Non-U.S. Resident graduates.

**FIGURE 37. Five year percentage change of doctoral degrees in engineering, by race and ethnicity: 2010-11 and 2015-16**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>2010-11 Percentage</th>
<th>2015-16 Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIAN</td>
<td>-29%</td>
<td></td>
</tr>
<tr>
<td>NHPI</td>
<td>-25%</td>
<td></td>
</tr>
<tr>
<td>Asian American</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Non-U.S Resident</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>Multi-Racial</td>
<td>258%</td>
<td></td>
</tr>
</tbody>
</table>

*Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2011 and Fall 2016, Completions component. (This table was prepared May 2018).*
Similar to the bachelor’s degree level, the gender disparity at the graduate level remains a significant issue. Among U.S. residents, women earn the majority of all master’s degrees, but less than 30 percent of engineering master’s degrees. The worst disparity is among White and NHPI female graduates who earned only 21.4 and 21.7 percent of engineering master’s degrees conferred within their racial group.

Racial and ethnic diversity continues to shrink when examining conferred doctoral degrees in engineering. Only 4.9 percent of engineering doctoral degrees were earned by Hispanic and Black graduates in 2016, see Figure 38. This is after significant increases from 2010-11 to 2015-16, 52 percent among Hispanic graduates and 36 percent among Black graduates, see Figure 37. Although AIAN and NHPI graduates represent a very small number, it is extremely alarming that number of engineering doctoral degrees earned by each group declined significantly from 2011 to 2016, -29 percent for AIAN graduates and -25 percent for NHPI graduates; the only racial and ethnic groups to see a decline in doctoral degrees during this time period.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2011 and Fall 2016, Completions component. (This table was prepared May 2018).
SECTION 2 SUMMARY

ENGINEERING TOP PRODUCERS FOR UNDERREPRESENTED RACIAL AND ETHNIC GROUPS BY INSTITUTION

An analysis of colleges and universities that confer the most engineering bachelor’s degrees to each URG and Multi-Racial student shows a high concentration of degrees earned for these groups in a very small number of institutions. It is important to note that not every college and university in the United States has an engineering program. In 2015-16, 433 colleges and universities conferred at least 10 bachelor’s degrees in engineering. However, among URGs and Multi-Racial students, a small fraction of these institutions conferred a disproportionate majority share of bachelor’s degrees in engineering. The top 10 producers of engineering bachelor’s degrees to Hispanic students also conferred 25 percent of all engineering bachelor’s degrees to all Hispanic graduates. Among Black students, the top 10 producers conferred one out of five engineering bachelor’s degrees to all Black graduates. The top nine producers of engineering bachelor’s degrees conferred to American Indian/Alaska Native (AIAN) students conferred 26.8 percent of all engineering bachelor’s degrees to all AIAN graduates. Among Native Hawaiian/Pacific Islander (NHPI) students, 16 top producers conferred 37.1 percent of engineering bachelor’s degrees to all NHPI graduates. As noted previously, the concentration of URG degree earners at the top producer schools is significantly higher than the overall percentage in certain top subdisciplines.

The proportion of degrees Minority Serving Institutions (MSIs) award to Hispanic and Black graduates shows their significance. Six of the top 10 producers are HSI, seven of the top 10 medium sized engineering programs are HSI, and seven of the top 10 small sized engineering programs are HSI. Among Black engineering graduates, the role of HBCUs cannot be overstated. Despite making up a fraction of the engineering programs at large public universities, four HBCUs were among the top 10 producers of bachelor’s degrees to Black graduates. Seven of the top 10 producers among small sized engineering programs are HBCUs. The importance of HSI and HBCUs as top producers is also noted among various engineering subdisciplines.

Opposite the high concentration of URG students graduating from MSIs and a small number of large predominantly white institutions (PWIs) are a significant number of colleges and universities with little to no diversity among their engineering degree earners at the undergraduate level. As table 43 shows, 156 colleges and universities conferred less than 5 percent of their bachelor’s degrees in engineering to URG students in 2016. Five percent was selected as a benchmark because it is below the halfway mark of the median for most of this size groups.
Many colleges and universities with engineering programs do not confer any degrees to AIAN and NHPI students. Out of 433 colleges and universities with a reasonable size engineering program, 68 percent did not confer any bachelor’s degrees in engineering to AIAN students. The numbers for NHPI students are even worse. Seventy-eight percent of schools with a reasonable size engineering program did not confer any bachelor’s degrees in engineering to NHPI students in 2015-16.

The analysis of the top and low producers of engineering bachelor’s degrees for URG students points to dual narratives about the impact of both national and local efforts to broaden participation in engineering. HBCUs and HSIs are responsible for a disproportionate majority share of engineering bachelor’s degrees conferred to Black and Hispanic students. The data analysis concludes that efforts to broaden participation have minimal impact on non-MSIs. These finding are not to suggest that all previous efforts to increase participation have been ineffective. Many of these efforts are likely to have directly or indirectly contributed to the large number of Hispanic and Black engineering graduates from HSIs and HBCUs. However, the data reveals that the impact on non-MSIs may be isolated to a small number of colleges and universities. Based on these findings, future efforts at the postsecondary level to increase diversity in engineering should be better structured to address specific issues and challenges; such as increased funding to HBCUs and HSIs to allow them to further expand upon their success in graduating engineers from URGs and a greater focus upon and effort at the colleges and universities that graduate almost no URG students in engineering.

Table 43. Colleges/Universities by number of engineering bachelor’s degrees conferred and level of racial and ethnic diversity indicators: 2015-16

<table>
<thead>
<tr>
<th>Number of Engineering Bachelor’s Degrees Conferred to All Students: 2015-16</th>
<th>Number of Colleges/Universities</th>
<th>Average Number of Engineering Bachelor’s Degrees Conferred to URG Students</th>
<th>Median Percentage of Engineering Bachelor’s Degrees Conferred to URG Students</th>
<th>Number of Colleges/Universities that conferred less than 5 percent of their Engineering Bachelor’s Degrees to URG Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 to 2,141</td>
<td>16 institutions</td>
<td>152</td>
<td>10%</td>
<td>0 institutions</td>
</tr>
<tr>
<td>600 to 999</td>
<td>28 institutions</td>
<td>85</td>
<td>8%</td>
<td>2 institutions</td>
</tr>
<tr>
<td>200 to 599</td>
<td>130 institutions</td>
<td>60</td>
<td>11%</td>
<td>13 institutions</td>
</tr>
<tr>
<td>100 to 199</td>
<td>80 institutions</td>
<td>22</td>
<td>11%</td>
<td>14 institutions</td>
</tr>
<tr>
<td>10 to 99</td>
<td>179 institutions</td>
<td>8</td>
<td>10%</td>
<td>49 institutions</td>
</tr>
<tr>
<td>Less than 10</td>
<td>121 institutions</td>
<td>1</td>
<td>0%</td>
<td>78 institutions</td>
</tr>
</tbody>
</table>

Most of these schools are smaller engineering schools or programs that awarded less than 100 degrees to all groups combined. Therefore, any increase in the diversity at these schools would have a minimal impact on the overall number of engineering degrees earned by URM students. Nevertheless, understanding both the concentration of URM students in a small number of schools and the extremely low representation of URM students in a significant number of schools provides important details to understanding the problem of low representation of URM students in engineering nationally and where the opportunities exist to broaden participation in engineering.

Many colleges and universities with engineering programs do not confer any degrees to AIAN and NHPI students. Out of 433 colleges and universities with a reasonable size engineering program, 68 percent did not confer any bachelor’s degrees in engineering to AIAN students. The numbers for NHPI students are even worse. Seventy-eight percent of schools with a reasonable size engineering program did not confer any bachelor’s degrees in engineering to NHPI students in 2015-16.

The analysis of the top and low producers of engineering bachelor’s degrees for URG students points to dual narratives about the impact of both national and local efforts to broaden participation in engineering. HBCUs and HSIs are responsible for a disproportionate majority share of engineering bachelor’s degrees conferred to Black and Hispanic students. The data analysis concludes that efforts to broaden participation have minimal impact on non-MSIs. These finding are not to suggest that all previous efforts to increase participation have been ineffective. Many of these efforts are likely to have directly or indirectly contributed to the large number of Hispanic and Black engineering graduates from HSIs and HBCUs. However, the data reveals that the impact on non-MSIs may be isolated to a small number of colleges and universities. Based on these findings, future efforts at the postsecondary level to increase diversity in engineering should be better structured to address specific issues and challenges; such as increased funding to HBCUs and HSIs to allow them to further expand upon their success in graduating engineers from URGs and a greater focus upon and effort at the colleges and universities that graduate almost no URG students in engineering.
SECTION 3 SUMMARY

DIVERSITY AND EQUITY IN ENGINEERING BY STATE - SUMMARY

As referenced in the earlier chapters of this report, an examination of diversity in conferred engineering bachelor’s degrees by state provides greater insight into frequently held discussions at the national or institutional level. The range of inequity across nearly every state demonstrates the lack of underrepresented groups in engineering is an alarming problem throughout the country but the implications may vary. States in the first and second quartiles, where the gaps are the greatest, may experience stifled economic growth and innovation due to the lack of diversity in engineering bachelor’s degrees and the college age population (18 to 24-year-olds). Closer analysis reveals several states where demographic shifts and limited diversity in graduating engineers will lead to an insufficient supply of engineers which will prevent these states from meeting labor demands in fast-growing technology industries and non-technology industries desiring engineering skills.

Led by New Mexico there are seven states (including the District of Columbia) where a majority of 18 to 24-year-olds are URGs: New Mexico (70 percent), Texas (60 percent), California (56 percent), District of Columbia (55 percent), Nevada (53 percent), Arizona (52 percent), and Florida (51 percent). The gap between URG college age population and URG graduates in engineering ranges from 30 to 34 percentage points for each of these states except Florida (20 percentage point gap). The economic implications for these states could be devastating in the coming years as a majority of those entering the workforce do not have degrees in a field that is key to economic growth and innovation.

There should also be a similar concern for the following seventeen states where approximately one-third to just under half of all 18 to 24-year-olds are URGs: Mississippi (48 percent), Georgia (48 percent), Louisiana (46 percent), Maryland (46 percent), New Jersey (41 percent), Delaware (41 percent), Hawaii (40 percent), New York (40 percent), South Carolina (40 percent), Illinois (39 percent), North Carolina (39 percent), Alabama (38 percent), Oklahoma (38 percent), Alaska (37 percent), Virginia (35 percent), Colorado (34 percent), and Connecticut (34 percent). Although these states have a very large share of URGs, on average only 12 percent of engineering graduates in 2015-16 were URGs. The gap between URG college age population and URGs graduates in engineering ranges from 21 to 34 percentage points.
These states are not devoid of institutions with considerable numbers of URG engineering graduates. On the contrary, a comparison of these high URG states to top producers of engineering graduates shows a direct correlation between URG college age population and URG engineering graduates (chapter 2). The data analysis shows that states with high URG populations are also likely to have institutions with a large number of URGs earning bachelor’s degrees in engineering. However, the contributions of a small number of top producers in each state cannot make up for the widespread underrepresentation of URGs in engineering programs. The state analysis moves beyond a focus on single institutions to reveal that the severe underrepresentation of most minority groups is a result of issues at every level of education. This fact is not simply an issue of equity and fairness, but one of economic viability for state and local economies and ultimately for the nation as the changing nature of the U.S. economy demands a workforce with technology skills. If the new majority population in these states are not academically prepared to enter college and study engineering, and if they are not recruited and retained in engineering programs, then the economic impact to the state and nation will be extreme and detrimental.
CONCLUSION

As this report has documented, the overall number of engineering degrees conferred from 2011 to 2016 at each degree level continues to increase, with major increases for Hispanic and Black students. However, the increases in engineering degrees among URM groups is not enough to close the gap in nearly every state between the share of engineering degrees and their representation in the college-age population of the state. What once was primarily an issue of equity and equal opportunity is now an issue of economic vitality and national security. Broadening diversity in engineering is necessary to meet the demands by employers for more workers in the U.S. with the scientific and innovation skills necessary for the tech-sectors driving economic growth. The goal is not to redistribute engineering degrees to better reflect the demographics of the nation. Rather the goal is to produce enough graduates to fill the expanding needs of employers for a high-skill workforce. The only way to reach that goal is to increase the number of women and URM students in engineering at a significantly higher rate than recent years.

As discussed in Section 1 of this report, a 30 percent increase in the number of bachelor’s degrees in engineering earned by White students from 2011 to 2016 accounted for about half of the overall growth in bachelor’s degrees in engineering (14,769 out of 30,864). In 2016, White males earned half of the bachelor’s degrees in engineering conferred by U.S. colleges and universities. Continued growth in the number of engineering degrees conferred in the U.S. can no longer rely on continued growth in the number of White students because of declines in the number of White students at the K-12 level. The impact of the decline in White students graduating from high school is already being felt in higher education overall. As noted earlier, since 2010, the number of White students enrolled in four-year colleges and universities has declined by 8 percent.

If the current five-year trend in the increase of engineering bachelor’s degrees remained the same for each group, by 2026, about 223,000 bachelor’s degrees in engineering would be conferred to U.S. residents from all groups, more than doubling the total conferred in 2016. However, if the number of White students earning bachelor’s degrees in engineering stops increasing over the next decade, like the current trend among all non-engineering degrees, the number of engineering bachelor’s degrees conferred to U.S. residents will only increase by 44,000 degrees. Depending on how the growth in engineering degrees is distributed across the high demand engineering subdisciplines, the potentially low supply of engineers will be detrimental at both the local and national level.

This study does not recommend specific strategies for increasing the number of engineering degrees conferred to URGs because the report does not examine the impact of various URG-focused recruitment and retention efforts. However, the national, state and institutional analysis in this report provides a better understanding of where to focus efforts based on the recent trends in degrees conferred. For maximum impact on the number of engineering degrees conferred to URGs, efforts should be focused on two specific groups of institutions: 1) HBCUs and HSIs and 2) universities with large engineering schools (primarily land-grant universities and large public universities).
HBCUs and HSIs show an impact on the diversity of engineering that far exceeds the number of institutions that are HBCUs and HSIs. Additional support and attention should be pointed toward these colleges and universities that are succeeding in graduating many students from URGs. The majority of HBCUs and some HSIs are majority-minority institutions that have a majority of students from lower socioeconomic status. Increased financial and institutional support from both government and industry will allow these institutions to enroll and graduate more URG students in engineering.

At universities with large engineering schools, a small percentage increase in URG graduates will have a major impact on the overall number URG engineering graduates. Most of these universities have significant URG enrollment outside of engineering. Among White, Hispanic and African American females, engineering was the eighteenth largest field of study, based on bachelor’s degrees conferred in 2016. Among Hispanic males, engineering was the fourth largest field of study and it was ranked tenth among African American males. Engineering was the second largest field of study among White and Asian American males. We see that even when URG students are on a campus they are less likely to major in engineering. Strategies and initiatives must be implemented to increase enrollment, retention and graduation of URGs in engineering.

Although the needs vary, evidence-based and innovative strategies are needed to assist both HBCUs, MSIs and universities with large engineering schools in significantly increasing their engineering graduates from URGs. In fall 2018, APLU launched two initiatives that are examples of how some broader focused efforts can also impact diversity in engineering. Funded by NSF, the ASPIRE Alliance is aimed at diversifying the nation’s STEM college educators and grounding them in inclusive teaching practices. The ultimate goal in diversifying STEM faculty is to attract more URG students into STEM fields and help them graduate and be successful in the STEM workforce.

The second initiative is APLU’s Powered by Publics, which is convening 130 change-ready institutions within 16 “transformation clusters.” Each cluster will focus on solving different pieces of the student success puzzle as public universities work together to tear down long-standing barriers, eliminate the achievement gap, and produce hundreds of thousands of additional degrees. The focus is university-wide and not discipline specific, but strategic efforts to improve retention across each institution should also impact retention gaps that exist within engineering.

Higher education must also collaborate with various stakeholders who can provide a greater reach into URG communities. One example involving several organizations is the 50K Coalition, which was launched by the National Society of Black Engineers (NSBE) and includes partnerships with other engineering organizations such as the American Indian Science & Engineering Society (AISES), the Society of Hispanic Professional Engineers (SHPE) and the Society of Women Engineers (SWE). NSBE set a goal of 50,000 diverse engineering graduates by 2025. In 2016, nearly 28,500 bachelor’s degrees in engineering were conferred to URM students and White females, an increase of 10,000 degrees over the previous five years. To reach the 50,000 goal by 2025, the rate of growth must increase significantly. Like the 50K Coalition, efforts are needed to address academic and financial factors for both K-12 and higher education.