Talent Development

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Roadmap

- Current & future industrial & educational landscapes
- Educational ecology
  - Recruit, retain, engage
  - NC case
- Comments/Contact
Current Nuclear Landscape

• 2nd largest source of low-carbon power globally (26% of the total in 2020)

• Global: 436 power reactors | 57 reactor construction | 220 research reactors

• U.S.: 92 reactors | 37 nuclear engineering programs (stand alone/within a department) | 1132 graduates: 622 BS, 316 MS, 194 PhD (ORISE, 2019)

• Nuclear energy supply chain challenges & opportunities
  • Sustain & grow based on our current fleet & advanced reactor technology

• Non-energy footprint: medical & industrial isotopes, sea-land-space propulsion, co-generation

• Nuclear science & technology is tackling the quality of planetary life & exploring new worlds. (UN Sustainable Development Goals, NAE Grand Challenges, ANS Nuclear Grand Challenges)
Forecasted Energy Growth

By 2050, global energy use increases nearly 50%, driven by non-OECD economic growth and population.

Do we have the workforce for these numbers?

https://www.eia.gov/outlooks/ieo/
STEM jobs have grown faster than non-STEM jobs since 2010.

However, this projected growth may be unevenly distributed across the U.S.

In 2019, out of the total workforce in each state, a greater proportion of STEM workers with a bachelor’s degree or higher were employed in coastal states and the Midwest region.

Whereas a greater proportion of the skilled technical workforce (STW) were employed in states in the South and the Midwest regions.

Higher Education in Science and Engineering

NSB-2022-3
S&E Degrees by Level

Degrees in S&E fields

- Associate's degrees
- Bachelor's degrees
- Master's degrees
- Doctoral degrees

2000 vs. 2019
Figure HED-5

S&E technologies associate's degrees awarded, by field: 2000–19

- Engineering technologies
- Health technologies
- Science and other S&E technologies
Figure HED-7
Certificates awarded for selected levels and fields, by institution type: 2019

- Associate's colleges
- Special focus 2-year institutions
- Mixed baccalaureate/associate's colleges
- All other institutions

Number

- Health technologies
- Engineering technologies
- Science and other S&E technologies
- S&E
S&E Bachelor’s Degrees

Figure HED-8

S&E bachelor's degrees awarded, by field: 2000–19

- Biological and agricultural sciences
- Computer sciences
- Mathematics and statistics
- Physical sciences
- Engineering
- Psychology
- Social sciences
S&E Graduate Degrees

Figure HED-9
S&E master's degrees awarded, by field: 2000–19

Figure HED-11
S&E doctoral degrees awarded, by selected field: 2000–19
In 2019, across all degree levels, women earned higher shares of degrees in earth, atmospheric, and ocean sciences (42%) and physical sciences (39%) than they did in engineering (24%) and mathematics and computer sciences (28%). They also earned 57% of the degrees awarded in agricultural sciences.

In the rapidly growing but still male-dominated field of engineering, women's share of total bachelor's degrees increased from 19% to 23% from 2011 to 2019.

S&E associate's degrees earned by Hispanics tripled from 2011 to 2019 as they increased their share from 13% to 30%. Asians more than doubled their earned S&E associate’s degrees and increased their share from 5% to 9%. There was much slower growth for Blacks (3%) and Whites (3%), and both dropped in their shares of S&E associate’s degrees earned. American Indians or Alaska Natives earned fewer S&E associate’s degrees in 2019 than they did in 2011.

In 2019, Hispanics constituted 21% of the U.S. population ages 20–34 (a typical age range for higher education degree earners) but earned 16% of the S&E postsecondary degrees awarded that year across all degree levels. Blacks constituted 14% of the U.S. population ages 20–34 years but earned 9% of S&E degrees awarded. American Indians or Alaska Natives were 0.8% of the U.S. population and earned 0.4% of all S&E degrees awarded. Asians constituted 7% of persons ages 20–34 and earned 11% of total S&E degrees conferred across all degree levels in 2019, while Whites constituted 54% of this age group and earned 58% of S&E degrees.

• U.S. high school graduation rates have been rising steadily, reaching 85% in 2018 (Hussar et al. 2020).

• Although high school completion represents a major milestone for adolescents, most of today’s fastest-growing, well-paying jobs—especially those in STEM fields—require at least some postsecondary education, including the attainment of nondegree credentials (Carnevale et al. 2020; NASEM 2017; NSB 2019).

• In school year 2019–20, the U.S. average adjusted cohort graduation rate (ACGR) for public high school students was 87 percent, the highest it has been since the rate was first measured in 2010–11 (79 percent).
  - Asian/Pacific Islander students had the highest ACGR (93 percent), followed by White (90 percent), Hispanic (83 percent), Black (81 percent), and American Indian/Alaska Native (75 percent) students.

• COVID impact: In late August 2021, some 16 percent of adults 18 years old and over who had household members planning to take postsecondary classes in fall 2021 reported that all plans to take classes in the fall had been canceled for at least one household member. The most frequently cited reason they reported for the cancellations was not being able to pay for classes/educational expenses because of changes to income from the pandemic (48 percent).
Ecology of Nuclear Engineering Education

• Students can choose any discipline
• Why STEM? Engineering? Why nuclear engineering?
  • Lies in the messaging, mentoring, milestones
  • Ecology versus pipeline
  • People, Policies & Practices
  • Cost-benefit analysis
• National-State-Industry Partnerships...
NC, an example

- The CHIPS and Science Act to upgrade university infrastructure and assist with the commercialization advanced reactors
- House Bill 951, Energy Solutions for North Carolina
- Senate Bill 678, Promote Clean Energy
- Professional organizations @ state, national & international levels e.g., ANS Navigating Nuclear
- College-level enrolments: early college/dual enrolment
  - Financial assistance & experiential learning needed to attract and retain
  - Increase of engineering enrolment by 4000 for NC State University
- NC State College of Engineering/Department of Nuclear Engineering
  - Teaching & research reactor, reactor simulator, modeling & simulation
  - Co-curricular programming: internships, co-ops, externships, study abroad, REUs, industrial senior design projects + funding → nuclear engineering identity
  - Attention to alumni & early-mid professionals e.g., inaugural IAEA Lise Meitner Program
References

• World Nuclear Association
• Nuclear Engineering Department Head Organization, NEDHO
• UN Sustainable Development Goals, NAE Grand Challenges, ANS Nuclear Grand Challenges
• International Energy Outlook 2021
• US DOE “Nuclear Energy Supply Chain Deep Dive Assessment”, 2022; response to Executive Order 14017
• NSF National Science Board, State of U.S. Science and Engineering, 2022
• National Center for Education Statistics (NCES). Public High School Graduation Rates, 2023
• ANS Navigating Nuclear
• NC State University, Department of Nuclear Engineering, www.ne.ncsu.edu
  • Fact sheet
Comments/Contact

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