Clean Technology/Clean Energy

Sector Intermediary

Workforce Strategy Report

February 28, 2023

Executive Summary

Clean technology and clean energy are rapidly emerging and changing fields in Washington state, driven by a combination of environmental concerns, technological advances, and government policies. These fields are creating new job opportunities and require a skilled workforce to meet the growing demand.

Washington state has taken a leadership role in promoting clean technology and clean energy, and has positioned itself as a clean technology leader on the global stage. Washington has the strongest suite of climate legislation of any state in the nation, including the Clean Energy Transformation Act, the Climate Commitment Act, and the Clean Fuels Standard. This legislation sets ambitious targets to reduce greenhouse gas emissions, increase energy efficiency, and promote renewable energy sources. The governor has set several milestones, starting with closing coal electrical generation plants in 2025, setting zero carbon emission vehicles sales in 2030, and achieving 100% clean energy by 2045, which will require a significant increase in renewable energy generation and deployment of new clean technologies. Environmental Justice is centered in the work as stipulated in the HEAL act, ensuring all communities benefit from new clean technology projects. Workforce development for the sector needs to focus on inclusion as well if our clean tech companies are going to maximize innovation, attract talent, and be competitive in global markets.

Clean technology and clean energy workforce needs in Washington state include a wide range of occupations and education and training levels, from engineers and technicians to installers and maintenance workers. These job, at all levels, require a diverse set of skills, including technical knowledge, problem-solving ability, and communication.

To meet the workforce needs of existing and emerging fields, the state has taken steps to promote education and training, and it is essential to continue these efforts to ensure a skilled and diverse workforce to meet the growing demand for clean energy and technology.

From our research and engagement with industry, we learned that the six jobs projected to be most in-demand over the next 2-3 years in Washington's clean energy sector are:

- Engineers (all practices)
- Electricians (across all industries: construction, marine, aerospace, energy)
- Technicians (all areas such as HVAC, electrical, engineering, EV, installers)
- Line workers
- IT/high technology
- Safety/Security/Cybersecurity

This report will give an overview of our study process and highlight existing program bright spots across the state. Then, we will present 7 key recommendations, and 14 programs ready for immediate implementation, as well as guidance for future program development by various interested parties.

I. Urgency for Clean Technology/Clean Energy Workforce Development

The 2019 Washington Clean Energy Transformation Act is the nation's strongest policy for transitioning away from carbon emission generation to clean electricity. The bill sets mandatory requirements for utilities to: phase out all coal power by 2025; achieve a carbon-neutral electricity supply by 2030; and transition to a 100-percent clean electricity supply by 2045. Also passed in 2019, the Clean Buildings Act creates standards for the energy performance of thousands of large buildings to significantly cut emissions in the built environment by 2035. This year, the Clean Cars 2030 legislation set a date of 2030 for requiring that all new cars registered in Washington have zero carbon emissions. To achieve Washington's aggressive targets for phasing out fossil fuels and emissions in the energy, building, and transportation sectors, rapid growth of the clean technology / clean energy workforce skilled across an array of renewable technologies will be essential.

Concurrently, the transition to a clean energy economy presents an unprecedented opportunity to advance social, economic, and environmental justice and ensure that traditionally excluded workers and disadvantaged communities access the benefits of the energy transformation. Federal funding programs—most recently escalated by the Bipartisan Infrastructure Law and the Inflation Reduction Act—recognize the critical importance of equity, inclusion, and collaborative partnerships to scaling effective climate solutions, ensuring resiliency, and increasing economic competitiveness. State and federal investments are fostering collaborations among industry, academia, unions, and community-based organizations to deploy technologies and develop the workforce needed to meet climate goals.

The CleanTech Alliance, in partnership with the Pacific Northwest Center of Excellence for Clean Energy, has prepared this report to outline strategies for supporting Career Explore, Care Prep, and Career Launch programs that close gaps in building the Clean Technology/Energy Workforce – currently one of the most pressing challenges facing this sector as it strives to meet the state's climate goals over the next three to five years.

CleanTech Alliance

CleanTech Alliance represents over 1,000 member organizations spanning seventeen U.S. states and four Canadian provinces. The Alliance facilitates the generation and growth of clean technology companies and jobs through a variety of educational programs, research, products, and services. Its diverse membership represents all facets of the clean technology industry sector. The CleanTech Alliance currently leads the Washington Innovation Cluster Accelerator Program's BUILT Cluster and serves as a partner for the Northwest Cleantech Innovation Network project funded by the U.S. Department of Energy's EPIC (Energy Program Innovation Cluster) program.

Pacific Northwest Center of Excellence for Clean Energy (PNCECE)

Located at Centralia College, the center is a statewide resource that represents the interests of the region's energy industry and its labor partners - within the Washington State Community and Technical College system. The center exists to narrow the gap between employers' demands for a highly skilled workforce and the colleges' ability to supply work-ready graduates. It convenes industry, labor, and sector organizations to help drive workforce development initiatives — and coordinates community college resources after industry and labor set the direction.

II. Industry Engagement

Methods

To connect Clean Technology/Energy industries with Career Connect Washington's goals and our work as Sector Intermediary, we surveyed our members and partners from across the state, primarily through one-on-one interviews conducted in-person, virtually, and by phone. We leveraged our boards and working committees to gather detailed feedback from our most engaged employers. And, our collaborative Energy Workforce Convening, held virtually and in-person at three sites, was attended by industry leaders, policymakers, educators, and community stakeholders to address key issues impacting the sector.

- Both organizations engaged their boards and committees to discuss workforce development gaps and planning. Employers from more than 60 companies participated, including:

A&R Solar
Advanced Professionals
Allumia
AMSC
Avista Corp.
Bia Energy Capital
Blue Dot Photonics
Boeing Commercial Airplanes
Bonneville Power Administration
Centralia City Light
Clean Energy Institute
CleanTech Strategies
Consulate General of Canada in Seattle
Corning Incorporated
Dorsey & Whitney
Douglas County PUD
Economic Alliance of Lewis County
Economic Alliance of Snohomish County
Energy Northwest
Evergreen Rural Water of WA
Grays Harbor PUD
Greentech Renewables
Group 14 Technologies
Helion Energy
IBEW 77
K&L Gates LLP
Kane Environmental, Inc.
Klein Tech Advisors
McKinstry
Neste
NextWatts
One Digital Health & Benefits
Pacific Northwest National Lab
Perkins Coie
Plum Energy LLC
Portland General Electric
Premera
Puget Sound Energy
Retrolux
Roofing Contractors Assoc. of WA
Seattle City Light
Snohomish County
Snohomish County PUD
Tacoma Power/Tacoma Public Utilities
The Jia Group
Thomas James International
Twin Transit
UMC Energy & Environment
U.S. Army Corps of Engineers
Wahkiakum PUD
WA Water Service
WASEIA (Washington Solar Energy Industries Association)
Washington Dept. of Commerce
WSU/JC DREAM
WaterTectonics
Western Solar
WorkSource/Thurston County Regional Business Solutions Team
Zila Works

- Staff from both organizations held follow-up meetings with board members, members, and other interested parties to refine the lines of inquiry and needs raised in these discussions.
    - The CleanTech Alliance CEO held one-on-one conversations with executives across our membership, multiple NGO's, non-profits, and other partners.
    - PNCECE's director held one-on-one conversations with industry subject matter experts, union representatives, educators, national laboratories, economic alliances, and the center's advisory board to gather the temperature of the clean energy landscape.

- Cleantech Alliance's Workforce Development Manager engaged with labor unions, educators, employers, and a community organization that supports a strong, inclusive workforce in Washington.

- We held an Energy Workforce Convening event in June 2022 to foster dialogue about workforce gaps and needs. Attendees included employers, educators, community-based organizations, and policymakers. Industry included:

3AC Engineering	City of Tacoma	Port of Seattle
Advanced Technologies and Laboratories	Conrad Industries	Portland General Electric
Centralia City Light	CT Fusion	Seattle City Light
City of Pasco	Itron, Inc	Tacoma Public Utilities
City of Seattle	Pacific Northwest National Lab	Twin Transit
	Port of Benton	UMC, Inc.

- CleanTech Alliance and PNCECE's staff then conducted detailed interviews to further inform the strategy presented in this report. Input was synthesized from the following employers:

A&R Solar	Group 14 Technologies	Seattle City Light
Avista Utilities	Helion Energy	Sharc Energy Systems
Benton County PUD	Impact Bio Energy	Sironix
Bonneville Power Administration	McKinstry	Snohomish County PUD
Centralia City Light	OCOchem	Tacoma Power Utilities
Douglas County PUD	Pacific Northwest National Lab	Twin Transit
Energy Northwest	Portland General Electric	WASEIA (Washington Solar Energy Industries Assoc.)
Grays Harbor PUD	Puget Sound Energy	

Key Findings

From these engagements, we gathered input regarding the greatest workforce hurdles industry is facing, current open positions and vacancy rates, current gaps in skills and education, and jobs expected to be most in-demand and/or created in the next two to five years. Across the board, we heard that the field is changing so quickly, anticipating workforce needs for emerging technologies is a significant challenge. Skills and competencies for jobs impacted by the latest technologies—including electrification/EV, grid integration, fusion, renewable hydrogen, wind, and batteries/energy storage—are still being identified, developed, and communicated by federal and state labor boards and agencies. As an example, one union leader shared that Solar Photovoltaic Installer has yet to be classified as a job code in the state's Occupational Employment Statistics.

Highlights from Industry responses to our surveys are below.

What is the biggest current workforce challenge?

- Understaffed workforce. Some utilities are experiencing a need to spend more on capital projects to meet initiatives than with recruiting.
- Recruitment – there is a lack of diverse and qualified individuals across the job–level spectrum. Applicant pools are mismatched (either too qualified or not qualified).
- Retention and succession planning.
- Retention is a multifaceted space. Competition within industry. Competition with other industries. Industry is seen as not always having shiny new objects to work with.
- Finding skilled journey level craft workers.
- Finding qualified personnel with electric utility experience.
- Finding and keeping workers skilled in technology and security.
- Balancing the changing dynamics of carbon and fossil fuels when operating across multiple states
- Bridging the gap between craft, technology and engineering as the traditional roles of generation, transmission and distribution continue.
- The distribution of the workforce is different now. Attrition has more than doubled throughout all departments – especially in support roles such as IT. Utilities compete with businesses, such as Amazon and Microsoft, as well as amongst themselves, that pay higher wages.
- Finding an equilibrium. This sector is growing so rapidly, as it adjusts to new initiatives, that employees find themselves striving for more with less capacity, which is causing a level of burnout.
- Smaller apprenticeship applicant pools: used have 500 applicants leading to 100 interviews after 80% pass rate on testing; recently only 130 applicants resulting in 29 interviews.

What challenges are anticipated in the next 2-5 years?

- High attrition rates, understaffed, high vacancy rates (15-19% for utilities).
- Coming out of the pandemic, some utilities haven't found a balance yet. The workforce used to have a strong onsite presence, which switched to hybrid. Wondering if hybrid will switch back
- Generations in the workforce. Millennials are the largest segment and will soon fill leadership roles. Does that change business culture dynamics?
- Millennials have a different approach to purpose. They do this as their job but want to make a difference in the world. They want to make the world a better place vs. make a profit. They aren't interested in making the business a profit either.
- The industry is losing knowledge, expertise, problem solvers, and time for knowledge transfer from those with experience to those without.
- New engineers are school capable, but few have electricity utility field experience.
- Shortage of workers with hands-on experience.
- More competition in recruitment.
- Finding people with technical skills that understand dams and how they react to seismic loads and water movement through structures.
- Aging infrastructure. Dams and transmission will need to be repaired and/or rebuilt.
- Increased safety and security issues (as seen in recent substation attacks).

Which jobs are currently open?

Apprenticeships
Communications Systems Technician
Compliance Analyst
Cybersecurity Engineer
Database Administrator
Electricians
Engineering Technicians
Journeymen Linemen
Journey Protection Control Technician
Maintenance Technicians
Plant Operator
Security Personnel
Solar Sales Staff

Which positions are most difficult to fill?

Customer Facing (sales/service) positions
Electricians
Engineering –skills are broadly transferable
Finance Administrators
Journeymen linemen
Middle management with experience
Operational support staff
Project Managers
Protection control technicians
Security Guards
Systems administrators (IT)
Transmission/Distribution Engineers

Which positions are anticipated in the next 2-5 years?

It will remain difficult to predict all needs, as well as what will be in-house versus outsourced given the newness of many emerging technologies. Current expectations include:

Control Technicians
Data Analysts
Electricians
Energy Management Services; Compliance type roles
Engineers—technical, civil, mechanical, electrical
GIS analysts
Grid Integration Analysts
Mechanics—qualified for renewables, concerned rush to transition will outpace workforce dev.
Plant Operators
Technicians: Engineering, Line, IT
Turbine Specialist

Where are the gaps in skills, competencies, and education?

- How to prepare students for existing and emerging roles.
- Develop employability skills focused on these questions: What is work? What does it mean to work? What is the value of work?
- There is a lack of drive, general work experience, and willingness to master a position before looking for promotions.
- Radiation protection training.
- Highly technical positions are lacking hands-on experience (caused by virtual learning).
- NABCEP certification is the best and only nationally recognized and respected solar and storage specific certification.
- Electrification of everything is going to drive growth in energy and built environment.
- Certifications, such as Commercial Driver's License, Safety, HazMat are valuable for applicants.
- 8th-10th grade are hearing about EVs (Electric Vehicle) and renewables but not understanding career opportunities. There is an increased need for career awareness.
- Nimble curriculum and short-term certificates.
- Safety protocols, engineering, technical analysis, manufacturers.

- Commercialization of technologies.
- Community-based job training partnerships.
- Grid distribution and EV charging planning.

Workforce Gaps

- Generation Gaps: Older generations find it unintuitive to existing work culture that newer generations wants to leave at 5 – before completing the task at hand.
- Lockdown prevented travel and people are lacking two years of hands-on experience.
- Evolving workforce education programs that keep pace with the evolution of this industry. Engineers of tomorrow need different skills than engineers of yesterday.
- Small public utilities need additional funding to increase training opportunities.
- Utilities need to work together and invest together to build the supply of workers. We need to market and build culture to make our industry attractive.
- The hiring pool of line workers has not increased to meet demand. Utilities hire from each other, leaving smaller PUDs without resources to compete with wages.
- Programming skills for aggregation and distribution management systems.
- The existing workforce needs to learn programming (smart meters and transmission needs).
- Technical analysis – for evolving safety protocols and engineering.
- Some new technologies are three to five years away. There needs to be time for transition of knowledge – and that needs to start now.
- Entry level gap. There's a large gap between high school and entry level jobs. Need to create internal training or skill bridge programs with colleges.

III. Industry Needs Analysis

Industry member input echoes federal and state labor statistics, industry association reports, and the findings of workforce development associations and nonprofits.

Good Jobs Require Accessible Pathways

Washington's suite of climate legislation is driving new job creation and the need for more trained workers. According to the U.S. Energy Employment Report, published June 2022:

- "The findings of the 2022 USEER shows that US energy sector jobs outpaced overall US
- employment in 2021. In recent years, jobs in the energy sector were among the fastest growing of any sector in the economy, but like most other sectors, energy was deeply affected by the COVID-19 pandemic and the associated economic impacts.
- In 2021, nearly all energy technologies added jobs, but most technologies have not rebounded to pre-pandemic numbers. As the nation continues to invest in energy technology, groups are optimistic about the future reported that they expect job growth in their sectors in 2022."

Chmura/JobsEQ reports Washington's Clean Energy sector employs more than 3.5 million (July 2022), who earn an average annual wage of $80,388. Many of the entry-level jobs in the sector are attainable without advanced education requirements. However, the sector has a diversity problem and requires

new pathways and approaches to recruit and retain diverse workers of differing socio-economic backgrounds, ethnicities, and genders.

According to E2's 2021 Diversity in Clean Energy Report,

- Over 60% of the clean energy workers in the U.S. are White non-Hispanics.
- Black and Hispanic/Latino workers are more poorly represented in clean energy than they are across the rest of the economy, with Black employees comprising only 8-percent of the clean energy workforce (compared with 13-percent economy wide); Hispanic/Latino workers make up 16.5-percent (versus 18 percent economy-wide).
- Women represent less than 30-percent of all workers in the sector, despite accounting for nearly half (48 percent) of the U.S. labor force.

Our industry partners recognize the need to modify hiring practices, increase professional development and career mobility opportunities, and shift workplace culture to attract and retain diverse candidates. Across all industry verticals, they are seeking assistance with these challenges. They also indicate that career awareness for clean technology/energy careers must be promoted at an earlier age (at elementary and middle school levels) to create the pathways that will fill talent pipelines.

A solar executive we interviewed advocated for Green Jobs as a strong pathway to economic mobility. He commented on the stigma attached to pursuing trade careers, critical to the clean energy sector, rather than a 4-year degree program. He mentioned there is also stigma against using a 4-year degree to move into the trades. With the prevailing wage for a commercial electrician in King County at $96/hour, he asked, “What degree gets you pay like that after a 4-year program?” Green Jobs and the Clean Energy Economy hold enormous potential for adding good paying union and family wage jobs to Washington’s employment landscape.

Labor Shortage and Future Growth

Clean technology/energy also faces an ongoing, skilled labor shortage in some occupations (e.g., hydro-operators, linemen, electricians) as well as stiff competition with large technology companies for highly qualified candidates.

- Growth, according to the U.S. Energy Employment Report, shows increased needs in electric power generation at 8.7%, within fuels at 7.2%, within electric power transmission, distribution, and storage at 4.9% and energy efficiency at 4.1%. The report states employers in Washington reported 56.0% overall hiring difficulty.
- JobsEQ 5-year forecast shows an increased need with: wind electric power generation (4.5%), solar generation (3.2%), transit systems (2.9%), and with wiring installation contractors.
- Since the passage of the Inflation Reduction Act, Climate Power (reported in the Hill 2.6.2023) the creation of more than 100,000 new cleantech have been announced by IRA (Inflation Reduction Act) funded projects, largely yet to be staffed.

Since the passage of the Inflation Reduction Act, Climate Power (reported in the Hill 2.6.2023) the creation of more than 100,000 new cleantech jobs have been announced by IRA funded projects, largely yet to be staffed.

The U.S. Department of Energy, Interstate Renewable Energy Council, and Solar Energy Industries Association list the following jobs as being key to the Clean Technology/Clean Energy sector:

Building Automation Engineer
Chemical Engineer
Civil Engineer
Code Inspector
Control Operator
Electrical Engineer
Electrician
Electronics Technician
Engineering Technicians
Environmental Scientist
Environmental Engineer
Electronics Technician
Materials Scientist
Mechanical Engineer
Occupational Safety Specialist
Process Control Technician
Regulatory Expert
Research Engineer
Roofer (w Solar expertise)
Software Engineer
Solar Marketing Specialist
Solar PV System Designers
Structural Engineer
Solar PV Installer
Solar PV Technician
Solar Site Assessor
Systems/Transmission Engineer
Site/Plant Manager

From our research and engagement with industry, we learned that the six jobs projected to be most in-demand over the next 2-3 years in Washington's clean energy sector are:

- Engineers (all practices)
- Electricians (across all industries: construction, marine, aerospace, energy)
- Technicians (all areas such as HVAC, electrical, engineering, EV, installers)
- Line Workers
- IT/high technology
- Safety/Security/Cybersecurity

Creating pathways and addressing training gaps to build a workforce for these jobs is most important to employers in our sector. In addition to these current, high demand jobs, we anticipate the emergence of entirely new jobs to support our emerging clean energy technologies. We will continue to track and map those to skills programs as we work to help our employers rapidly deploy new energies.

Skilled Workforce Needed

Our state will play key roles in multiple emerging technologies, including fusion energy, green hydrogen, offshore wind, and carbon capture and sequestration. Needed skills in these fields are not yet entirely known, but some of our other state industry and training programs will develop cross-applicable skills.

- Fusion will employ engineers, technicians, and is already co-locating within our highly skilled aerospace sector to leverage existing highly skilled machinists.
- Hydrogen technology, waste energy transfer, and districts may create viable pathways to redeploy pipe fitters that may face a decrease in building construction due to declining installation of natural gas heating into new construction.
- Washington could become a key manufacturing location for offshore wind turbines due to our accessible ports not blocked by bridge infrastructure, allowing us to get blades the length of a

football field shipped along the west coast. Aerospace and marine manufacturing workers and facilities are poised to stand up this new industry most easily.

There are many foundational soft skills, knowledge, and attributes that will be cross-applicable at all levels of clean technology/energy employment; from boots-on-the-ground laborers to PhD students working in research institutions. Cleantech companies frequently raised the following two points relating to the clean technology/energy workforce:

- Having a basic familiarity with climate change and sustainability principles is important for clean technology/energy employees. This knowledge helps workers to understand the value of clean energy technologies and align with company values.
- Often, key skills are not highly specialized in clean energy technology. There is a perception that clean technology/energy roles require extensive specialized technical knowledge, when often common skills can be used with a different lens.

This assertation was confirmed by attendees of our workforce convening event, and by industry leaders and company executives during the employer interviews we conducted.

IV. Program Landscape Analysis

Most employers we interviewed indicated a greater need for increased training programs. We heard from many of them that most educational institutions have accelerated their energy, sustainability, and renewables offerings and the construction industry is ramping up apprenticeship offerings. However, the availability of apprenticeships and training across the sector is limited. Employers often conduct their own, on-site training as a stop-gap measure to meet immediate workforce needs. Making connections between employers, existing CCW (Career Connect Washington) programs, training and support services offered by community-based organizations, and apprenticeships will solve near-term challenges. The greater need is to build more programs. Washington's larger utilities have more resources to build and host programs to reach K-12 audiences. Bright Spots and highlights discussed during industry interviews serve as potential scalable models.

K-12 and Career Explore

PNCECE continues to update comprehensive online resources, such as:

- K-12 Resources – An extensive list of links to STEM (Science, Technology, Engineering, and Mathematics) and clean energy resources for K-12 educators, parents and students that includes places to visit, summer programs, lesson plans and resources for educators, and activities to do at home.
- Clean Energy Career Exploration - Reveals career pathways, pay scale, education and training requirements.
- College Programs – A searchable database of programs, degrees, and certificates at community and technical colleges. This resource, which includes transfer programs to universities, is a living document that will continue to be updated annually as a public resource.

- Below are examples of successful K-12 programs that came up during industry interviews. A broader list is included on K-12 | Center of Excellence for Clean Energy (cleanenergyexcellence.org).

K-12 Bright Spot—Avista Utilities

Avista hosts up to 20 high school students each summer in a four-week program that introduces students to a potential career path in energy. The program establishes an understanding of the employability skills companies are looking for in future candidates and how to be prepared for the career paths. Students experience onsite tours, classes, and labs that focus on all aspects of utility operations including energy generation, transmission, and distribution. The last week of the four-week program gives students an opportunity to spend three days job-shadowing a position that they felt was interesting. For Avista, the company benefits from broader awareness of career opportunities that they offer, and the program develops a broader and more diverse pool of future applicants that represent the communities that they serve.

K-12 Bright Spot—Tacoma Power

Tacoma Power offers K-12 activities on their website and in parks as well as a comprehensive suite of programs. They provide Tacoma Public School District with a nine-month general internship program in administration/clerical type work for 2-10 students and a Summer Jobs Program for 10-12 high schoolers to gain general office experience (80 hours of work). Tacoma Power is working with MESA (Math Engineering Science Achievement) at PLU on a three-week summer high school internship program. Students will get direct on-the-job experience, learn about power systems and the utility environment, and have exposure to several key positions and careers at the utility. TPU (Tacoma Public Utilities) Academy is a four-week program for 5th graders in partnership with Boys & Girls Club, with week-long sessions about: power, cybersecurity, rail, and water. With the Girl Scouts, 80 – 100 girls connect to a panel of women who work in the sector such as engineers, biologists, and crafts/trades.

Additional K-12 Programs

- Bonneville Power Administration: Activities on website and visitation by request.
- Douglas County PUD: Partners with ESD (Employment Security Department) and FWEE (Foundation for Water Energy & Education) to fund curriculum in hydropower education. Offers tours of hydro facilities to schools. Participates in Public Power Week (consumer education).
- Energy NW: Fulfills requests to speak at schools. See Internship Bright Spot below.
- Lewis County PUD: An interactive kid-sized transmission display introduced young county fair visitors to tools and jobs.
- Puget Sound Energy: Gas utility side hosts an open house. They bring equipment to high school career fairs. Issaquah alternate education program visits.
- Smaller PUDs would like to engage in these opportunities; however, they stated that lack of staff and resources keeps them from participating.

Internship Bright Spot—Energy Northwest

The Public Power Internship Program is a workforce development program designed to encourage, attract, and increase the number of students and professionals interested in the Pacific Northwest

public power industry. The program's intent is to build connections with students through on-campus activities such as mentoring and support, while also reaching student groups through a range of social media platforms. These engagement efforts are designed with diversity and inclusion built in. This program improves the effectiveness of the intern identification, selection, and onboarding process for utilities. Unique opportunities such as utility tours and workshops introduce the students to the diversity of public power. The program is initially focusing on engineering internship opportunities and expects to expand to additional fields beginning fall of 2022.

Internship Bright Spot—Sphere Solar Energy

Sphere specializes in providing workforce development in the clean energy sector to underserved communities and is committed to advancing equity in clean energy jobs. Programs include job training, educational instruction, and internships. Through grass-roots community outreach, partnerships with environmental nonprofits, and financial support from granting organizations, Sphere provides programs to increase the visibility of clean energy career opportunities in under-resourced communities. Programs include:

- Internships – In partnership with Seattle University and Sustainability Ambassadors.
- Solar 101 Workshops – Tailored to youth and family members of community-based organizations installing solar systems.
- School-based Instruction – Partnerships with local high schools to provide interactive, hands-on lessons in clean energy systems and job opportunities at Nathan Hill High School.
- Youth Education – Education on the role of solar in reducing carbon emissions. Participants include Sustainability Ambassadors and Lake City Young Leaders.

Work-Based Learning Bright Spot—Avista Utilities

Avista developed a nine-month work-based learning program that dives deeper into the utility's operations. Now in a pilot program (first year with three students), students will earn power/energy technology credentials along with completing their high school credits. In the end, students will receive their high school diploma and energy certificates. Avista's goal is to enroll up to 20 students each year (recruiting students will also broaden the utility's outreach and increase careers in energy awareness at all participating high schools).

Employer-Led Apprenticeships

- Avista: Cableman, Lineman, Communications Technician, Protection Control Meter Technician, Gas Meter and Gas Service Technicians, Electric Meterman, Electrical Mechanic, Mechanical/Structural Mechanic, Hydro & Substation Operator, and Gas Main fitter
- Bonneville Power: Line workers, High Voltage Electricians, and Substation Operators
- Centralia City Light: Hydropower and Substation Operators
- Chelan County PUD: Lineman, Power Systems Wireman, Meterman, Generation Mechanic, Hydro Operator, Generation Wireman, and Electric Utility Technician
- Douglas County PUD: Linemen with NW Line JATC and Chelan County PUD, Dam Operators, Wiremen and Metermen through various programs.
- Grays Harbor PUD: Partners with Grays Harbor College to offer Line Worker and Wire Technician; Harris Institute for online meterman program.

- Portland General Electric: Line Technician, Wire Technician, and Meter Technician
- Puget Sound Energy: Meterman, Wireman, Combustion Turbine Specialist, Hydro Electrician, and Hydro Mechanic

Apprenticeship Programs in Development

- Centralia City Light: Engineering Technician 1
- Tacoma Power: Pre-apprenticeship for basic electricity knowledge starting mid 2023
- Twin Transit: Submitted grants to work with Centralia and Chehalis School Districts to develop CTE (Career and Technical Education) Renewable Energy Pathways.
- Twin Transit in partnership with the Pacific Northwest Center of Excellence: Is applying for funding of the Renewable Energy Vehicle and Infrastructure Technician Training (REVIT) program which will incorporate apprenticeships.

V. Recommendations

Many high-school and college-aged learners are keenly interested in integrating their careers into meaningful work that helps adapt to climate change, and this interest must be leveraged by employers and communicated by educators to help students prepare, locate, and choose careers in clean technology/energy.

Recommendation A – Prioritize funding for clean technology/energy training programs and workforce development.

As Washingtonians face increasingly urgent environmental changes, it is critical to invest in a workforce that is equipped to tackle these challenges and help create a sustainable future. It is essential to have a skilled workforce that can design, develop, and deploy the technologies and systems that will help transition Washington to a low-carbon economy.

1. Technician Training

To support the development of a technician training program to impact the deployment of clean energy technology. As we work to address the increasing demand for energy, we recognize that clean energy is a promising solution that offers clean, abundant, and reliable energy. However, the development of clean energy technology requires a highly skilled workforce with specialized knowledge and expertise. The training program should cover a wide range of topics, including basic physics principles, engineering design, instrumentation, and operations.

2. Line Workers (Linemen)

Expansion of line workers apprenticeships in rural Washington and small utility companies. Support organization committed to providing training and employment opportunities for individuals interested in pursuing a career in the energy sector. Organizations are particularly interested in expanding the availability of line worker apprenticeships in rural areas of Washington, where there may be a shortage of skilled workers, and in small utility companies that may not have the resources to develop their own apprenticeship programs.

3. Balancing Engineer

Building and Balancing Engineer programs at technical colleges will equip students with the knowledge and skills necessary to succeed in building engineering. The curriculum typically includes courses in building systems and operations, energy management, HVAC design and maintenance, plumbing, electrical systems, and structural engineering. Students may also learn about codes and regulations, building automation systems, and project management. Practical experience is often integrated into the program through internships or co-op opportunities. Graduates of the program are prepared to pursue careers as building engineers, facilities managers, energy auditors, and sustainability professionals. With a focus on practical skills and real-world applications, a building engineer program at a technical college can provide students with a valuable education that can lead to a fulfilling career in the growing field of building engineering.

We anticipate the need for additional specific training programs will continue to emerge, as the clean technology/energy sectors are rapidly changing and offer a tremendous opportunity for economic growth and job creation. Continued investment in training programs would provide funds for:

- Train-the-trainer coursework.
- Faculty continued training.
- Substitutes to teach, while faculty attends training.
- Curriculum research and design.
- New curriculum and sharing of approved curriculum.
- Equipment for laboratories and hands-on activities.
- Uplifts for current laboratories that need enhancements for new clean energy technology.
- Administrative support to track funds, promote programs, and recruit new students.
- Career Explore, Career Prep, and Career Launch programs.

Recommendation B – Develop and promote career pathways for an inclusive clean energy and clean technology workforce.

As Washington strives to build a more sustainable and equitable future, it is essential that we develop and promote career pathways for an inclusive clean energy and clean technology workforce.

4. Career Navigator

Clean Technology Career Navigator will assist individuals interested in pursuing a career in the clean technology sector. It aims to provide students and faculties with relevant information, resources, and tools that can help them understand the various career paths and opportunities in the clean technology field. The navigator will provide information on the various career paths available in the clean technology and clean energy sector, including job titles, skill sets, education and certification requirements, and job outlook.

5. Emerging Technologies Navigator

Emerging clean technology and clean energy solutions are critical for transitioning towards a sustainable and low-carbon economy. As industries around Washington continue to recognize the importance of reducing their carbon footprint, the demand for innovative clean technology and clean energy solutions is increasing. To support industry members in this transition, the Clean Technology and Clean Energy

Navigator serves as a comprehensive resource for businesses looking to adopt and implement sustainable solutions. The Navigator provides valuable information on the latest advancements in clean technology and clean energy, as well as best practices for implementation and adoption.

6. Internship Coordinator

An internship coordinator for clean energy and clean technology plays a crucial role in connecting students with opportunities to gain practical experience in the field of sustainable energy. This individual serves as a liaison between academic institutions and companies in the clean energy sector, identifying and facilitating internships that align with students' interests and academic programs. They may also provide guidance and support to students throughout the internship process, helping them to develop skills and make valuable industry connections. By promoting hands-on learning and professional development, the internship coordinator helps to prepare the next generation of leaders in clean energy and technology.

Additional recommendations for program areas that can continue to develop career pathways include:

- **Foster partnerships between educational institutions and industry** to develop and promote career pathways. This will help to create programs that are relevant to the needs of the industry and provide students with hands-on experience.
- **Providing access to training and skill-building** is crucial for individuals looking to pursue a career in clean energy and technology. These can include apprenticeships, internships, and on-the-job training programs.
- **Ensure inclusivity**. It is important that career pathways are developed and promoted in an inclusive manner. This means ensuring that individuals from diverse backgrounds, including women, minorities, and individuals with disabilities, have access to the same opportunities. Grant programs that create scholarships for traditionally underrepresented populations are strongly encouraged for emerging tech sectors that could become national hubs for energy and clean tech industries.
- **Communicate the benefits of clean energy and technology careers** to attract more individuals to these career pathways, it is important to communicate the benefits of working in clean energy and technology. These can include job security, competitive salaries, and the opportunity to make a positive impact on the environment.
- **Promoting career pathways through outreach and recruitment efforts** can include partnerships with community organizations, targeted advertising campaigns, and events aimed at raising awareness about the opportunities available in clean energy and technology. Promoting the skills needed to fulfill jobs will enable students to recognize the skills they have already acquired or are interested in improving – that can be matched to great careers.

Recommendation C – Integrate clean technology and clean energy into existing education and professional development pathways.

Continue education to ensure that our educators are up to date with best practices in the clean tech/energy sector. Tuition reimbursement allows faculty and staff to engage in Energy/STEM type program to share knowledge with schools and districts. Energy focus fellowship will enhance faculty and staff knowledge of the field. This will help them bring new skills, certification, or one-off classes to teach them new skills.

7. Renewable Technology Program for CTC's

Supporting renewable energy technology programs at community and technical colleges is an important step towards building a sustainable future. These programs provide students with the knowledge and skills needed to design, install, and maintain renewable energy systems such as solar, wind, and geothermal. By offering hands-on training and practical experience, students are prepared for careers in the growing field of clean energy. Additionally, these programs can benefit local communities by promoting the use of renewable energy sources and reducing reliance on fossil fuels. To support these programs, it is important to provide funding for equipment and facilities, as well as industry partnerships and job placement support for graduates. By investing in renewable technology programs at community and technical colleges, we can help build a skilled workforce for a more sustainable future.

Additional programs that could be developed include:

- **Create awareness and advocacy** within clean energy and clean technology is vital to ensuring that the sector continues to receive support and investment. Educational institutions and professional development programs should engage in advocacy efforts and create awareness campaigns to promote the benefits of clean energy and clean technology.
- **Foster industry partnerships**. Collaboration between educational institutions, professional development programs, and clean energy and clean technology companies is critical to ensuring that students and professionals are trained in the skills and knowledge that are in high demand in the industry. By forming partnerships, educational institutions and professional development programs can provide students and professionals with access to real-world projects and networking opportunities.
- **Provide hands-on training** is essential to ensure that students and professionals have the practical skills needed to work in the clean energy and clean technology sectors. Educational institutions and professional development programs should offer training that allows participants to work with renewable energy systems and clean technology equipment.
- **Encourage research and development** in clean energy and clean technology is essential to ensuring that the sector continues to grow and advance. Educational institutions and professional development programs should provide opportunities for students and professionals to engage in research and development projects in the field.
    - **Bonneville Environmental Foundation Fellows** provide an opportunity for enhanced training and advocacy and will help to create clean technology/clean energy ambassadors for the state.
- **Develop relevant and up-to-date curricula.** Educational institutions and professional development programs need to offer courses and programs that cover topics related to clean energy and clean technology. The curriculum should be updated regularly to keep up with advancements in the field and provide students with the latest knowledge and skills.
    - **DACUMS and Listening Sessions** should be held regularly for industry to share gaps and needs with education partners. Industry should be invited to assist CTE advisory boards.
- **Develop more industry liaison programs that help industry** attract talent and support workforce training partners. These positions could include navigators, curriculum designers, apprenticeship consultant IT/cybersecurity in energy pathways, skill standards and more.

Recommendation D – Deploy standardized, industry-vetted clean technology/clean energy resources.

As the world continues to shift towards a more sustainable future, it is imperative that we equip our students with the knowledge and skills needed to succeed in a rapidly changing job market.

By implementing standardized, industry-vetted resources, we can ensure that our students receive high-quality education that aligns with industry needs. These resources have been developed by experts in the field and have been thoroughly reviewed and tested, making them a reliable and effective tool for teaching.

All too often, industry replaces old technology with state-of-the-art equipment; and donates the old technology to schools. Having access to the same state-of-the-art equipment will further enhance students' employable skills, making them job-ready versus needing more on-the-job training.

8. Procurement of Training Equipment

The procurement of training equipment that employees currently use is a crucial component in supporting advanced training programs at community and technical colleges. By providing students with access to the same equipment and tools used in the industry, they can gain practical experience and be better prepared for the workforce. This can be achieved through partnerships with industry leaders, who can provide guidance on the equipment and technology needed for effective training. In addition, funding for equipment and facilities is essential to ensure that community and technical colleges can offer state-of-the-art training programs. By investing in training equipment, community and technical colleges can provide students with the tools they need to succeed and help meet the demand for skilled workers in various industries.

9. Support Services Program

Support services programs for clean technology and energy careers can be particularly important for underserved and rural communities. These programs can provide career counseling, training, and job placement services to individuals in these communities who may not have access to the same opportunities and resources as those in urban areas. Additionally, these programs can provide support for students pursuing clean energy and technology education, such as financial assistance, tutoring, and mentorship. By providing these support services, it can help ensure that individuals from underserved and rural communities have an equal opportunity to pursue careers in the clean energy and technology industry and help create a more diverse and skilled workforce for the industry. Ultimately, these programs can contribute to a more sustainable future for all communities and help bridge the gap between urban and rural areas in terms of access to clean energy and technology opportunities.

10. Compile Labor Market Data

Assist with labor market data by reporting actual number of job openings. All too often, businesses publish one job posting for 30 positions. An accurate account of open positions (30 job postings) will give educators a true sense of available positions for students; and will allow for additional program development within the education system. Labor market data is an important tool for understanding the current and future state of clean technology and energy careers. This data can provide information on job growth, salaries, and required skills and education for various occupations within the industry. By analyzing this data, it can identify trends and gaps in the workforce, and make informed decisions on

workforce development initiatives, education and training programs, and job placement services. Additionally, labor market data can help businesses and organizations in the clean energy and technology industry make strategic decisions on hiring and recruitment and help ensure that the industry has the skilled workforce it needs to continue to grow and innovate. Ultimately, labor market data is crucial for promoting a more sustainable and equitable future and ensuring that the clean energy and technology industry continues to thrive.

Recommendation E – Enhance awareness and recruitment campaigns featuring clean energy workers as "energy heroes."

As the world transitions towards clean energy and a more sustainable future, it is important to recognize the important role that clean energy workers play in making this transition possible. By highlighting these workers as "energy heroes," recruitment campaigns can help inspire more individuals to pursue careers in clean energy, as well as raise awareness of the crucial work that these individuals do. This awareness will be crucial to attracting a diverse workforce from all areas of the state and should focus on reaching Middle School age students.

11. Virtual Field Trips

Virtual clean energy and clean technology field trips are an excellent way to introduce students to the latest advancements in sustainable technology and energy solutions. With virtual field trips, students can visit clean energy installations and technology centers from anywhere in the state, without the need for physical travel. These field trips can provide students with an opportunity to see first-hand how renewable energy sources such as solar, wind, and geothermal power are harnessed and how they can contribute to a more sustainable future. In addition, virtual field trips can include interactive components, such as Q&A sessions with industry professionals, to further engage students and deepen their understanding of the technology. By providing virtual clean energy and clean technology field trips, industry can inspire the next generation of innovators and leaders in the field of sustainable energy.

12. Social Media Campaigns

Social media campaigns can be an effective way to raise awareness of the many opportunities available in clean energy and clean technology careers. By utilizing popular social media platforms, industry can reach a broad audience and engage with individuals who may not otherwise be aware of these career paths. Emphasis should be placed on platforms that inspire youth to choose energy and clean technology careers before they have made formative decisions about career pathways. Campaigns can include sharing success stories of people working in the industry, showcasing innovative projects, and highlighting the latest advancements in the field. Additionally, partnership with industry leaders, educational institutions, and career centers to promote job opportunities and career resources for those interested in pursuing clean energy and clean technology careers.

13. Toolkits

Clean technology and clean energy toolkits for K-12 students can be a valuable resource to increase awareness of the many opportunities available in the clean energy and clean technology industry. These toolkits can include interactive and engaging activities, such as experiments and games, to introduce students to the concepts and principles behind sustainable technology and energy solutions. Additionally, the toolkits can provide career information and resources for students interested in

pursuing careers in clean energy and technology. By providing these resources, it can inspire the next generation of innovators and leaders in the field of clean technology and energy and promote a greater understanding of the importance of clean energy and technology for a more sustainable future.

14. Energy Career Week Campaigns

K-12 clean technology and energy careers campaigns can be an effective way to inspire students to pursue careers in the clean energy and technology industry. These campaigns can include a variety of activities, such as informational sessions, guest speakers, and field trips to renewable energy installations and technology centers. Additionally, the campaigns can provide resources and guidance for students interested in pursuing clean energy and technology careers, such as internships, apprenticeships, and college and career counseling. By creating these campaigns, it can promote a greater understanding of the importance of clean energy and technology for a more sustainable future and inspire the next generation of innovators and leaders in the field. Ultimately, these campaigns can help create a more diverse and skilled workforce for the clean energy and technology industry and contribute to a more sustainable future.

Future recommendations to effectively feature clean energy workers as "energy heroes" includes the following strategies:

- **Highlight the importance of clean energy**: Start by emphasizing the need for clean energy and the impact that it can have on the environment and society as a whole. This can help establish the importance of the work that clean energy workers do and why it is a valuable career path to pursue.
- **Tell the stories of real clean energy workers**: Rather than using generic images or stock photos, feature real clean energy workers and their stories in recruitment campaigns. Highlight their backgrounds, their motivations for pursuing clean energy, and the impact that they have had in their roles.
- **Showcase the diversity of clean energy careers**: clean energy is a rapidly growing field with a wide range of career paths available. Highlight the diversity of roles within clean energy, from technicians and engineers to project managers and salespeople.
- **Emphasize the potential for career growth and advancement**: clean energy is a dynamic and evolving industry, and there are many opportunities for career growth and advancement. Highlight the potential for career progression and the skills and experience that can be gained by working in the field.
- **Promote the positive impact of clean energy work**: clean energy workers are not just helping to protect the environment; they are also helping to build a more sustainable and equitable future. Highlight the positive impact that clean energy work can have on communities, economies, and future generations.
- **Partner with Center for Energy Workforce Development**. PNCECE and utilities belong to this national organization that is working to address many points within this recommendation. Partnering with CEWD will open access to many tools that are being established.
- **Focus on skills required for jobs**. Many Centers of Excellence are finding this approach is very successful – to promote skills that the workforce has already acquired but doesn't realize those skills match the great careers.

Recommendation F – Add IT to upskill current workforce.

As the industry updates equipment, more technicians are using tablets to troubleshoot issues. Upskilling in IT (internet technology) will have significant benefits for both the current and future workforce. The following explains why IT upskilling can be advantageous:

- **Increased Employability**: By developing specialized IT skills in areas such as data analytics, cloud computing, and cybersecurity, individuals can make themselves more competitive in the job market. Employers in the clean technology and clean energy industries are always seeking candidates with specialized skills to meet their unique IT needs.
- **Improved Efficiency and Productivity**: By upskilling in IT, individuals can develop the tools and knowledge necessary to optimize and streamline business processes, leading to increased efficiency and productivity. This can result in cost savings for businesses and organizations, as well as greater output and profitability.
- **Opportunity for Innovation**: With a deep understanding of IT, individuals can develop and implement new technologies and processes that can drive innovation and growth in their respective fields. This can lead to new product development, improved sustainability practices, and greater efficiency in energy production and consumption.
- **Positive Impact on the Environment**: Upskilling in IT can help individuals to develop a deep understanding of sustainability practices and renewable energy technologies. By leveraging this knowledge and expertise, IT professionals can play a critical role in driving the adoption of clean energy and reducing the carbon footprint of businesses and organizations.

Recommendation G – Continue expansion of work-based learning opportunities for clean energy technology occupation.

As the world continues to transition towards renewable energy sources, there is an urgent need for skilled workers who can design, install, maintain, and operate clean energy infrastructure.

Work-based learning programs, through internships and apprenticeships, are an effective way to provide hands-on training and practical experience to individuals who are interested in pursuing a career in clean energy. These programs offer a range of benefits to both employers and potential employees and leads to increased productivity and improved job satisfaction.

By expanding apprenticeship opportunities in clean energy occupations, we can ensure that the workforce is prepared to meet the demands of the growing clean energy sector. This can help to create new job opportunities, support economic growth, and contribute to the fight against climate change.

VI. Summary

Washington state's energy industry is changing at an unprecedented rate as we collectively work to achieve clean energy and climate goals set by the state's leadership. Programs recommend for immediate implementation are:

A - Prioritize funding for clean technology/energy training programs and workforce development.

1. **Technician Training**
2. **Line Workers (Linemen)**
3. **Balancing Engineer**

B - Develop and promote career pathways for an inclusive clean energy and clean technology workforce.

4. **Career Navigator**
5. **Emerging Technologies Navigator**
6. **Internship Coordinator**

C - Integrate clean technology and clean energy into existing education and professional development pathways.

7. **Renewable Technology Program for CTC's**

D - Deploy standardized, industry-vetted clean technology/clean energy resources.

8. **Procurement of Training Equipment**
9. **Support Services Program**
10. **Compile Labor Market Data**

E - Enhance awareness and recruitment campaigns featuring clean energy workers as "energy heroes."

11. **Virtual Field Trips**
12. **Social Media Campaigns**
13. **Toolkits**
14. **Energy Career Week Campaigns**

There is opportunity for far more workforce collaboration in the clean energy and clean technology sector, and awareness of available training programs should be increased. . Building trust is critical to this process. Modeling workforce networks, collaborative programs, and partnerships expanding existing models for innovative ecosystems and clusters is a viable avenue for developing the cleantech workforce in a coordinated and holistic manner that would benefit industry, workers, and communities. Increasing convenings, working groups, and task forces, as well as access to newsletters, tool kits, and other resources will be key to successful outcomes in a complex and rapidly changing ecosystem. Justice, Equity, Diversity, and Inclusion must be deliberately built into workforce programs at all levels and is critical to attracting and retaining a modern workforce critical to achieve our climate goals.

Appendix -Opportunities for Workforce Development Action Across the Cleantech Ecosystem

While specific immediate and next step recommended strategies are presented above, we also developed a comprehensive list for various actors in the field to consider as they develop their own individual strategies that best contribute to workforce transitions as we shift to a clean economy.

Sector Intermediary

- Expand ecosystem partnerships to act as a bridge between Industry, Government and NGO's, Indigenous, rural, and distressed communities, Labor Unions, CBO's Non-Profits, and Academia to continue to identify and close gaps in workforce development and diversification.
  - Continue outreach and information sharing tools such as newsletters to all interested parties.
  - Plan continued convening events to provide a forum for shared knowledge.
  - Identify follow-on federal and state funding opportunities to continue to fund workforce development positions at the CleanTech Alliance and Center of Excellence.
- Leverage military transition / internship funding to connect employers with workers separating from the military.
  - These workers will be well versed in Basic Skills, Cross-Functionality, Social Awareness, Project Management, and Collaboration.
  - Many will have specialized STEM knowledge or be rapid on-the-job learners of needed additional skills or background.
- Develop initiatives to increase public awareness and understanding of cleantech as a career option.
  - Begin with middle school students, per recommendation from employers across the sector.
  - Engage with environmental non-profits to help raise awareness of the critical role of a diverse and prepared workforce to build our clean energy carbon neutral future.
  - Provide information and toolkits to K-12 teachers linking them to curriculum and help them develop an understanding of future career opportunities as best fits the ages they instruct.
  - Work with counselors and parents to raise awareness of the most in-demand jobs, myriad of training pathways, and opportunities for all youth to find good paying jobs in their own communities.
  - Connect counselors with industry-led internship programs and pre-apprenticeship programs and identify the key times to reach students seeking opportunities.
  - Work with industry members to organize or support Green Job Career Fairs.
  - Organize industry members to provide career exploration opportunities for students from high school through college, mid-career transition, and women returning to the workforce.
- CleanTech Alliance and PNCECE recognize that there are a variety of facilitators and barriers to attracting high-quality diverse talent to the public sector.
  - Students, teachers, and counselors have low awareness of the range of opportunities available in the public sector.
  - Many students view public-sector work as a way to improve their communities, but they also tend to have a variety of negative misperceptions about public-sector work.

- Internships often lead to applicants being more competitive for employment, but there is a perception that public-sector internship opportunities are both not widely and not equitably publicized, thus limiting the diversity of the applicant pool.
- Students all rely on informal connections and personal networks for recruiting, but informal networks tend to connect people of similar characteristics and exclude people from traditionally underrepresented backgrounds from opportunities.
- Government hiring processes are often very lengthy and complicated, which may limit the pool of talented and diverse applicants with the knowledge, patience, and resources to persist through these processes.

- Support a talented diverse workforce for public sector careers.
  - Consistently articulate leadership commitment to increasing recruitment of talented and underrepresented individuals into the public sector.
  - Communicate the benefits of public-sector careers: Emphasize the public sector's purpose-driven mission, employee benefits, and job stability, and publicize improvements.
  - Improve the awareness and sharing of job and internship opportunities, including by making job titles and descriptions clearer and helping students navigate the hiring process.
  - Foster preparation for career entry and retention by promoting funded internships and mentoring and professional development programs.
- Continue to update the twenty existing published skills standards and develop new skills standards organized by industry verticals and develop career pathways. PNCECE will gather input from industry for these needed updates beginning in the fall of 2022.
- Map existing training and education program maps for each industry vertical and create common core and basic skill shared programs to add efficiency to degree and certification programs, while helping learners explore a myriad of career pathways and options.
- Organize skills standards and training pathways into the following industry verticals, and use these definitions when working with STEM networks, teachers, and academia to create a stronger shared understanding of careers in the sector:
  - Utilities & Smart Grid
  - Building Technology & Construction
  - Clean (renewable) Energy: Hydro power, solar, wind, hydrogen, waste energy transfer, district energy, fusion, fission (small modular reactors).
  - Energy Storage & Batteries
  - Electrification/Zero Emission Transportation
  - Manufacturing & Materials
  - Circular Economy/Carbon Capture
  - Increase emphasis on work-integrated learning elements in curricula.
  - Water
  - Ag Tech and biofuels
  - Information Technology/Cybersecurity in Energy
- Identify successful internships and programs the industry is creating and leading, then:
  - Share outcomes and best practices.
  - Track internships and program completion rate

- Study outcomes to further identify the highest program effectiveness.
- Scale top programs to distribute statewide.
    - Connect employers with funding support to develop new programs.
    - Create toolkits to aid smaller employers create programs.

- Ensure entrepreneur training opportunities are available to workers who wish to upskill from laborers to owners, helping ensure career mobility opportunity is available to all. Seek following funding from federal agencies to support career transition program linkages with existing accelerators across the state.
- Continue research on workforce development gaps and employer needs for current openings and future technologies.
    - We have an open RFP for a research firm to conduct follow-up from our summer convening event and anticipate updating this strategy with their results this fall.
    - We will focus on workforce development as we continue to engage with our boards and committees.
    - We will include a workforce track at our existing conferences and events such as:
        - Energy Leadership Summit – each November
        - Innovation Showcase – each spring
        - Perkins Coie Learning Series
        - Summits/workshops developed by Centers of Excellence

Academia

- Encourage DEI-A hiring procedures - BIPOC and Women are recruited and supported in STEM fields; set targets for successful completion of STEM majors by underrepresented populations and report on progress.
- Connect students with industry early so they are aware of a variety of clean tech career options in our state.
- Leverage Community and Technical College existing programs to upskill, reskill, and quickly prepare learners for the most in-demand skills and jobs, versus develop entirely new programs.
    - Emphasize ‘soft skills’ employers have identified.
    - Use a shared model that prepares students to quickly adapt to more than one job placement and makes programs more efficient.
- Support the growing trend of short-term credentials to support entry and mid-career transitions.
- Create programs and pathways to attract women re-entering the workforce that include industry linkages and mentoring opportunity with corporations that have a demonstrated commitment to pay equity and transparency.
- Encourage a multi-disciplinary approach to learning across faculties.
- Increase emphasis on work-integrated learning elements in curricula.

Government/NGO’s

- Provide financial support to further the research and development of training programs to transition workers into clean economy jobs.
- Provide streamlined availability for effective JEDI (Justice, Equity, Diversity, and Inclusion), cultural sensitivity, and Women’s equity training modules.

- Government and NGO funding is recommended to assist small-midsized employers in retention of well-trained diverse workers.
- We suggest linking completion of a program by key industry staff to future funding rubrics that would provide support for industry to create apprenticeship or other internal training programs.

Industry

Industry will experience tremendous change in workforce needs, while simultaneously facing shortages due to a 'silver tsunami', rural recruiting challenges, and the current state of workforce shortages occurring globally. Industry members in our network are engaging with us to support their hiring efforts and provide best practices.

- Continue to expand efforts to recruit and retain a diverse workforce, and report on outcomes.
- The industry would see value in partnering at an industry-led level, and we recommend efforts include engagement with one or more of Washington Commerce's Innovation Cluster Accelerators or similar groups to join workforce development working groups and have another pathway to gather shared knowledge.
  - BUILT – CleanTech Alliance
  - Advanced Technology Cluster – WTIA
  - CH_2ARGE – JCDREAM
  - Washington VERTical – Port of Benton
  - EDGE – 5G Open Innovation Lab
  - SATE – Aerospace Futures Alliance
  - WAV-C – Kitsap Economic Development
  - PNAC – Pacific Northwest Aerospace Alliance
  - Evergreen Bioscience – Greater Spokane
  - CEWD – Center for Energy Workforce Development – regional and national
- Prioritize limited resources to align with the most in demand jobs and sectors and create training and pre apprenticeship programs internally where no other option exists or can scale to suit the need.
- Engage with Academia to create real-world learning opportunities for students from middle school through PhD.
- Connect with funding opportunities in the state to help create new programs.
- Career Connect Washington
- NGO's and CBO's
- Federal Grants
- Impact Washington
- Consider developing 'shared internship' programs that rotate learners through a variety of partnering businesses that demonstrate the foundational knowledge that applies to many clean technology jobs and makes the cost of hosting interns more affordable for smaller companies.
- Industry members should support programs and program builders focused on recent technology standard changes.
- Utilities have immediate large hiring need at up to 19% vacancy rates, ranging from engineers to customer services roles.

- Employers are stating that soft skills are needed to create a strong workforce and that candidates need to be people facing and can adapt to changes in the workforce.

Unions

The United States has an enormous opportunity to invest in a clean energy-driven economic recovery that will support millions of good-paying union jobs, confront environmental injustice, and prevent the worst impacts of climate change. Building the clean energy economy must go hand in hand with creating high-quality American jobs. Unions and worker power are integral to realizing this outcome. Large and small employers should access pre-apprenticeship and apprenticeship that will support the growth of the sector. Union apprenticeships create flexible training options that ensure workers develop the right skills and recruit and develop a highly skilled workforce that will support unions growth and create family sustaining wages, including career ladders so that every person has access to a middle-class career with health care, retirement benefits, and worker protections. It is critical that we maintain and strengthen strong partnerships with unions to create a clean energy economy and clean tech future.

- Ensure union leaders have access to continued information (meetings, newsletters, conferences, CEO roundtables and JEDI training) so they remain strong champions of clean energy, clean tech, and continue to provide leadership to help meet climate goals.
- Identify those who may be at risk of declining workloads as the state moves away from carbon-based fuel dependence.
- Help create pathways that map highly skilled workers to future emerging technologies.

Community Based Organizations

Community-based organization (CBO) service providers are often the entry point into the workforce ecosystem for job seekers historically excluded from economic advancement. CBO's engagement shows that providers can have a powerful impact when they combine in-demand job skills preparation, strong relationships with quality employers, and connections to other community resources. Groups that assist with employing immigrants, formerly incarcerated and disabled workers will continue to be added to this list as we continue research and establish connections. CBO's that can help support these efforts include:

- Workforce Development Councils/WorkSource
- TRAC Associates
- Pacific Associate
- Urban Leagues of Metropolitan Seattle and Pierce County
- ANEW (Apprenticeship and Nontraditional Employment for Women)
- Northwest Education Access
- Emerald City Collaboratives
- El Centro de la Raza

Strategies all groups can employ include:

- Connect with sector intermediaries to assist employers' ability to pay for wraparound care and support for workers from the most disadvantaged communities.
- Make connections for wrap around care to diversify workforce.