

Oregon's Semiconductor Workforce:

Harnessing Workforce Education and Training Investments to Prepare Oregonians for Equitable Prosperity

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Supporting the Workforce Needs of Oregon's Growing Semiconductor Industry

Oregon's semiconductor workforce, one of the largest in the nation, is poised for significant growth over the next decade.

According to the [August 2022 Seizing Opportunity report of Oregon's Semiconductor Competitiveness Task Force](#), the state is "home to 15 percent of the national semiconductor workforce." Findings from the Oregon Employment Department (OED) indicate that semiconductor and electronic components manufacturing currently employs more than 34,000 Oregonians—accounting for nearly one out of every six manufacturing jobs (17.6 percent of Oregon's total manufacturing employment).

"Semiconductor industry expansion presents Oregon with an extraordinary opportunity to intentionally create the kind of jobs and investment the state needs for us to emerge from the pandemic with a stronger, more deliberately equitable economy."
- [Seizing Opportunity: Initial Report and Subcommittee Findings. Oregon Semiconductor Competitiveness Task Force \(August 2022\)](#)

In July 2022, Congress passed the \$52 billion CHIPS Act to promote semiconductor manufacturing and design in the United States. The *Seizing Opportunity* report indicates that, with the injection of CHIPS funding, the state's semiconductor workforce could increase by more than 10,000 jobs. Significantly, Oregon workers in semiconductor and other electronic component manufacturing positions earn wages averaging \$161,584 annually—nearly two and a half times as much as the average statewide wage of \$65,389, according to 2022 data from the OED. Furthermore, many of these new, good-paying jobs will be accessible through short-term education and training pathways.

This brief introduces Oregon's semiconductor talent landscape and highlights recent statewide efforts among public institutions and partners. **These are highlights and not intended as a comprehensive catalog of activity; contact the institutions directly for more information on their programs.** In spring 2023, the Higher Education Coordinating Commission (HECC) convened industry and education partners to inform a **comprehensive Semiconductor Talent Assessment that will guide strategic investment and collaboration.** This more thorough assessment is expected to be complete in September 2023 and will review Oregon's current semiconductor talent profile, identify critical short- and long-term industry needs, and analyze the current capacity of Oregon's postsecondary institutions and workforce education and training providers to address gaps and seize opportunities.

Oregon's Leaders Are Investing in Collaborative and Innovative Approaches to Workforce Education and Training

As the agency working to improve equitable access to and success in higher education and workforce training statewide, Oregon's Higher Education Coordinating Commission (HECC) is well positioned to support Oregonians on their journey to meaningful careers within the semiconductor industry. The HECC envisions a future in which all Oregonians—especially those whom our systems have underserved and marginalized—benefit from the transformational power of high-quality postsecondary education and training. This work is anchored in an [Equity Lens](#) that guides efforts to improve outcomes for historically underserved populations. The HECC supports and administers several initiatives that equip community-based organizations, educational programs, and employers to prepare individuals for employment in the high-tech and manufacturing sectors that encompass semiconductor manufacturing and design.

The HECC [Office of Workforce Investments \(OWI\)](#) deploys funds for a variety of resources, programs, initiatives, and activities that are focused on skill attainment, work-related training, wraparound supports, and employment opportunities. OWI administers these funds through sub-grants to local workforce development boards and other partners, who prioritize these resources for regionally identified in-demand occupations and industry sectors.

Manufacturing is a priority sector in every workforce region in Oregon, while technology is a priority in five of the nine workforce regions (see Targeted Industry Sectors map).

The [Workforce and Talent Development Board \(WTDB\)](#), which advises the Governor on workforce matters, comprises leaders representing business, labor, local workforce development boards, community-based organizations, the Oregon Legislature, local government, and state agencies. As the Governor's core advisor for the interconnection and alignment of education, training, and workforce development in order to realize equitable prosperity for all, the WTDB's primary functions are gathering, analyzing, and reporting on current issues and future trends to guide and shape workforce strategy and policy development for Oregon. This body of work includes a series of talent assessments, including the forthcoming Semiconductor Talent Assessment.

Local Workforce Development Boards



Future Ready Oregon is Well Positioned to Support Investments in the Semiconductor Workforce

In early 2022, the Oregon Legislature committed to supporting the educational and training needs of Oregonians through passage of Oregon Senate Bill 1545, also known as [Future Ready Oregon](#). This comprehensive \$200 million investment package advances equity in education and training, connecting Oregonians from historically underserved priority populations* to good-paying jobs in the technology, manufacturing, and healthcare sectors. Future Ready Oregon emphasizes a multifaceted approach to equitable prosperity through inclusive, culturally specific, and linguistically appropriate career-connected learning, employment services, and related initiatives.

- **Workforce Ready Grants**, which represent a \$95 million investment, are available to community-based and culturally specific organizations, along with workforce service providers. They fund the creation and expansion of education and training programs in the key sectors of technology, manufacturing, and healthcare; expand the capacity of organizations to provide workforce development services; and provide direct benefits and wraparound supports to individual jobseekers.
- Implementation of Future Ready Oregon will be informed by the convening of three statewide [Industry Consortia](#) representing the technology, manufacturing, and healthcare industry sectors. Industry Consortia will provide a forum for convening industry, education, and community partners to better understand the state's sector-specific workforce needs, identify education and training programs and career pathways, and recommend strategies to address gaps and opportunities.
- **Workforce Benefits Navigators** will be available in communities across the state to help individuals efficiently access the resources that match their unique needs and explore programs and benefits available for workforce education and training.

**Priority populations include communities of color, women, low-income communities, rural and frontier communities, veterans, persons with disabilities, incarcerated and formerly incarcerated individuals, members of Oregon's nine federally recognized Tribes, older adults, and individuals who identify as members of the LGBTQ+ community.*

Training for Oregon's semiconductor workforce begins in K-12, with support from recent statewide STEM- and career-oriented education initiatives.

In 2013, the Oregon Legislature established [Oregon's STEM Investment Council](#) and charged it with "doubling the percentage of students in the 4th and 8th grades who are proficient or advanced in math and science by 2025." Oregon's [Regional STEM Hub Network](#), established two years later, includes 13 Regional STEM Hubs covering all counties in Oregon, aims to improve student participation and outcomes in STEM education and Career and Technical Education (CTE), and increase the number who enter high-wage, high-demand STEM professions. The [Oregon CTE State Plan](#) integrates state and federal priorities into a plan for the Strengthening Career and Technical Education for the 21st Century Act by leveraging ongoing partnerships and identifying actionable strategies. The CTE State Plan focuses on supporting schools and colleges in serving underserved and marginalized students and families with equitable access to CTE programs.

Oregon's Semiconductor Education and Training Programs Are Advancing Opportunities for a Diverse Workforce

Oregon is home to 17 community colleges and seven public universities. Many of these institutions offer coursework, work-based learning, and research in semiconductor-related fields such as microelectronic and mechatronic engineering and technology, industrial mechanics, chemistry, and computer science. Oregon's education and training programs expand equitable opportunities for a diverse workforce and advance Oregon's economic competitiveness, providing short-term pathways to meaningful employment, higher earning potential, and opportunities for economic mobility. **The highlights here are not intended to be a comprehensive list of programs; please contact the institutions directly on their offerings.** Oregon postsecondary institutions support student success in many ways which often include:

- Career and technical education certificate and degree programs, along with transfer options, that open pathways to both further education and a variety of jobs, from entry-level positions to advanced careers;
- Partnerships with employers, community-based organizations, workforce service providers, and public agencies, which help ensure direct access to industry-informed training, internships, and job opportunities;
- Hands-on training, often using state-of-the-art technology;
- Culturally appropriate wraparound services that support a more diverse student body, and in turn, advance a more diverse workforce;
- Pathways for students to successfully transfer between programs at different institutions that maximize credits toward their degrees and certificates; and
- Many institutions offer a range of [Credit for Prior Learning \(CPL\)](#) opportunities as a way to obtain credit for evidence-based assessment of learning that occurs outside of traditional college-level coursework.

Oregon's approach to equitable prosperity aims to provide diverse jobseekers with culturally and linguistically relevant career-connected learning and employment services, connecting businesses to the skilled labor they need for growth.

PROGRAM HIGHLIGHTS: *City of Hillsboro Advanced Manufacturing Workforce Partnership & Youth Apprenticeship*

The Hillsboro Advanced Manufacturing Workforce Partnership (HAMWP) brings together the Hillsboro School District, Portland Community College, workforce service providers, and community-based organizations to expand access to training opportunities that provide pathways to direct employment, create culturally and linguistically relevant career mapping, and launch a campaign promoting careers in advanced manufacturing. The City is building capacity through investments that support a strong workforce ecosystem, including an aligned talent pathway informed by industry, community engagement to support priority populations, and advocacy and awareness of the manufacturing sector.

- Hillsboro Advanced Manufacturing Workforce Partnership 2022 Annual Report

Several of **Oregon's community colleges** prepare students for positions in the semiconductor industry through a range of certificates and degree programs, as well as through a variety of partnerships. Highlights include:

- [Columbia Gorge Community College \(CGCC\)](#) prepares students for careers in renewable energy and engineering fields through its Electro-Mechanical Technology (EM) associate degree. CGCC's Technology and Trades programs, like advanced manufacturing and fabrication, support employers reliant on and supporting the semiconductor industry. The EM and Technology and Trades programs teach portable skills to advance within and beyond this industry. CGCC belongs to the [Gorge Technology Alliance](#), an innovative partnership supporting technology, industry, and workforce across the bi-state Columbia Gorge region.
- [Klamath Community College](#) offers an associate degree and certificates in Computer Engineering Technology.
- [Linn-Benton Community College](#) offers an Industrial Building Mechanic certificate; Green Technician and Mechatronics: Industrial Refrigeration certificate; and associate degrees in Mechatronics and Industrial Automation Technology.
- [Mt. Hood Community College \(MHCC\)](#) offers certificates in Mechatronics specializing in Maintenance or Industrial Automation and associate degrees in Mechatronics, Engineering Technology, and Engineering (Transfer). MHCC is collaborating with Microchip and onsemi for several workforce training programs that include paid internship and mobile trainings.
- [Portland Community College \(PCC\)](#) offers a certificate in Mechatronics and associate degrees in Microelectronics Technology and Mechatronics, Automation, and Robotics Engineering Technology; PCC's OMIC Training Center and Willow Creek Center provide customized incumbent worker training programs. PCC's non-credit workforce training, including Discovery Courses, teaches career/college readiness in the context of industry sectors. One such course is Advanced Manufacturing, with entry-level training in the semiconductor industry.
- [Rogue Community College](#) offers certificates and/or associate degrees in Electronics Technology, Electronics Technician, Electrician Apprenticeship Technologies, Manufacturing/Engineering Technology, High Technology, Computer Hardware/Embedded Systems, and Computer Science Software Engineer Technology. These programs support building foundational electrical, electronics, and manufacturing skills that are needed to design, build, and test semiconductors. This includes knowledge of systems, storage, programming, design, materials, and specialized tools in the manufacturing process.

PROGRAM HIGHLIGHTS: COLLABORATIVE AND INNOVATIVE APPROACHES TO EDUCATION AND TRAINING

MHCC: Mobile Training Project

MHCC provides workforce training opportunities for incumbent workers and jobseekers in introductory mechatronics classes and provides wraparound support for participants through student resource specialists, strengthening job attainment, retention, and promotion. With support from a Future Ready Oregon grant, MHCC is creating a mobile teaching lab that will provide onsite training for incumbent workers at local manufacturing businesses. Industry experts collaborate with college faculty to deliver trainings.

PCC: Intel Quick Start Semiconductor Technician Paid Training Program

PCC is partnering with Intel, Worksystems, Inc., and the City of Hillsboro to help deliver the Intel Quick Start semiconductor training program in Washington County. This short-term, entry-level training program intentionally recruits from culturally based organizations, and advances entry-level career opportunities for women and people of color. Participants receive a \$1,000 training stipend and the program expects to train 150 participants through June 30, 2023. All completers of each QuickStart cohort are guaranteed an interview with Intel. Students can then transition with wraparound support into certificates and associate degrees.

Oregon's public universities offer a number of semiconductor-relevant programs at the undergraduate and graduate level and partnerships. **The public universities have each provided the following highlights of semiconductor-related programs and activity.**

- [Eastern Oregon University \(EOU\)](#) offers a Chemistry degree that includes coursework introducing students to the chemistry of semiconductors. Interested students have the opportunity to gain research experience and explore the structure/property relationships in semiconductors based on the synthetic conditions. Students gain experience with sol-gel synthesis, spin coating, four-point resistivity and Seebeck measurements, x-ray diffraction, and scanning electron microscopy.
- The [Oregon Institute of Technology \(Oregon Tech\)](#) offers a variety of Engineering programs that include coursework in semiconductor devices, semiconductor device physics, semiconductor process engineering, and embedded systems engineering technology. The university also participates in the [Multiple Engineering Cooperative Program](#)—a robust, hybrid educational and industry experience for university engineering students. The program enables participants to take seminars and engage in two six-month internships with partners from businesses, cities, and community-based organizations across Oregon. Oregon Tech also partners with high schools and community colleges to prepare students to transfer to the university's bachelor programs at its Klamath Falls and Wilsonville campuses.
- [Oregon State University's \(OSU's\)](#) College of Engineering is the 7th largest engineering college in the nation for undergraduate enrollment. In fall term 2022, the college enrolled 9,132 undergraduates, 685 master's degree students and 528 doctoral students. In 2022, OSU awarded 2,247 computer science degrees, the most of any college or university in the nation. OSU is a national leader in training data analysts, artificial intelligence scientists, circuit designers, and materials, device, and software developers vital to the semiconductor industry. OSU has research and innovation partnerships with multiple firms in the semiconductor industry, including Intel, HP, NVIDIA, and Lam Research. Related special projects underway include the development of the \$213 million [Jen-Hsun and Lori Huang Collaborative Innovation Complex](#) (which will include an NVIDIA supercomputer and state-of-the-art clean room, and will also be the hub for OSU's efforts to diversify the STEM pipeline); [spearheading of a \\$1M National Science Foundation Regional Innovation Engine development award](#) in partnership with over 20 public sector, industry, and academic partners; joining over 200 institutions and over 1,500 SEMI member companies that are advancing the [American Semiconductor Academy Initiative & SEMI](#) project, which is focused on the U.S. semiconductor talent pipeline; and serving as a founding member in [Micron's Northwest Semiconductor Network](#), which establishes a core group of universities to address the full

technical needs and demands of the industry and expand STEM access to underrepresented students, including women, people of color, and Indigenous and rural communities. OSU's work is guided by a [Semiconductor Strategy Advisory Committee](#) that is focused on identifying and advancing initiatives that capitalize on federal and industry calls related to CHIPS, in collaboration with industry and government partners. OSU is currently leading or participating in over 20 proposals that range from [internal efforts to expand semiconductor-related curricula via various modalities and levels \(onsite, online, undergraduate, graduate\) to proposals seeking to advance research in areas critical to the industry such as lithography, electronic materials science, and chip cooling](#). OSU's depth of experience is supported by the state's two-decade investment in Oregon's public engineering and computer science programs. These funds have [transformed engineering programs](#), supported innovation, and significantly increased the diversity of graduates in STEM fields.

- [Portland State University \(PSU\)](#) provides an engaged, diverse workforce for Oregon's semiconductor industry. PSU graduates work across the semiconductor enterprise: in fabrication, in the research laboratory, in the administrative offices, and in the boardroom. The university offers undergraduate and graduate degrees as well as certificates across a range of programs. These include Physics (Applied Physics, Nano & Materials Track, etc.), Computer Science (AI/ML, security, software), Electrical Engineering (Embedded Systems, Analog, RF & Microwave Circuits), Material Science, Engineering Management, and business degrees in a range of key services. Over 45 percent of undergraduates are students of color and nearly 60 percent are women. Eighty percent of PSU students are from Oregon. In 2023, PSU graduated over 5,500 students, with nearly 600 engineering graduates. PSU is also home to numerous state-of-the-art facilities and multi-university collaborations that support faculty research efforts related to semiconductors. Learn more at pdx.edu/semiconductors
- The Chemistry Department at [Southern Oregon University \(SOU\)](#) prepares undergraduates to enter the semiconductor job market with a B.S. in Chemistry. SOU's American Chemical Society-accredited curriculum includes core concepts and scientific principles related to semiconductors. Over the past seven years, 13 SOU undergraduate research students have been mentored in the specialized field of cationic aluminum-oxyhydroxide clusters. These aluminum nanoscale clusters have been proven to be environmentally friendly and effective precursors to create dense, defect-free aluminum oxide thin-films, which are extremely relevant to the semiconductor industry. SOU is also actively conducting research with five students on liquid crystal organic photovoltaics via the monetary support of a Providing Research Infrastructure in Space and Materials Sciences grant.
- [University of Oregon \(UO\)](#) supports research expertise, facilities, and programming needed to recruit diverse students and connect them with semiconductor and advanced manufacturing industries. The [Oregon Center for Optical, Molecular, and Quantum Science](#) seeks to promote and facilitate research and education that directly advance fundamental science and technology applications related to semiconductor technologies. The [Materials Science Institute \(MSI\)](#) facilitates leading-edge research in polymers, synthetic chemistry, and advanced materials. On average, 10-15 Ph.D. students trained in MSI are placed in the semiconductor field. Faculty in the [Knight Campus for Accelerating Scientific Impact](#) advance research at the intersection of hard and soft materials, with implications for biotechnology, semiconductors, and human health. UO's Knight Campus houses the state's first public Class 1000 cleanroom to support the fabrication of next-generation micro- and nano-scale devices on traditional semiconductor substrates as well as soft materials. Established in 2010 through state investment, [CAMCOR](#) is a full service, comprehensive materials characterization center that serves as a national resource for researchers, a training ground for students, and industry partnership for unique instrumentation. UO confers roughly 1,000 STEM undergraduate degrees annually and is number 1 in the nation in applied Physics master's degrees and number 5 in Applied Chemistry master's degrees. The [Knight Campus Graduate Internship Program](#) is an accelerated master's program with a nine-month paid internship. Tracks include Photovoltaics and Semiconductors, Polymer Science, Optical Materials & Devices, and more. On average, 25 program graduates are placed annually in the semiconductor field.
- [Western Oregon University's \(WOU's\)](#) Computer Science, Information Science, Data Analytics and Math-Computer Science programs can support semiconductor development and the semiconductor industry in several ways. Research and innovation at WOU can contribute to advancements in areas such as materials science, circuit design, and computational modeling. WOU can also provide education and training programs that equip students with the knowledge and skills necessary for careers in the semiconductor industry. WOU's computer science program can offer specialized courses in areas such as integrated circuit design, semiconductor physics, and device modeling. In addition, WOU's programs can provide a pipeline of talented graduates who are well-versed in programming, algorithms, data analysis, and other relevant skills.
- Oregon Tech, OSU, and PSU are members of the [Oregon Manufacturing and Innovation Center \(OMIC R&D\)](#). Oregon Tech also serves as the operational host of the facility. OMIC R&D is a collaboration of industry, higher education, and government entities working together to address challenges in manufacturing that may be unsolvable when approached in isolation. Center activities engage in applied research such as concept design, prototyping, third-party unbiased product testing, and development of innovative manufacturing methods to apply on the manufacturing line.
- OSU, PSU, and UO number among the 13 founding partners that comprise Micron's newly convened [Northwest University Semiconductor Network](#). The network will "support research and experiential learning opportunities in the computer chip industry with equitable access for underrepresented students, including those in rural and tribal communities" ([OSU](#)).

For More Information

Ben Cannon, Executive Director, HECC,
Ben.Cannon@HECC.OREGON.GOV

Donna Lewelling, Director, HECC Office of Community Colleges and Workforce Development,
Donna.J.Lewelling@HECC.OREGON.GOV

Jennifer Purcell, Director, Future Ready Oregon, HECC, Jennifer.Purcell@HECC.OREGON.GOV

Julia Steinberger, Director, HECC Office of Workforce Investments, Julia.Steinberger@HECC.OREGON.GOV

Veronica Dujon, Director, HECC Office of Academic Policy and Authorization,
Veronica.Dujon@HECC.OREGON.GOV

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