NREL
Transforming ENERGY

SEP National Training Forum

Workforce Development Session

Allison Moe, Sarah Truitt, Julia Sullivan, Robin Tuttle

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Denver, CO

NREL Team

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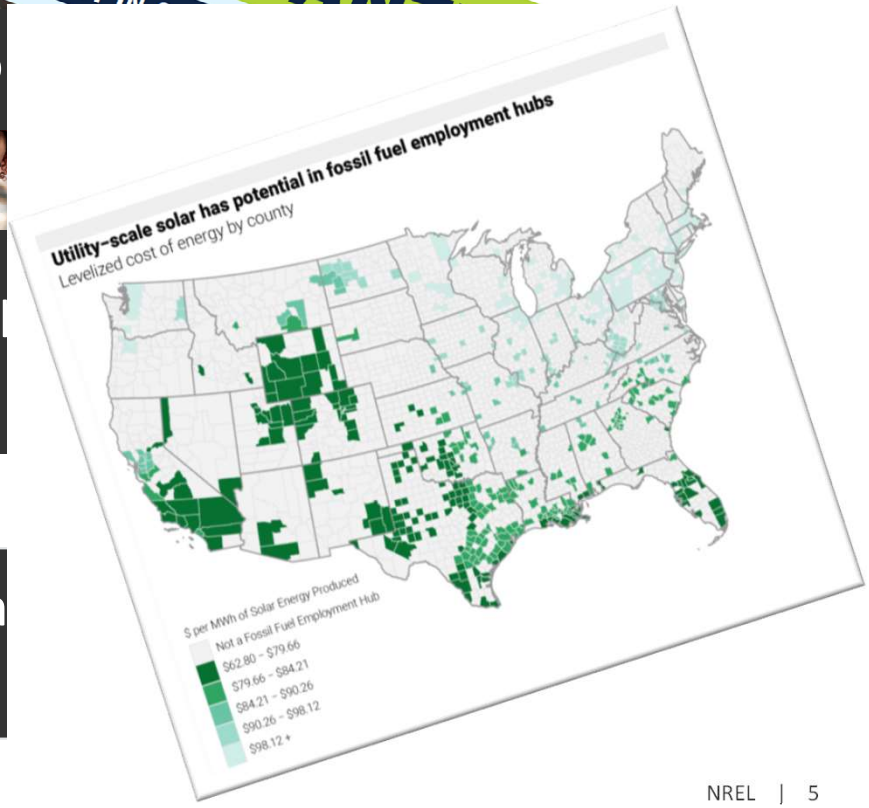
Agenda

1. Employment in the Clean Energy Industry: Unpacking the Data
2. State-Level Employment Projections Report Overview
3. Workforce Development Intro
4. Case Studies
5. Breakout Session
6. DOE Wrap-up

Employment in the Clean Energy Industry: Unpacking the Data

Sarah Truitt

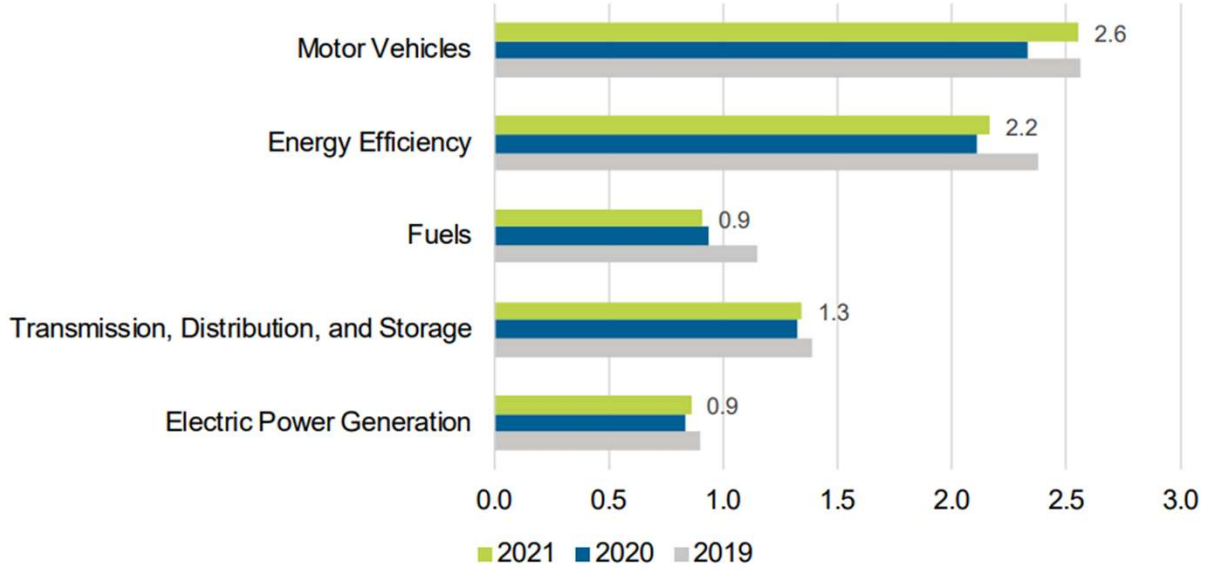
There is no shortage of data on clean energy jobs!



industry.

2021 Energy Industry Employment Statistics (U.S.)

- The U.S. energy sector grew 4% over 2021, outpacing the overall job growth of 2.8%.
- In 2021, the energy sector added 300,000 jobs, totaling 7.8 million workers nationwide.



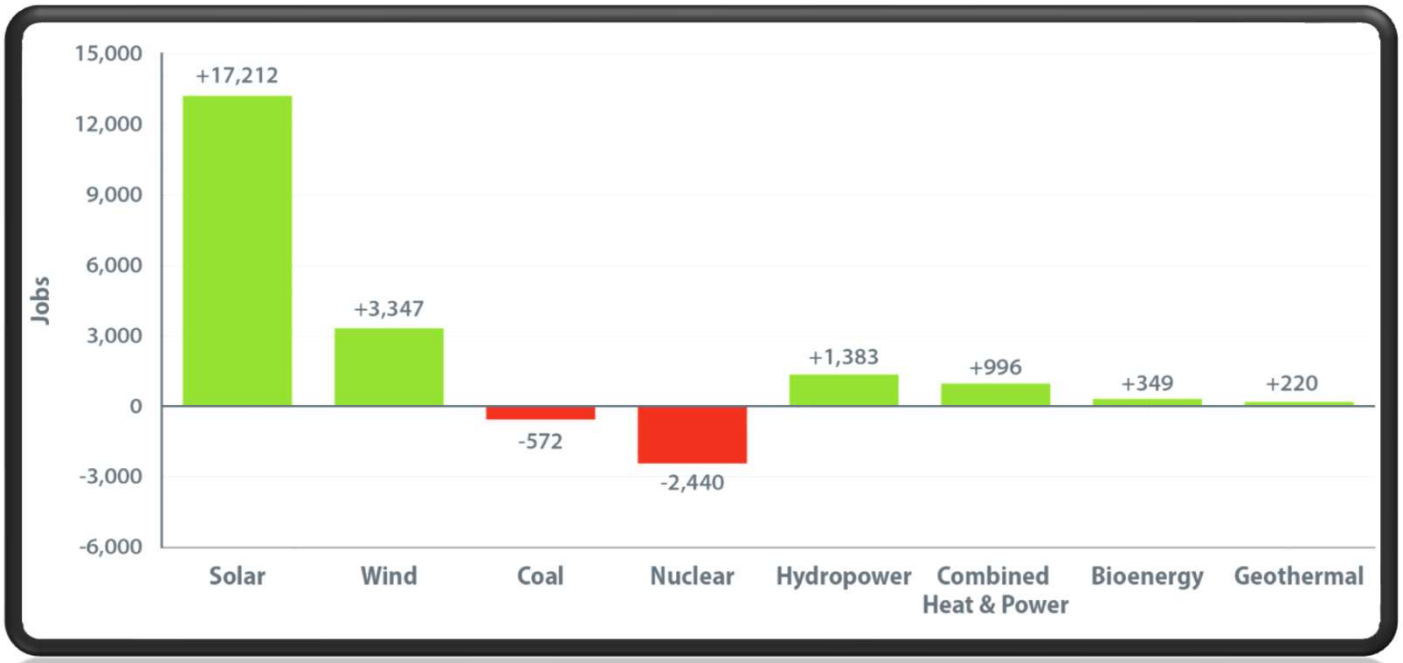
U.S. Energy & Employment Report 2022

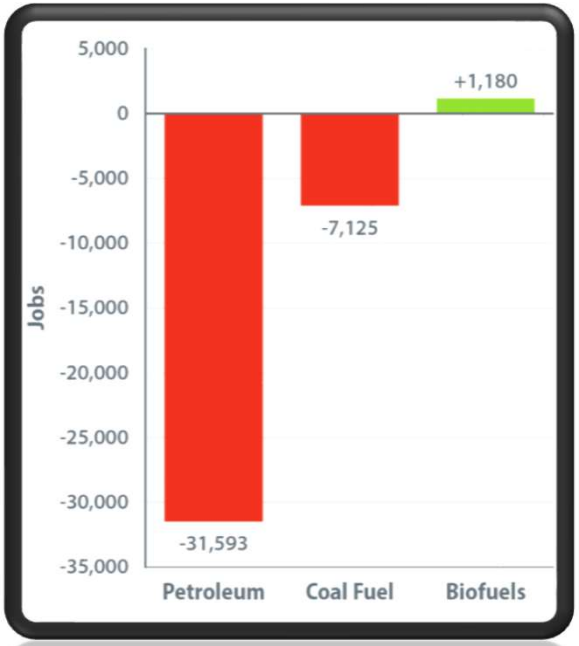
Roughly 40% of 2021 energy jobs (about 3 million jobs) are in net-zero aligned* occupations.

*Net-zero aligned occupations are those related to renewable energy, grid technologies and storage, transmission and distribution, nuclear energy, a subset of energy efficiency, biofuels, and plug-in hybrid, fully electric, and hydrogen fuel cell vehicles and components.

Energy Sector Jobs Added or Lost in 2021: (U.S.)

In general, clean energy jobs are on the rise while fossil fuel jobs are declining.





Source: https://www.energy.gov/sites/default/files/2022-06/USEER%202022%20Fact%20Sheet.pdf

A Closer Look at Wages

- Clean energy jobs pay more than the national median wage in most states.
- 10 states where it pays less and 7 where it pays a lot more (20%+ more).
- The median wage is enough to sustain a family in only six metro areas.

Data from E2, ACORE, and CELI (2020)

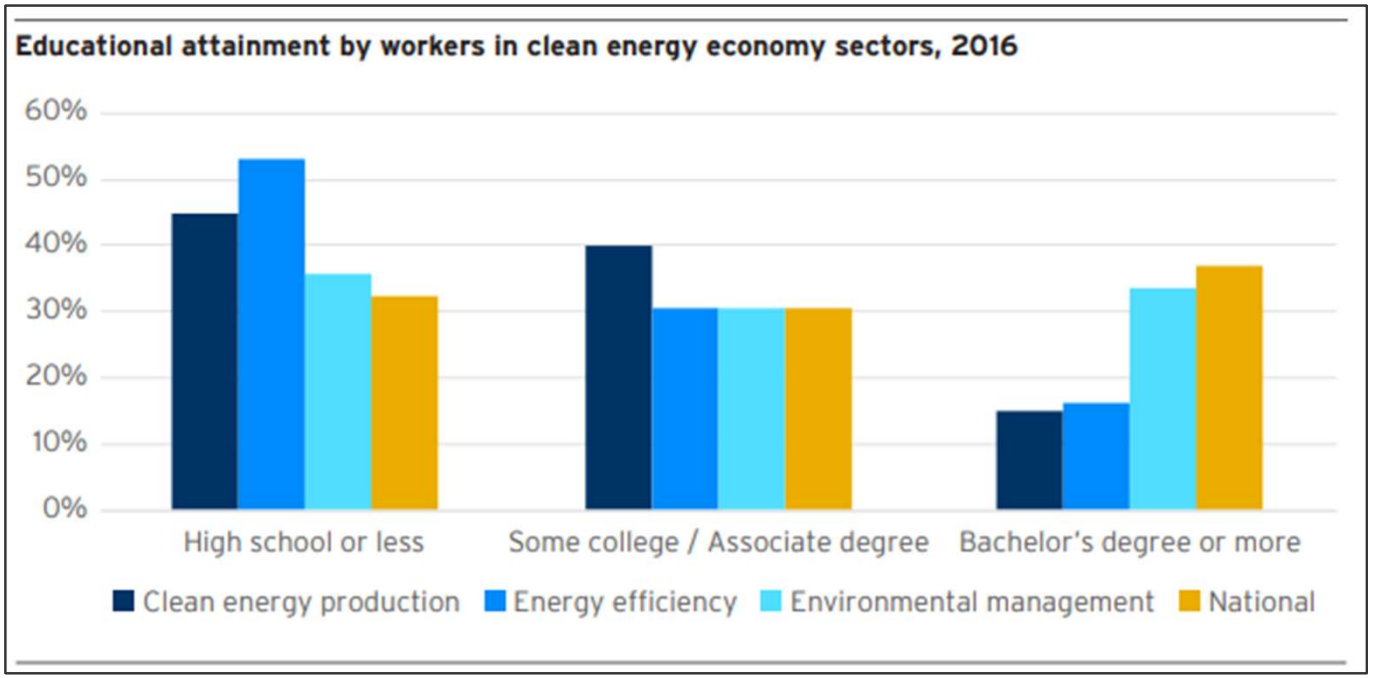
	State Clean Energy Wage, 2019	% Above/Below State-Specific Median Wage
Alabama	$18.56	10.8%
Alaska	$25.75	10.3%
Arizona	$21.27	14.9%
Arkansas	$16.71	5.5%
California	$27.49	29.2%
Colorado	$23.12	8.5%
Connecticut	$25.19	8.4%
Delaware	$22.44	13.6%
District of Columbia	$27.56	-21.8%
Florida	$19.13	11.1%
Georgia	$21.36	19.9%
Hawaii	$23.78	11.3%
Idaho	$17.91	5.8%
Illinois	$22.46	13.1%
Indiana	$17.37	-2.3%
Iowa	$17.93	-2.8%
Kansas	$18.67	5.0%
Kentucky	$17.92	5.0%
Louisiana	$20.98	24.9%
Maine	$18.22	-1.4%
Maryland	$24.37	10.6%
Massachusetts	$29.84	23.2%
Michigan	$19.93	6.8%
Minnesota	$22.44	5.9%
Mississippi	$14.69	-2.2%
Missouri	$18.97	6.2%

	State Clean Energy Wage, 2019	% Above/Below State-Specific Median Wage
Montana	$18.08	3.9%
Nebraska	$17.54	-4.6%
Nevada	$20.55	16.9%
New Hampshire	$23.02	14.4%
New Jersey	$24.22	11.1%
New Mexico	$18.95	11.7%
New York	$27.07	20.9%
North Carolina	$20.05	12.8%
North Dakota	$20.34	-0.1%
Ohio	$18.85	1.2%
Oklahoma	$17.50	1.9%
Oregon	$23.91	20.9%
Pennsylvania	$20.26	5.7%
Rhode Island	$21.33	0.2%
South Carolina	$17.98	7.8%
South Dakota	$16.15	-3.2%
Tennessee	$19.87	15.2%
Texas	$23.39	27.6%
Utah	$19.30	5.5%
Vermont	$18.81	-4.8%
Virginia	$21.84	7.1%
Washington	$25.39	10.7%
West Virginia	$17.91	10.3%
Wisconsin	$19.73	4.5%
Wyoming	$19.14	-4.4%

Note: Wages presented are pre-pandemic wages and do not reflect changes in the labor market since then.

More information is at the Clean Jobs, Better Jobs report website.

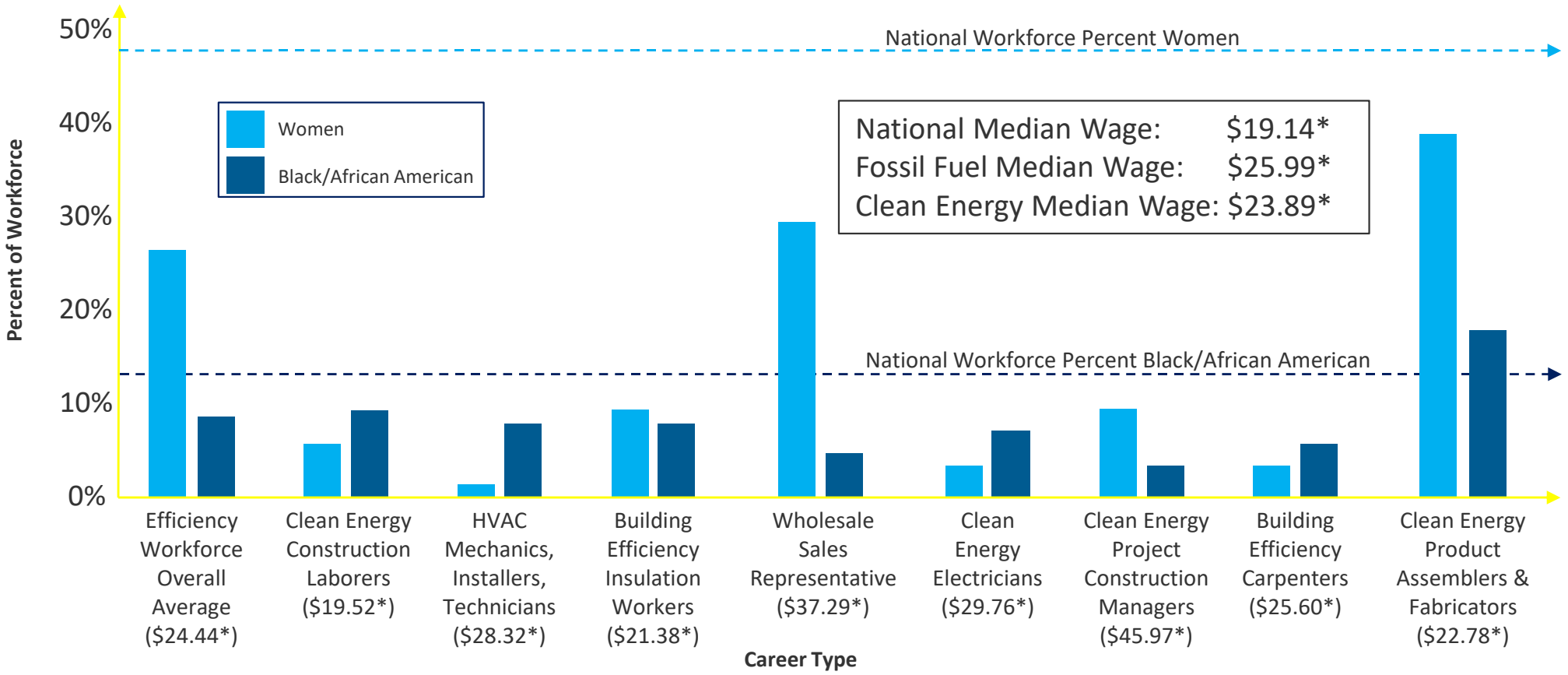
Clean Energy Jobs are Attainable for All Education Levels



Source: Brookings, 2019, Advancing Inclusion through Clean Energy Jobs

- Many clean energy jobs do not require a 4-year college degree.
- Over half of EE workers have no college education.
- Clean energy workers on the lower end of the income spectrum are paid $5.00-$10.00 more per hour than similar workers in other industries.

Wages & Diversity



Source: E2, 2020, Clean Jobs, Better Jobs Report

*Dollar value represents median hourly wage in sector.

Sampling of Data from Recent Job Studies

Author Organization(s)	Publication Title	Year	Sectors	Methodology	Job Types Reported	Job Units Reported	Sample of Results
Elsevier (Garrett-Peltier 2017)	*Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model*	2017	Renewables, EE	I/O	Direct, indirect	Jobs/$1M	7.49 jobs/ $1M invested in renewable energy, 7.72 jobs/ $1M invested in EE
Solar Energy Industries Association (SEIA 2021)	*National Solar Jobs Census*	2020	Solar (PV)	Survey	Direct, indirect	Total jobs	400,000–900,000 solar (PV) jobs created by 2030
National Association of State Energy Officials, Energy Futures Initiative, BW Research (NASEO, EFI 2020)	*U.S. Energy and Employment Report*	2020	Total energy sector	Survey	Direct, indirect	Total jobs	2.3M jobs in economy-wide EE sector
Energy Storage Association (ESA 2020)	*Enabling the Clean Power Transformation*	2020	Energy storage	Literature review	Unspecified	Total jobs	At least 200,000 jobs created by 2030
University of Massachusetts (Pollin et al. 2021)	*Employment Impacts of Proposed U.S. Economic Stimulus Programs*	2021	All infrastructure industries (including energy)	I/O	Direct, indirect, induced	Jobs/$1M	11.8 jobs per $1M investment in wind
American Council for an Energy Efficient Economy (Ungar 2021)	*Clean Infrastructure: Efficiency Investments for Jobs, Climate, and Consumers*	2021	Clean infrastructure industries	I/O	Unspecified	Job years/ $1B	1.9M–4.3M job years/ $107–$232B invested

Important items to identify when interpreting jobs data:

- **Total jobs:** The number of people needed to support an industry in a specific year.
- **Job years:** Adds time element to a "job" to account for short-term (construction) and long-term jobs (operations).
- **Job multipliers -** Jobs/ unit of deployment or investment.
- **Direct:** Jobs directly associated with installing or operating a technology.
- **Indirect:** Jobs related to supply chain.
- **Induced:** Jobs resulting from additional spending in the region.
- **FTE:** Full-time equivalent.

Source: https://www.nrel.gov/docs/fy22osti/81486.pdf

State-Level Employment Projections for Four Clean Energy Technologies 2025-2030

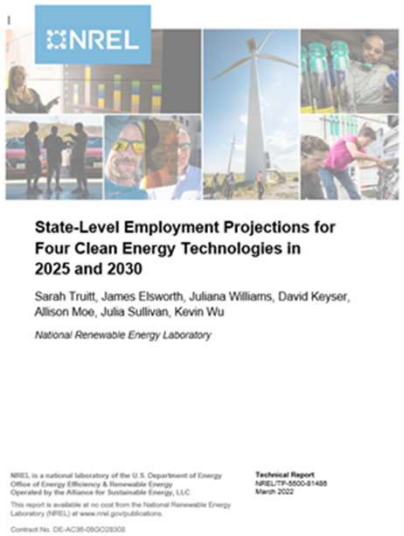
Julia Sullivan

Objectives:

- ✓ Model future job growth scenarios to inform workforce planning decisions
- ✓ Provide a simple methodology readers can apply to their own forecasts and local contexts

State-Level Employment Projections for Four Clean Energy Technologies in 2025 and 2030

- NREL Technical Report
- 51 Individual Fact Sheets



https://www.nrel.gov/docs/fy22osti/81486.pdf

Report Overview: Clean Tech Sectors

The report provides a simple, transparent estimation methodology and jobs data in four areas:

- Energy efficiency in buildings
- Grid-connected battery energy storage (BES)
- Solar photovoltaics (PV)
- Land-based wind

Images source: NREL

U.S. Jobs Estimates for Four Clean Energy Sectors (Total direct and indirect jobs)

Clean Energy Sector	U.S. Job Estimates 2020 (Reported/Modeled)	U.S. Job Estimates 2025* (Modeled)	U.S. Job Estimates 2030* (Modeled)
Solar (PV)	293,874	384,000–529,000	509,000–757,000
Wind (land-based)	116,817	132,000–161,000	143,000–219,000
Battery Storage (grid-connected)	66,751	126,000–181,000	197,000–376,000
Energy Efficiency** (utility cost-effective measures in buildings)	65,313	167,000	283,000

2020 jobs for PV, BES, and wind jobs were reported in the 2021 USEER, then modified to align with the select technologies included in this report. Energy efficiency jobs were modeled using expenditure projections from the *U.S. Energy Efficiency Potential Through 2040: Update on Potential for Energy Savings Through Utility Programs Across the Nation from the Electric Power Research Institute* and the IMPLAN model. Jobs in 2025 and 2030 were estimated using methods described in report methodology.

*The lower end of the range represents jobs associated with supporting the existing installations and new deployments in 2025 and 2030 under a business-as-usual scenario. The upper end is associated with an accelerated level of new deployments through 2030.

**Energy efficiency jobs include only those associated with cost-effective efficiency measures from a utility perspective and do not capture energy efficiency jobs associated with economy-wide energy efficiency measures in buildings or those aligned with meeting decarbonization goals.

Report Overview: Included Information

National data for each clean energy technology:

- Reported jobs and deployments in 2020
- Projected jobs in 2025 and 2030 based on “business-as-usual” and “accelerated, but realistic” deployment scenarios
- COVID-19 impacts on jobs
- Breakdown of industries within each clean energy sector
- Sampling of skills, education, and certifications required for a range of occupations
- Links to additional resources.

https://www.nrel.gov/docs/fy22osti/81486.pdf

States' Jobs Potential Fact Sheets

Go to NREL.gov for full report, summary, an interactive map feature to connect you with your state's fact sheet

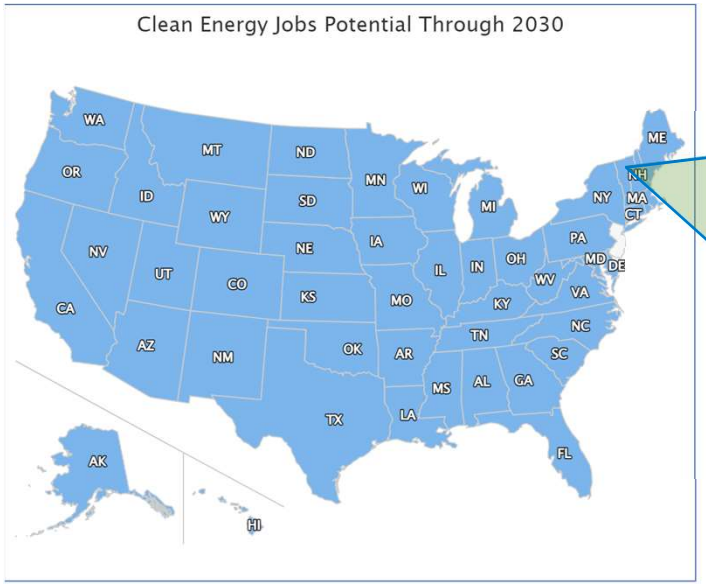
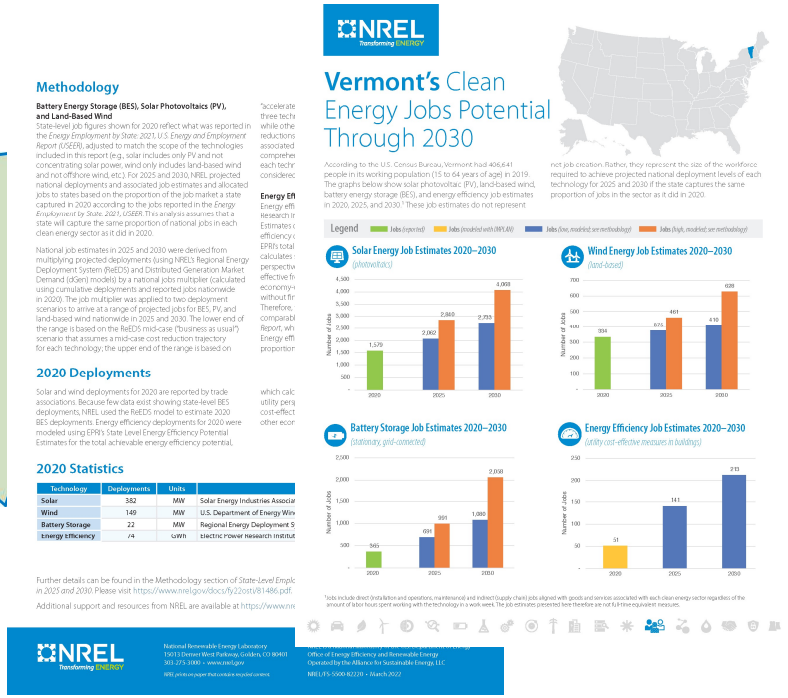


Photo from NREL Communications



https://www.nrel.gov/state-local-tribal/state-employment-projection-support.html

Using Jobs-Multipliers for 2025 and 2030

Table B-2. Calculations for PV Job Multipliers

Step	Description	Solar (PV)		
		2020	2025	2030
1	Calculate a national jobs multiplier using 2020 reported deployments and jobs (jobs/MW) (293,874/102,465 = 2.87).	2.87		
2	Calculate the rate of CapEx cost decline expected from 2020–2025 and 2025–2030 from the Annual Technology Baseline (ATB) for each technology (moderate CapEx cost reduction scenario, average cost decline among utility, commercial and residential solar applications).		-28%	-40%
3	Reduce the 2020 jobs multiplier by the amount of cost declines to derive 2025 and 2030 jobs multipliers.		2.06	1.23
4	Estimate national MW deployment in 2025 and 2030 based on NREL's ReEDS model for mid-case and low-cost scenarios, adjusted to include Alaska, DC, and Hawaii deployments in 2020.		186,772–257,226 MW	412,105–613,463 MW
5	Multiply 2025 and 2030 deployments by the 2025 and 2030 jobs multiplier to arrive at an estimated number of jobs nationally in 2025 and 2030 in each technology sector (rounded to nearest thousand).		384,000–529,000 jobs	509,000–757,000 jobs
6	Calculate each state's ratio of total jobs in each technology sector in 2020.	State by state %s		
7	Multiply total jobs nationwide in 2025 and 2030 by state's proportion of all U.S. jobs to arrive at estimated jobs in each state in 2025 and 2030 (assuming the state captures the same proportion of total U.S. solar jobs as they did in 2020).	State by state #s	State by state #s	State by state #s

Job / MW multipliers can be utilized directly*

**accounting for capex declines over time*


COLORADO'S CLEAN ENERGY PLAN

AUGUST 2022 UPDATE

INFORMATION SHEET COLORADO

Xcel Energy®

How we'll get there

Decision summary

We're proud of our nation-leading Clean Energy Plan, which we crafted working with customers, communities and commissioners to accelerate the delivery of clean energy in Colorado while protecting reliability and affordability. We all benefit from reduced carbon emissions. Together we've mapped out a path to add low-cost renewable energy and make significant improvements to the grid's overall resilience. It's an important step to becoming a net-zero energy provider by 2050.

Robert Kenney,
President, Xcel Energy - Colorado

100 MW forecasted for 2025 x 2.06 jobs / MW = 206 potential direct & indirect solar jobs

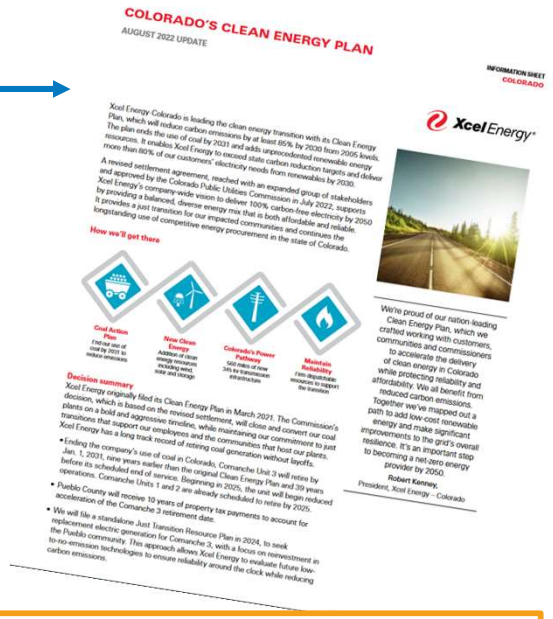
Sources: https://www.nrel.gov/docs/fy22osti/81486.pdf; https://www.xcelenergy.com/staticfiles/xe-responsive/Environment/Clean%20Energy%20Plan%20InfoSheet%208.31.22.pdf

Jobs Multipliers for Energy Efficiency

Table C-1. State Jobs Multipliers for Direct Jobs Associated With Energy Efficiency Investments

State	Estimated Investment in Utility Cost-Effective Energy Efficiency Programs		Average Direct Jobs/ $1M USD
	2025	2030	
AK	$33,307,204	$51,494,832	5.61
AL	$426,497,279	$720,254,982	5.83
AR	$303,474,359	$521,944,586	6.62
AZ	$547,905,330	$927,275,446	5.44
CA	$1,625,991,860	$2,518,732,887	4.32
CO	$341,537,337	$576,299,939	4.45
CT	$80,939,193	$125,596,993	4.73
DC	$90,427,042	$151,968,187	3.63
DE	$66,475,483	$111,716,125	5.69
FL	$1,817,829,818	$3,229,205,021	6.36
GA	$798,661,768	$1,342,116,034	5.43
HI	$57,915,209	$89,540,208	5.47
IA	$190,947,795	$316,731,190	5.97
ID	$135,228,258	$228,180,139	6.38
IL	$374,590,108	$646,768,067	4.60
IN	$437,641,529	$755,632,783	5.59
KS	$155,327,393	$257,646,494	4.32
KY	$371,107,290	$626,714,138	4.87
LA	$528,438,214	$908,859,206	6.38
MA	$151,827,113	$235,596,975	4.07
MD	$454,343,507	$763,552,117	5.91
ME	$34,289,747	$53,208,946	7.21
MI	$514,488,817	$888,317,470	3.84
MN	$273,575,909	$453,789,075	5.46
MO	$312,730,305	$518,735,718	5.62
MS	$238,689,718	$403,091,571	6.50
MT	$84,510,837	$142,601,072	6.77
NC	$837,115,455	$1,406,823,841	4.66

Direct jobs / $1 M USD associated with utility energy efficiency investments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Robert Kenney,
President, Xcel Energy – Colorado

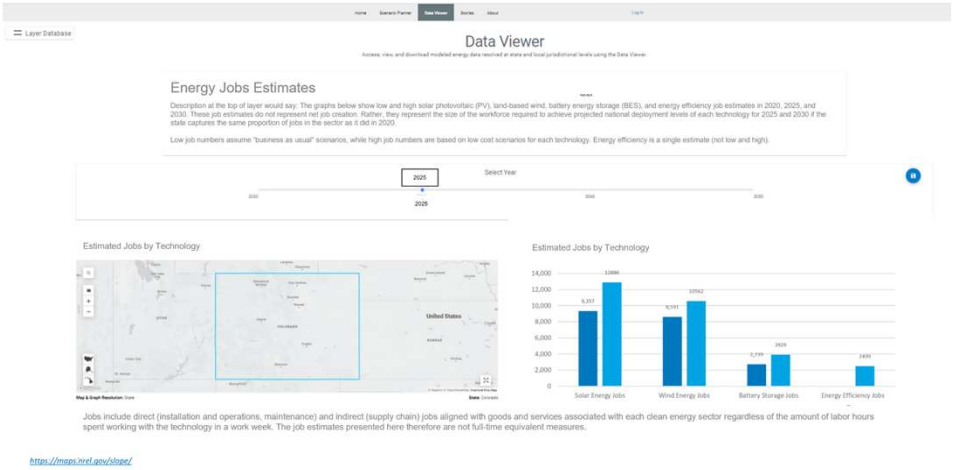
$100 M forecasted x 4.45 jobs / $1 M = 445 potential direct jobs in energy efficiency

Sources: https://www.nrel.gov/docs/fy22osti/81486.pdf; https://www.xcelenergy.com/staticfiles/xe-responsive/Environment/Clean%20Energy%20Plan%20InfoSheet%208.31.22.pdf

Coming Soon - 2023

State-specific data & resources:

- Jobs data on SLOPE (Winter)
- Clean Energy Job Openings Dashboard (Summer)
- Workforce Development Program Evaluation Framework (Fall)



SLOPE Jobs Data - Sample Mockup

Occupation Title	Number of Job Postings	Mean Market Salary, last 12 months	% Requiring High School	% Requiring Post-Secondary or Associate's Degree	% Requiring Bachelor's Degree	% Requiring Master's Degree	% Requiring Doctoral Degree	% With Unspecified Education	% With a High School Diploma or Less	% With Some College or An Associate's	% With a Bachelor's or Higher
Geospatial Information Scientists and Technologists	15,273	$67,601	32%	7%	73%	17%	3%	35%	28%	11%	61%
Solar Sales Representatives and Assessors	14,323	$41,517	73%	10%	30%	2%	1%	82%	44%	9%	48%
Solar Photovoltaic Installers	9,029	$36,718	96%	10%	4%	1%	0%	65%	78%	10%	12%
Water/Wastewater Engineers	3,934	$79,026	0%	0%	96%	41%	3%	21%	9%	3%	88%
Wind Turbine Service Technicians	3,050	$41,884	82%	30%	45%	2%	1%	35%	79%	10%	11%
Sustainability Specialists	2,694	$69,710	5%	3%	88%	47%	3%	20%	27%	8%	65%
Water Resource Specialists	2,554	$36,244	0%	16%	78%	36%	10%	93%	7%	3%	89%
Energy Engineers	2,280	$84,112	0%	0%	93%	35%	6%	13%	12%	7%	81%
Solar Energy Installation Managers	2,259	$58,166	17%	2%	86%	14%	1%	60%	82%	7%	11%
Green Marketers	1,788	$46,344	7%	5%	93%	4%	0%	33%	19%	6%	76%
Chief Sustainability Officers	1,612	$78,297	7%	5%	86%	45%	4%	19%	25%	5%	70%
Solar Energy Systems Engineers	917	$69,766	0%	0%	94%	27%	8%	36%	12%	7%	81%

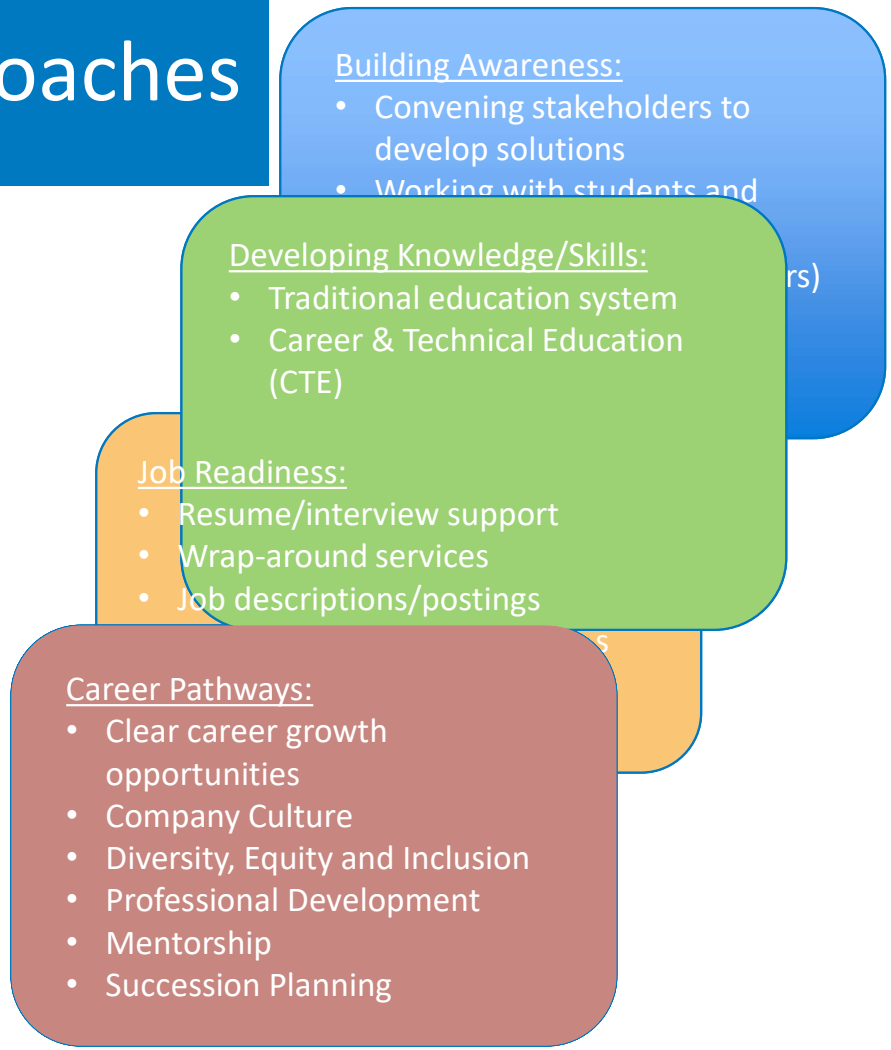
Energy Jobs Dashboard - Sample Mockup

Introduction to Workforce Development

Allison Moe

Workforce Development Approaches

- Building Awareness and Interest
- Developing Knowledge and Skills
- Job Readiness and Placement
- Supporting Career Pathways (Employee Retention)



Equity plays a major role in all of this.

Workforce Development Approaches

Workforce Development *can* include:

- Market potential research
- Jobs modeling/projections
- Asset Inventories/gap analyses

Economic Development *can* include:

- Recruiting or supporting business in a region
- Legislation/policy
- Local tax or incentive policies
- Community Benefits Agreements

These may be necessary foundations to develop/implement workforce development activities.

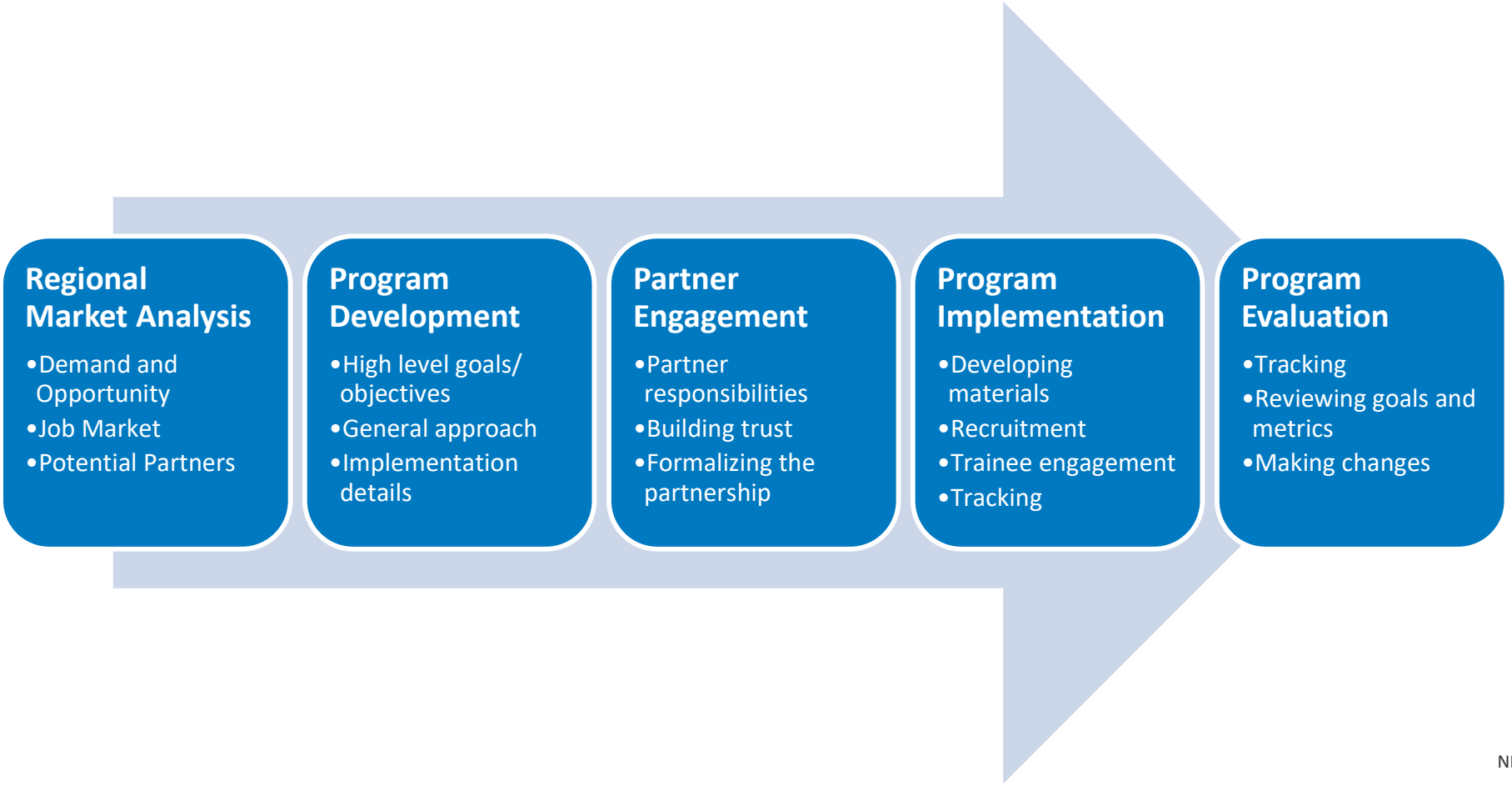
Who is Involved with Workforce Development?

- Building Awareness and Interest
- Developing Knowledge and Skills
- Job Readiness and Placement
- Supporting Career Pathways/Employee Retention

- K-12 Educators
- Community/Technical Colleges
- Colleges and Universities
- Unions/Labor organizations
- Workforce Boards (state/local)
- Nonprofits, Corps/Service Year Programs, Housing Authorities
- Firms/Employers
- Industry/trade groups
- Municipal/state governments
- Utilities/State Energy Offices
- More . . .

PARTNERSHIPS ARE KEY TO SUCCESSFUL IMPLEMENTATION

Sample Steps to Develop Workforce Development Programs



Sample Steps to Develop Workforce Development Programs

Workforce Development Case Studies

Robin Tuttle

Milwaukee, Wisconsin Offsite Construction

Focus on underserved and formerly incarcerated populations

- Train 30 people of color for energy efficiency jobs.
- Determined offsite construction has the most potential, particularly for those with risk factors that could lead to incarceration or recidivism.
- Four training levels recommended.
- Public housing units using prefabricated wall and floor panels may reduce construction costs 5-7%; part of savings could fund both the training program and production facility.

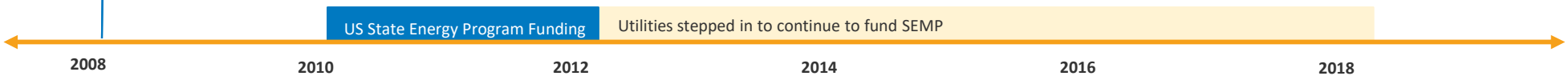
Foundation Level
NCCER Core
OSHA 30
Basic Level
NCCER Manufactured Construction I
OJT (500 hours)
Advanced Level
NCCER Manufactured Construction II
OJT (1,000 hours)
Supervisor Level
NCCER Project Management
NCCER Sustainable Const Supervisor

Business Plan Lite: https://city.milwaukee.gov/ImageLibrary/BBC/Events/ProspectusBusinesPlanLite004.pdf
RFI: https://city.milwaukee.gov/ImageLibrary/BBC/images/Housing-Plan/RFIforMilwaukeeManufacturingPartnership.pdf

Kentucky: School Energy Management Program (SEMP)

Focus on school facility energy managers

The Kentucky School Board Association (KSBA) partnered with **the Kentucky Department for Energy Development and Independence (DEDI)** for $5 Mil from the **U.S. DOE State Energy Program.**



SEMP funded and trained local school energy managers from 2010-2018, **saving an estimated $225 million** and helping the state's portfolio of Energy Star rated schools grow from 12 in 2008 to 450 in 2018.

SEMP energy managers learned **ENERGY STAR guidelines for energy management** and skills such as:

- Stakeholder engagement
- Energy assessment
- Energy management planning
- Annual energy and financial reporting.

"It is important to understand that learning how to manage our energy resources does not happen overnight."

- Jimmy Arnold, Energy Manager and Chief Information Officer for Butler County Schools

Blog Post: https://landairwater.me/2016/07/01/school-energy-managers-the-sustaining-power-of-energy-efficiency/
Case Study: https://www.energystar.gov/sites/default/files/tools/Kentucky%20School%20Energy%20Managers%20Project%20Case%20Study.pdf
Utility Report: https://psc.ky.gov/pscecf/2015-00398/rick.lovekamp@lge-ku.com/09122017110517/Closed/LGE_ENERGY_MANAGEMENT_REPORT_FY2017.pdf

Virginia: Energy Workforce Consortium

Focus on state consortia model

Virginia Energy Workforce Consortium (VEWC)

- Brings together education, industry, labor, and public partners to support the energy sector workforce in Virginia, including renewable energy.
- Hosts a Careers in Energy Week each year
- Supported the state's adoption a formal 17th Energy Career Cluster for career and technical education (CTE) programs across the state.

Virginia Energy Workforce Consortium: https://www.mwdoc.com/water-energy-education-alliance-weea/
Center for Energy Workforce Development – State Consortia: https://cewd.org/state-consortia/

NYSERDA Clean Energy Workforce Development

Focus on clean energy workers in various career stages

Clean Energy Internship Program

- Limited time **interns**
- $6500 per intern
- 80 – 480 hrs at up to $17 / hr
- Have supported 129 clean energy interns at 20 NY businesses.
- Businesses who bring on paid interns get on-the-job training support

On The Job Training Program

- full-time **new workers**
- $8000 per hire
- 4-6 months training period / 960 hours
- The workers must be *hired* not taken on temporarily
- They've supported 36 businesses in hiring 106 new hires
- Have spent $700,000 thus far

Climate Justice Fellowship

- 12 mo. full-time **fellows**
- $37K towards salary and $3K training
- 12-month employment
- In 2021 ~50 fellows
- In 2022 and 2023 ~100 fellows
- Includes training and mentoring support for both fellow and company

Focus on underserved communities or priority populations

- Veterans
- Native Americans
- Individuals with disabilities
- Incumbent or unemployed power plant workers
- Previously incarcerated individuals
- 16–24-year-olds in/from work preparedness training
- Homeless individuals
- Single parents

Funding Training Programs for clean energy

- $3.3 mil for 17,000 workers to get training and $8 mil for 4,6000 in building O&M
- Curriculum development
- Online, classroom, and other training
- Training labs and equipment
- Hiring new trainers
- Testing and certification fees
- Apprenticeships and pre-apprenticeships
- Services to place individuals in job or training opportunities
- Training for non-English speakers

Blog Post: https://www.nyserda.ny.gov/About/Newsroom/2019-Announcements/2019-09-24-NYSERDA-Announces-New-Yorks-Rapidly-Growing-Clean-Energy-Economy-Employed-Nearly-159000-Workers-in-2018
Climate Justice Fellowship Webinar: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Clean-Energy-Workforce-Development/PON-4772-Climate-Justice-Fellowship-Info-Webinar-91621.pdf
Energy Efficiency and Clean Technology Training Summary: https://www.nyserda.ny.gov/All-Programs/Energy-Efficiency-and-Clean-Technology-Training
Newsletter: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Clean-Energy-Workforce-Development/Summer-2022-Clean-Energy-Quarterly-Newsletter.pdf
Blog Post: https://www.nyserda.ny.gov/About/Newsroom/2019-Announcements/2019-09-24-NYSERDA-Announces-New-Yorks-Rapidly-Growing-Clean-Energy-Economy-Employed-Nearly-159000-Workers-in-2018

Breakout Sessions

Guiding Questions

- What workforce approaches have worked in your state?
- What workforce approaches haven't worked?
- What are the main clean energy workforce challenges/concerns in your state?
- How have you addressed challenges?
- What tools and resources could be the most helpful to you?

Thank you!

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