



REGIONAL ENERGY CONVERSATIONS

Energy

JOBS

POWER

EFFICIENCY

sustainability

TECHNOLOGY

Technician

ADVANCED TECHNOLOGY ENVIRONMENTAL AND ENERGY CENTER

A report from Regional Energy
Conversations sponsored by the
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and Energy Center

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Eastern Iowa Community College District



Partnership for Environmental
Technology Education



University of Northern Iowa

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ATEEC is part of the Eastern Iowa
Community College District (EICCD).



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Additional copies of this report can be downloaded at ATEEC's Web site: www.ateec.org.

INTRODUCTION

The energy technology industry is growing by leaps and bounds. The advent of new technologies, public interest in “green” jobs, the increased role of energy in national security issues, changes in regulatory compliance requirements, and the changing demands of industry call for a realignment of academia, industry, business, and government stakeholders. New energy technology career categories are emerging at an unprecedented pace, and skill sets traditionally associated with energy technology are cutting across both traditional and emerging industries.

In 2008, the Advanced Technology Environmental and Energy Center (ATEEC) published the national *Defining Energy Technologies and Services* report. This report, funded by the National Science Foundation (NSF), contains the results of a national forum for defining energy technology. The report provides an overview of the energy field in the U.S., including:

- Title and definition of the field of energy technology
- Definition of technician
- Energy technology occupational categories
- Technician-level occupational titles
- Job functions typically performed in each occupational category

Committed to promoting collaboration and flexibility among energy stakeholders in order to meet the needs of the U.S. workforce, NSF decided in 2009 to take a second important step in beginning to effectively and efficiently address the rapid changes in the energy field and the resulting need for worker training. Pragmatically, there is a growing need to ensure that the rush to train energy technology workers is balanced by a systematic analysis of what jobs are needed and where those jobs are located. The workforce cannot be well served by providing training to technicians without corresponding jobs in the labor market.

To this end, NSF tasked ATEEC with facilitating a series of seven regional Energy Conversations. The primary purpose of the conversations has been to obtain a snapshot view of

existing and upcoming energy jobs and to determine which jobs are currently needed in different regions of the country. The resulting report on these Energy Conversations is intended to provide a preliminary labor market analysis and needs assessment. This information allows educational organizations to most effectively target regional energy industry requirements and to provide both short- and long-term education and training for the energy technicians of the 21st century workforce.

Energy Technologies and Services is a career field that applies the principles of science, engineering, communication, economics, management, and law to optimize the sustainable production, delivery, and use of energy resources.

The audience for this report includes:

- Counselors, faculty, and administrators of academic institutions at all levels, but particularly in two-year colleges and high schools
- Technicians and employers of technicians (e.g., companies, government agencies);
- Leaders of professional societies
- Federal, state, and local government officials responsible for the quality and quantity of the nation’s technical workforce

Ultimately, this report should contribute to addressing the workforce development needs of business, industry, and government by providing educators with information needed to develop relevant curriculum that prepares students for energy technology careers. The report will also be used to provide direction for ATEEC, a Center of Excellence partially funded through a grant from NSF. The Center brings together educational institutions, training organizations, business, and industry stakeholders from across the nation to promote and assist in developing relevant and high-quality energy technology programs.

BLUEPRINT OF THE ENERGY CONVERSATIONS

ATEEC collaborated with NSF to choose seven representative regions in the country in which to hold each one-day Regional Energy Conversation meeting. ATEEC coordinated the effort with regional host organizations, which invited experienced energy technology practitioners and educators in the region who have a broad perspective of the various occupational areas included in this field. The participants who attended the Energy Conversations included business, industry, non-profit, and government agency representatives, as well as two- and four-year college environmental technology educators. The coordinators attempted to gather as broad a representation of participants from each region as possible within limited time and budget constraints.

Using the national *Defining Energy Technologies and Services* report as a point of reference, the 2009/2010 Regional Energy Conversation participants agreed to use the following general assumptions for the purposes of their discussion, in order to make the most efficient use of their expertise in targeting specific energy occupations:

- Energy technologies and services is a career field that applies the principles of science, engineering, communication, economics, management, and law to optimize the sustainable production, delivery, and use of energy resources.
- The definition of a technician is a worker who applies knowledge, skills, and abilities to perform scientific, technical, communication, and regulatory tasks.
- The educational background for technicians typically ranges from a high school diploma plus on-the-job training to a two-year associate degree, usually in an applied technology program.

In each energy conversation, ATEEC facilitators assisted participants working in large and small discussion groups to address the following items at a regional level:

- Specific technician-level jobs typically found in the area
- Types of certification required by these jobs
- Labor market data resources for the region
- Most prevalent and fastest-growing jobs
- Area's current Best Practices in education and training for energy jobs
- Common technical skills that cut across energy occupations
- Common employability skills required for most of these occupations
- Future trends in the energy field

The results of the input gathered from the energy field experts across the country are contained in this report. The following sections are presented by region and detail the area's current occupations, labor market data, and model programs and partnerships in energy technology education. Highlighted job titles indicate regional differences between regional and national occupational titles. (National job titles are based on those listed in the *Defining Energy Technologies and Services* report.)

A technician applies knowledge, skills, and abilities to perform scientific, technical, communication, and regulatory tasks, to optimize the sustainable production, delivery, and use of energy resources.

A small wall chart is located in the middle of the report, depicting a snapshot view of the fastest-growing jobs in each region. The report continues with additional cross-cutting occupational data that applies to jobs in the energy sector. The final section takes a look at emerging and future trends in technology and employment in the energy field.

ATEEC's mission is the advancement of environmental and energy technology education through curriculum, professional, and program development and improvement.

SUMMARY

SUMMARY OF THE RESULTS

SOME COMMONALITIES AMONG REGIONS

- Energy auditing is consistently the highest rated occupation in all regions. All representatives from utility companies agreed that the next five to ten years will see a significant and critical increase in the need for utility workers. This is due to several factors, primarily the beginning of the retirement of much of the current workforce.
- The fastest-growing occupations that will need to be addressed by the education and training community fall into the categories of:
 - Energy efficiency, including building design/construction, facilities operation and maintenance, and energy assessment.
 - Need energy auditors to find inefficiencies
 - Need system verification technicians (third party to verify efficiencies)
 - Knowledge of LEED important
 - Once buildings are efficient, will need building operators to maximize efficiencies
 - Renewable energy, particularly wind, solar photovoltaic, and solar thermal
 - Need knowledgeable installers and maintenance technicians to ensure that the renewable energy systems work effectively for the long-term (lack of this was a major reason for public abandonment of renewable energy in the 1980s)
 - Need both large- and small-scale systems technicians
- Most of the occupations in the energy field are not new jobs; they are “increased demand” (e.g., utility workers) or “enhanced skills” (e.g., wind turbine technicians) occupations. (See page 6 for a good description of these distinctions from the U.S. Department of Labor.) The implication for education and training is that most curricula developed for the energy field will entail integrating minor new skills into an existing program or using an existing program as a base upon which to build new and/or enhanced energy skills.
- When developing any new energy program, it is critical that the first step is a credible labor market assessment to ensure that education aligns with available and upcoming jobs.
- With the rapid changes in technology in the energy sector, educators must maintain regular, periodic interaction with business and industry (e.g., advisory committees, occupational analyses) to ensure that skills being taught align with the skills needed in the workplace.
- Business and industry representatives noted an increasing importance for short-term credit and noncredit certificates that emphasize skills.
- Core foundational courses and programs are needed that can be transferred to a variety of energy careers.
- Local and state energy incentives do much to determine the regional demand for different types of workers.

Snapshot of Some Regional Emphases in Energy

- Alternative Fuel Vehicle (AFV): Northwest, Southeast, and Southwest
- Building trade workers: Mid-Atlantic and North Central
- Geothermal: North Central and South Central
- Large-scale solar: Southeast and Southwest
- Large-scale wind: North Central, South Central, and Southwest
- Nuclear: Mid-Atlantic
- Ocean energy: Northwest and South Central
- Oil and gas: South Central and West
- Small-scale solar and wind: North Central and Southeast
- Solar and wind equipment manufacturing: West
- Utility and smart-grid workers: Northwest and Southeast

Green Jobs Analysis

While written to address the overall area of green jobs rather than targeted specifically to the energy sector, the following excerpts from a report (*Greening of the World of Work: Implications for O*NET®-SOC and New and Emerging Occupations*) from O*NET at the U.S. Department of Labor provide a description of occupational analysis pertinent to jobs in the energy field and accurately capture a major theme from the Regional Energy Conversations:

To summarize, there are two primary implications for occupational analysis in general [...]. First, the vast job-level information in the existing green economy literature must be consolidated and interpreted for its meaning at the occupation level. In particular, a focus on occupational requirements (tasks, duties, tools and technology, knowledge, skills, and so forth) is essential for discovering the occupational implications of the green economy.

Second, any analytical or descriptive approach used to determine the occupational implications of the green economy must be sensitive to the varying degrees with which green economy activities shape occupational performance. This entails a definitional approach to “green occupations” that moves beyond labeling (i.e., green as adjective) to encompass the dynamic nature of occupational performance (i.e., greening as verb). A parallel can be seen in the shift away from an emphasis on “organization” to “organizing” in the general management literature in order to address the effects of contextual changes in the 1990s (e.g., flattening of firms, use of teams, project-based work).

This definition lends itself to three general categories, each describing the differential consequences of green economy activities and technologies on occupational performance. These categories of occupations are described below and include examples of the effects indicative of each. [...]

Green Increased Demand Occupations. The impact of green economy activities and technologies is an increase in the employment demand for an existing occupation. However, this impact does not entail significant changes in the work and worker requirements of the occupation. The work context may change, but the tasks themselves do not. An example is the increased demand for electrical power line installers and repairers related to energy efficiency and infrastructure upgrades.

Green Enhanced Skills Occupations. The impact of green economy activities and technologies results in a significant change to the work and worker requirements of an existing occupation. This impact may or may not result in an increase in employment demand for the occupation. An example is the occupation architect, where greening has increased knowledge requirements pertaining to energy efficient materials and construction, as well as skills associated with integrating green technology into the aesthetic design of buildings. For example, many architects have pursued Leadership in Energy and Environmental Design (LEED) certifications to ensure the proper application of U.S. Green Building Council principles to building designs. The essential purposes of the occupation remain the same, but tasks, skills, knowledge, and external elements, such as credentials, have been altered.

New and Emerging (N&E) Green Occupations. The impact of green economy activities and technologies is sufficient to create the need for unique work and worker requirements, resulting in the generation of a new occupation. This new occupation could be entirely novel or “born” from an existing occupation. An example would be solar system technicians who must be able not only to install new technology, but also to determine how this technology can best be used on a specific site.

Acknowledgement

Participants expressly asked ATEEC to include in this report their thanks to the National Science Foundation for providing this opportunity for the diverse sets of energy stakeholders to gather and share their needs and knowledge. They hope that conversations such as these can continue to be promoted by government entities to help integrate the requirements of business and industry with the education and training needed by technicians of the U.S. workforce to enhance the economy by successfully keeping pace with a rapidly changing industry and world.

SUMMARY

Northwest

- Renewable energy systems installer
- Energy auditing technician (residential)
- Maintenance technician
- Utilities technician
- Manufacturing technician



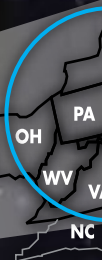
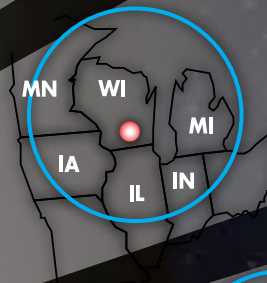
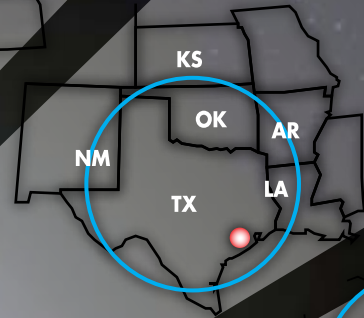
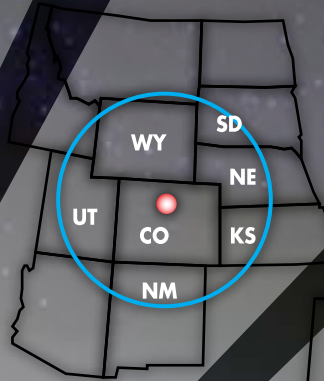
Southwest

- Alternative Fuel Vehicle (AFV) repair/maintenance technician
- Energy auditor
- Renewable energy systems installer
- Solar photovoltaic technician
- Electrical controls technician



West

- Energy auditor
- Building analyst
- Solar/wind manufacturing production technician
- Wind turbine mechanic
- Power quality engineer



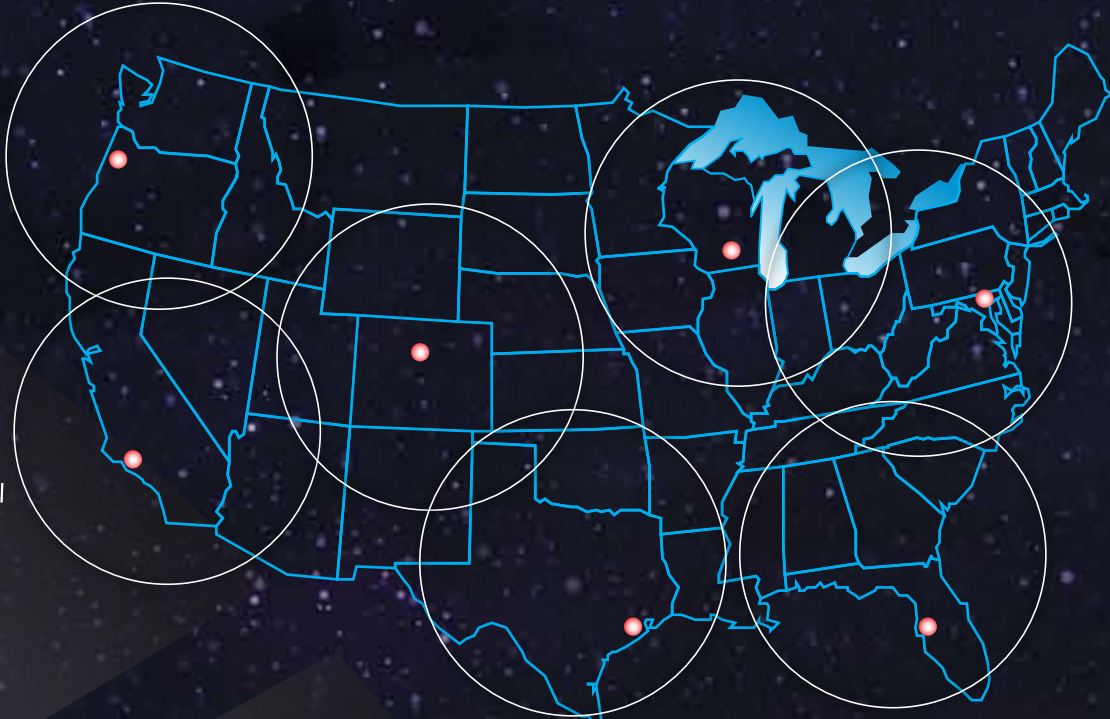
Fastest-Growing Energy Jobs



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South Central

- Solar/wind/wave/geothermal resource assessor

Oil & gas field technician
 programmer/operator
 optimization technician
 technician
 technician

North Central

- HVAC technician

- Energy auditor

- Wind turbine technician

- Solar system installer

- Controls technician



Mid-Atlantic

- Plans, Review, and/or Building Inspector

- Skilled construction tradesperson

- Mechanical maintenance technician

- Plant operator

- Electrical maintenance technician

- Instrumentation control technician

Southeast

- Solar panel installer

- Wind turbine technician/mechanic

- Lineman

- Hydropower maintenance technician

- HVAC technician

- Energy auditor



MID-ATLANTIC ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

Note: Highlighted text in this section indicates a regional difference in the job title from the national job titles. It may indicate a difference in wording of the job title or a job title specific to a region that was not identified as a national job title. (National job titles are based on those listed in the national report, *Defining Energy Technologies and Services* (www.ateec.org/store/)).

FASTEST-GROWING JOBS IN THE MID-ATLANTIC

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- Plans, review, and/or building inspector
- Skilled construction workers
- Mechanical maintenance technician
- Plant operator
- Electrical maintenance technician
- Instrumentation control technician
- Project planner/scheduler
- Building energy auditor
- HVAC technician
- Design technician (solar PV)
- Rooftop solar installer
- Welder
- Process equipment energy technician
- Energy evaluator
- Machinist
- Chemistry technician
- Distributed automation technician
- Substation technician
- Electrical system operator
- Recycling plant operator
- Battery technician

JOBS

Buying & Selling Energy

Energy consultant
Residential customer service tech

Construction/Building Science

Building energy auditor
Crane operator
Facilities operations tech
Green building appraiser
Insulator/air sealer
Journeyman
LEED officer
Permits & license tech
Plans, review, and/or building inspector
Procurement officer
Skilled construction tradesperson
Trades/industry instructor
HVAC tech

Cross-Cutting

Assembler
Bio-security tech
Cost analyst
Customer service tech
Electrician
Energy paralegal
Estimator
Fire protection tech
Foreman/manager
Installation tech
Instructor
Network tech
Non-destructive examination tech
Plant security
Project planner/scheduler
Purchasing & contracts tech
Quality assurance tech
Resource assessment tech
Safety tech
Sales
Site inspector
Site planning tech
Technical writer
Welder

Energy Efficiency

Carbon/greenhouse gas analyst
Energy evaluator
Green roof tech
Process equipment energy tech

Generation

Electrical maintenance tech
Instrumentation control tech

Machinist
Mechanical maintenance tech
Non-licensed operator/auxiliary operator
Pipefitter/pipe layer/boiler maker
Plant operator
Process control operator

Miscellaneous

Biofuel lab tech
Composites tech (wind)
Geothermal tech
Hybrid auto tech
Hydrological site assessor
Landscape tech
Miner
Storage tech
Tidal/currents tech

Nuclear

Chemistry tech
Radiation protection tech

Recycling

Battery tech
Computer/equipment repair tech
Plant operator

Research

Grant writer
Web site designer

Solar PV

Design tech
Rooftop solar installer

Solar Thermal

Plumbing tech
Rooftop solar installer

Sustainability

Agricultural engineering tech
Stormwater management tech

Transmission/Distribution (incl. Smart Grid)

Distribution automation tech
Distributed generation interconnection tech
Electrical system operator
Engineering tech
Industrial mechanic
Line worker
Meter tech
Relay tech
Substation tech
Utility communications tech

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MID-ATLANTIC ENERGY CONVERSATION (cont.)

OCCUPATIONAL DATA

Labor Market Data Resources

Annual reports available from each resource
Career Technical Education STEM report
Center for Energy Workforce Development (CEWD) & National Energy Institute (NEI) work-
force surveys 2007-2009
Construction Users Round Table
EPRI & Western Maryland Consortium
EPRI—industry-specific organization
Industry-Wide Technical CEWD Energy Competency Model
Mid-Atlantic—utility profile regionally consistent
National Commission of Energy Policy
South East Manpower Tripartite Alliance—EMTA Data
State energy consortium
U.S. Department of Energy reports
U.S. Department of Labor Bureau of Labor Statistics—forecast of energy jobs
U.S. Department of Labor Governor’s Workshop Investment Board reports

Potential numbers of jobs

- Baltimore Gas & Electric 50-100 gas technician types per year for the next five years (out of a 3,300 employee company)
- CEWD—technician type positions 70,000-80,000
- *USA Today* (September 25, 2009)—Clean jobs 770,000
- NEI 19,400 +/- in next five years—104 facilities in U.S.
- Anecdotal info:
 - Large manufacturing industry still moving out of MD
 - Follow the money

Five-year jobs outlook (guesses for MD)

- 3,000 utility
- 30,000 meter upgrades/smart grid
- 5,000 distributed generation
- >10,000—recycling/
infrastructure sustainability

Best Practices

Anne Arundel Community College—Green Technology Certificate
Association of Energy Engineers (CEM, CEA, Green Building certification)
BGE & PEPCO line training—\$250,000/18 months
CEWD partnering access
Fort Ritchey (former army base), COPT—mixed-use ultra green transformation
Gulf Power Academy/High School Career Academy—mentorship program & cooperatives based on apprenticeships
High school career academies
HVAC & CCBC—model best practices
Internal utility training programs
Linn State program
National Clean Energy Center Network—researchers & 14 centers
Online training programs (e.g., Bismarck State)
PG&E partnerships with community colleges—pipeline of interns
Pittsburgh—Economic Development Model
PJM—Training stakeholders/FERC recognized
Pre-apprentice programs—8-10 weeks
Purdue Green Technician certification with Society of Manufacturing Engineers
Southeast Lineman Center
Texas A&M—community college pilot projects/easy handoffs of courses/articulate to 4-year/
coordinated with industry
Two-year technician certificates, variety of programs (classroom & OJT)

JOBS

NORTH CENTRAL ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

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FASTEST-GROWING JOBS IN NORTH CENTRAL U.S.

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- HVAC tech
- Wind turbine tech
- Controls tech (industrial)
- Pipefitter
- Hybrid auto tech
- Transportation planner permit specialist
- Maintenance tech (transportation)
- Energy engineering tech (building)
- Building & construction tech
- Building inspector
- Agri-science tech
- Biorefinery tech
- Process tech (biomass)
- Turbine maintenance & repair tech
- Electronic/electrical tech (wind)
- Transmission tech (wind)
- Site assessor (solar)
- Electrician (solar)
- Inspection/tester (solar)
- Electrical engineering tech
- Lineman
- Meter specialist
- Energy manager (industrial)
- Energy auditor
- Solar system installer
- Plumber
- Well driller

JOB S

NORTH CENTRAL ENERGY CONVERSATION (cont.)

Biomass

Aggregator/broker
Agri-science tech
Biorefinery tech
Biotechnology tech
Diesel engine repair & maintenance
Engine assembler
Farmer
Forester
Harvester
Horticultural specialist
Instrumentation automation control tech
Lab tech
Machine operator (pellet mill)
Moisture specialist
Process tech
Tank inspector/cleaner
Water/hydro tech

Building Science

Architect tech
Building & construction tech
Building inspector
Carbon footprinter
Carpenter
Cement masons
Commissioning agent
Construction tech
Energy auditor
Energy engineering tech
Energy program manager
Green roof installer
Habitat restoration specialist
Home performance evaluator
Home weatherization installer/tech
Insulator
Landscape site evaluator
Lead abater
Operating engineer
Project management assistant
Residential energy efficiency consultant
Residential energy efficiency tech
Steamfitter

Energy Efficiency (Industrial/Business)

Boiler operator
Compressed air specialist
Controls tech
Electromechanical (integration) tech
Energy manager
Industrial machinery mechanic
Lighting tech
Process maintenance tech
Refrigeration tech
Small business direct installer

Geothermal

Geology/soil tech
HVAC tech
Industrial maintenance tech
Marketer
Pipefitter
Plastic tech
Plumber
Well driller

Miscellaneous

Accountant
Computer support specialist
Data acquisitions tech
Educator/ trainer
GIS tech
IT network tech
Measurement verification tech
Permitting specialist
Policy analyst
Public relations specialist
Real estate appraiser
Small hydropower installer

Solar

Assembler
Electrician
Financial analyst
Glazier/glass installer
Inspector/tester
Laminator
Office manager
Roofer
Shift manager
Site assessor
System installer

JOBS

Transportation

CAD operator
Fuel analyst
Hybrid auto tech
Logistics tech
Maintenance tech
Surveyor
Transportation planner permit specialist

Utilities

Cartographer
Computerized machinist CNC operator
Dispatcher
Electrical engineering tech
Gas tech
Lineman
Meter specialist

Wind

Cement civil works engineering tech
Crane operator
Turbine maintenance & repair
Electronic/electrical tech
Land agent
Machinist
Meteorological tech
Sheet metal worker
Sound tech
Transmission tech
Welder
Wind turbine tech

Labor Market Data Resources

American Solar Energy Society
Apollo Alliance
American Wind Energy Association
Community college program advisory committees (local)
Center on Wisconsin Strategy (COWS) reports (cows.org)
Energy Information Services
Focus on Energy
IBEW (apprenticeships)
Interstate Renewable Energy Council
Midstate Technical College-Wisconsin Rapids
Midwest Renewable Energy Association
NBB Biodiesel Board
OEI
Professional associations (e.g., architects, engineers, state chapters)
PWD—Projections

Regional partnerships
Renewable Fuels Association
Renew Wisconsin
Rise Project/WIRED
Roger Bezbeck reports
SCIA
Specific company needs
Union of Concerned Scientists
U.S. Green Building Council chapters
Wage and Economic Development Council
WI Regional Training Partnership

Best Practices

Advanced Technology Education community (National Science Foundation)
Advanced Technology Environmental and Energy Center (ATEEC)
Alliant Partnerships—(pipeline, K-12)
Appalachian State College
Build America—U.S. Department of Energy
Career fairs
Clean Energy Corps—President Obama
Energy Academy (high school)—Mid-State
Energy Center of Wisconsin
Equipment manufacture/training
Equipment training
Farm Kids
Florida Solar Energy Center
Great Lakes Renewable Energy
Integrated skills
Internships
Interstate Renewable Energy Council
Lane Community College
LA Trade Tech
Madison Area Technical College/CERET
MidState Renewable Programs
Midwest Renewable Energy Association
Military training
NFPA curriculum/codes
North Carolina State University diploma series
On-the-Job Training (OJT)/job experience
PLTW/Wisconsin Energy Education Program
RESNET
Rise Partnership
Solar Energy International
State agencies (e.g., Department of Natural Resources)
University of Wisconsin Extension Offices
Wisconsin Public Utilities Institute
Wisconsin Energy Conservation Corps
Wisconsin Regional Training Partnership

J
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NORTHWEST ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

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FASTEST-GROWING JOBS IN THE NORTHWEST U.S.

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- Renewable energy systems installer
- Energy auditing tech (residential)
- Maintenance tech
- Utilities tech
- Manufacturing tech
- Alternative Fuel Vehicle (AFV) repair/maintenance tech
- Renewable energy maintenance tech
- Energy efficient construction tradesperson/site foreman
- Renewable energy site assessment tech
- Energy analysis tech
- Energy manager/specialist/consultant
- Energy project developer/manager
- Sustainability coordinator
- Wind turbine tech
- Alternative financing specialist
- Building control systems tech
- Building operator
- Carbon trading analyst
- Commissioning tech
- Electrical energy storage tech
- Ocean power tech*
- Utility-scale renewable energy installation tech
- Energy regulation specialist
- Sales representative

*Emerging

JOBS

Buying & Selling Energy

Customer service representative (internal)**
Power scheduler
Real-time trader
Sales representative (external, non-utility)

Energy Assessment

Energy analysis tech
Energy auditing tech
Energy portfolio planning tech*
Industrial process tech
Measurement & verification tech*
Renewable energy site assessment tech
(residential)*, including geothermal, hydro-
power, ocean energy, solar, & windfield site

Energy Efficient Building Construction, Project Engineering, & Implementation

Commissioning tech
• Verify systems operation & interoperations
• Measurement & verification
Energy auditing tech
Energy efficient construction tradesperson/site foreman*
Energy project developer/manager, including scheduler, engineering tech, CAD/CAM tech/draftsperson, & GIS tech
Interior design tech
Renewable energy systems installer*
Site & building exterior manager, including xeriscaping & shading
Testing/commissioning tech
Water conservation tech

Exploration

Crop yield/biomass analyst (agriculture, aquaculture, & silviculture)
Geology tech
Geospatial tech
Oil & gas exploration tech
Solar resource assessor
Surveyor/site resource assessor
Wind resource assessor

Generation & Utility-Scale Construction

Biofuels processing tech*
Boiler tech
Coal gasification tech
Coal miner
Cogeneration tech
Combustion tech
Energy crop farmers
Energy specialist
Fuel cell tech*

Generator tech
Geothermal tech
Green power tech*
Hydropower tech
Infrastructure/construction tech (installation)
Instrument/control tech & process operator
Nuclear fuel enrichment & reprocessing tech
Nuclear reactor tech
Ocean power tech*
Oil & gas field tech
Oil & shale & tar sand processing tech
Oil refinery/process tech
Solar photovoltaic tech
Solar thermal tech
Utility-scale renewable energy installation tech
Waste-to-energy tech
Wind turbine tech

Operations & Maintenance

Building control operator
Building control systems tech
Building operator
Building systems automation tech*
Direct digital control (DDC) programmer
Energy cost analyst
Energy manager/specialist/consultant
Industrial process equipment maintenance & operations specialist
Lighting specialist
Maintenance tech
Performance monitoring/continuous commissioning tech
Program/project coordinator
Renewable energy maintenance tech
Resource conservation/efficiency manager
Stationary operating engineering tech
Sustainability coordinator*
Waste management/recycling tech

Regulatory Affairs

Code inspector (municipal, county, & state)
Compliance specialist (municipal, county, state, & federal)
Energy regulation specialist
Energy technology program specialist (state & federal)
Fuel testing/verification tech
Incentive auditing (verification)
Permit specialist
Plan reviewer/checker
Public policy specialist
Surveyor/site assessor

*Emerging

**On-the-Job Training (OJT)

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NORTHWEST ENERGY CONVERSATION (cont.)

Transmission & Distribution

Distribution tech

Emergency response
Environmental safety & health
Equipment operator/controls operator
Fuel storage tech
Infrastructure/construction tech
Outage reporting
Utilities tech

Transportation (Mobile) Services

Alternative fuel vehicle (AFV) repair/maintenance tech
Emissions testing & repair tech
Fleet manager
Transportation, warehousing, & logistics tech (geospatial, planning, public transportation, multi-modal transportation, expediting)

OCCUPATIONAL DATA

Labor Market Data Resources

American Wind Energy Association
“Analysis of Clean Energy Workforce Needs and Programs in Oregon”—3E Strategies
Center of Excellence for Energy—Centralia Community College, Oregon
“Employment Department” Web site—State of Oregon
Energy Efficiency and Renewable Energy Network, U.S. Department of Energy
“Energy Efficiency Study”—Centers of Excellence in California Community Colleges (COECCC)
Foundation for Water and Energy Education
“Get Into Energy” training database—Center for Energy Workforce Development (CEWD)
“Greening of Oregon’s Workforce Jobs, Wages, and Training” report—Worksource Oregon
Idaho Office of Energy Resources
“Northwest Energy Efficiency Taskforce Report, Recommendations, Action Plan”—Northwest Energy Efficiency Taskforce
Northwest Energy Education Institute
Northwest Energy Efficiency Alliance
Northwest Energy Efficiency Council
Northwest Public Power Association
Oregon Department of Energy
Oregon State University Energy Efficiency Center
Oregon Labor Market Information System
“Task Force on America’s Future Energy Jobs”—National Commission on Energy Policy
Trades association statistics (e.g., IBEW)
Washington State Board for Community and Technical Colleges
Washington State University, Extension Energy Program
Washington Work Source

“Workforce Challenges of Electric Sector Employers in Washington and Oregon”—Washington State University, Extension Energy Program
Worksource Oregon

Best Practices

Annual review of curriculum relevance
Bridge programs/pipeline, occupational, contextualized adult basic education/GED
Career pathways roadmap Web tool
Co-op programs
Emphasize the specificity of individual renewable energy areas (community colleges need to educate students, career advisors, guidance counselors, public with career fairs, career videos, etc.)
Employer advisory boards with each department
Energy awareness (e.g., behavior changes, social responsibility, sustainability, organizational fit)
High school exposure by community college & employer panels—bring manufacturing to students
Industry experts hired as adjunct faculty
International programs/connections
Internships for students & teachers
National certification of programs
Regional assessments & information-gathering
Regional Technical Education Centers (RTECs)
Reiterate importance of soft skills
Repurposing existing programs
Reverse engineering
Skill contests
Student chapters/clubs, professional societies, alumni
Students guided toward nationally-recognized certifications
Youth academies with at-risk students

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JOBS

SOUTH CENTRAL ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

Note: Highlighted text in this section indicates a regional difference in the job title from the national job titles. It may indicate a difference in wording of the job title or a job title specific to a region that was not identified as a national job title. (National job titles are based on those listed in the national report, *Defining Energy Technologies and Services* (www.ateec.org/store/)).

FASTEST-GROWING JOBS IN SOUTH CENTRAL U.S.

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- Solar/wind/wave/geothermal resource assessor
- Oil & gas field tech
- Energy optimization tech
- Oil refinery/process tech
- Instrumentation/control tech and process operator
- Oil & gas exploration tech
- Renewable energy systems installer
- Waste management/recycling tech
- Alternative Fuel Vehicle (AFV) repair/maintenance tech
- Biofuels processing tech
- Cogeneration tech
- Energy auditor
- Fuel cell tech
- General sales representative/sales engineer (oil & gas)
- Generator tech
- Geospatial tech
- Offshore logistics coordinator
- Petroleum tech (inside)
- Research tech
- Surveyor/site assessor
- Waste-to-energy tech
- DCS programmer/operator
- Geothermal tech
- Carbon trading analyst
- Solar PV tech
- Boiler tech
- Commissioning tech
- Energy cost analyst
- Geology tech
- Legal aide/insurance specialist
- Remote operating tech
- Solar thermal tech
- TAB tech

JOB S

SOUTH CENTRAL ENERGY CONVERSATION (cont.)

Buying and Selling Energy

Alternative financing specialist (multiple source incentives)
Billing analyst/rate analyst
Carbon trading analyst
Customer service representative/account executive
Energy broker assistant
Energy contracting specialist (multiple source incentives)
General sales representative/sales engineer (oil and gas)
Landman
Purchasing agent
Renewables, oil, and gas accountants
Renewables, oil, and gas appraisal tech
Technical salesperson (oil and gas)

Energy Assessment

Energy analyst
Energy auditor
Energy portfolio planner
Industrial process specialist
Measurement & verification tech
Renewable energy site assessment tech

- Biomass
- Energy efficiency
- Geothermal
- Hydropower
- Ocean energy
- Solar
- Windfield

Energy-Efficient Building Construction, Project Engineering, & Implementation

Architecture tech (including LEED)
Commissioning tech, including:

- Verify systems operation & interoperations
- Measurement & verification

Energy-efficient construction tech/site foreman (new & retrofit)
Energy optimization tech
Energy project developer/manager, including:

- Scheduler
- Engineering tech
- CAD/CAM tech/draftsperson
- GIS tech

Program/project coordinator

Renewable energy systems installer
Sustainability coordinator
Testing, Adjusting, Balancing (TAB) tech
Testing/commissioning/decommissioning tech
Waste management/recycling tech

Exploration

Crop yield/biomass analyst (agriculture, aquaculture, & silviculture)
Geology tech
Geophysical tech
Geospatial tech
Oil & gas exploration tech
Research tech
Surveyor/site assessor
Solar/wind/wave/geothermal resource assessor*
Waste-to-energy recovery tech

Generation & Utility-Scale Construction

Biofuels processing tech
Boiler tech
Coal gasification tech
Cogeneration tech
Combustion tech
Energy crop farmer
Fuel cell tech
Generator tech
Geothermal tech
Hydropower tech
Infrastructure/construction tech (installation)
Instrument/control tech & process operator
Nuclear fuel enrichment & reprocessing tech
Nuclear reactor tech
Ocean power tech (tidal & undercurrent)
Oil & gas field tech
Oil refinery/process tech
Petroleum tech (inside)
Remote operating tech
Solar photovoltaic tech
Solar thermal tech
Waste-to-energy tech
Wind turbine tech

JOBS

Operations & Maintenance

Building **automated** control systems tech
Building control operator (**environmental**)
Digital Control System (DCS) programmer/
operator
Energy cost analyst
Energy manager
Equipment maintenance specialist (industrial &
commercial)
Performance monitoring tech
Resource conservation/efficiency manager

Regulatory Affairs

Code inspector (municipal, county, & state)
Compliance specialist (municipal, county, state,
& federal)
Incentive auditing (verification)
Industry standards specialist
Legal aide/insurance specialist
Permit specialist
Plan reviewer/checker
Surveyor/site assessor
Testing/verification tech (fuel, **appliance,**
HRVOC, etc.)

Transmission & Distribution

Emergency response tech (**marine, road, &**
rail)
Environmental safety & health tech
Equipment operator/controls operator
Fuel storage tech
Infrastructure/construction tech
Outage reporting tech
Pipeline distributed generation tech
Power engineering tech
SCADA/telecommunications tech
Utilities tech

Transportation (Mobile) Services

Alternative Fuel Vehicle (AFV) repair/
maintenance tech
Emissions testing & repair tech
Fleet manager
Hazardous materials coordinator
Off-shore logistics coordinator
Transportation, warehousing, & logistics tech
(geospatial, planning, public transportation,
multi-modal transportation, expediting)

*Emerging

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SOUTH CENTRAL ENERGY CONVERSATION (cont.)

OCCUPATIONAL DATA

Labor Market Data Resources

Algae 2020
Aerotek
Alamo Area Council of Governments
Association of Energy Engineers
Culinary Engineering Staffing
DeVry & ITT Tech—proprietary schools
Energyjobsites.com
Greater Houston Partnership
Houston Galveston Area Council
Labor Market and Career Information
Monster.com
National Algae Association
National Biodiesel Board
RIGZONE.com
Saving With Energy
Texas Workforce Commission
U.S. Department of Labor:
• O*NET
 o Career Voyages
 o Careeronestop.org
• Bureau of Labor Statistics

Best Practices

Authenticity—Hands-On/Minds-On:

- Curriculum
- Equipment
- Industry-standard equipment
- Recent technology
- Simulators

Balanced programs:

- Comprehensive
- Contextual
- Experienced instructors
 - o Industrial experience
 - o Pedagogical skills
- Face-to-face, lab, online
- Prescriptive, interactive

Best programs provide:

- Affordability
- Connection to industry
- Convenient location & accessible
- Engaging curriculum

- E-texts
- Flexible times (day, evening, online/anytime)
- Good instructors
- Internships
- Placement services
- Scholarships
- Student counseling
- Video game-like activities (interfaces, engaging, whole-brain activity)
- Well funded

Examples:

- City of Houston—Green Ribbon Com (SA) & Green Building Resources (e.g., LEED)
- E2E Energy to Engineers
- Ecobots
- Energy4me.org
- Energy City of 2050
- Energy Collaborative Committee
- Leadership Forum
- Lone Star and Houston Community Colleges partnership
- Odessa College (CSTEM & STEM)
- OILSIM
 - o Exploration simulation software
 - Choosing prospects
 - Drilling
 - Farm in/out
 - Survey data
 - o Modules for production and refining
 - Discovery
 - Drilling
 - Economics
 - Production
 - o Troubleshooting/problem-solving for:
 - Chemical engineering tech
 - Petroleum tech
 - Process tech
- Project Lead the Way
- Technical Engineering High Schools (KISD, SBISD, HISD, etc.)
- Texas Girl Project
- Texas Renewable Energy Industries Association

JOBS

SOUTHEAST ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

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FASTEST-GROWING JOBS IN THE SOUTHEAST U.S.

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- Solar panel installer
- Lineman
- HVAC tech
- Biomass lab tech
- Carpenter
- Nuclear controls tech
- Electromechanical tech
- Geothermal well driller
- Heavy equipment operator
- Maintenance tech
- Project manager
- Smart grid meter installer
- Smart grid meter mechanic
- Survey & mapping tech
- Weatherization installation tech
- Welder
- Wind system installer
- Wind turbine tech/mechanic
- Hydropower maintenance tech
- Energy auditor
- Biomass harvester
- Chemist/water tech
- Electrician
- Energy consultant
- Gray water plumber
- IT tech
- Plumber
- Safety tech

JOB
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SOUTHEAST ENERGY CONVERSATION (cont.)

Biomass

Agricultural tech
Engineering tech
Harvester
Heavy equipment operator
Laboratory tech
PLC tech
Process tech
Silviculturalist
State inspector

Building Science (new and retrofit)

Building inspector
Carpenter
Certifying agent
Cistern fabricator (freshwater collection)
Electrician
Energy specialist
Estimator
Gray water plumber
HVAC tech
Interior designer
ISO auditor
Irrigation specialist
Landscape
Lighting specialist
Material handling specialist
Smart house tech

Coal

Boiler operator
Ceramics/masonry tech
Controls tech
Electromechanical tech
Environmental tech
Field service tech
Heavy equipment operator
Instrumentation & automation tech
Machinist
Maintenance
Relay tech
Sub-station tech
Turbine generator operator
Underwater welder

Geothermal

Geology tech
Pipefitter/steamfitter
Plumber
Well driller

Hydropower

Chemist/water tech

Dredge operator
Hydrological tech
Maintenance tech
Marine biology tech
Wetland ecology tech

Miscellaneous

AutoCAD operator
Automotive conversion specialist
Chemical applications specialist
Data recording specialist
Dispatcher/distribution
Educator/trainer
Energy consultant
Energy consultant/lobbyist
Energy management specialist
Facility performance analyst
Fluid power specialist
GIS mapper
Human resources specialist
IT tech
Maintenance tech
Market rate analyst
Natural gas utility tech
Operator
Paralegals
Permit processor
Project manager
Public education coordinator
Safety tech
Sales associate
Small business/entrepreneur
State compliance auditor specialist
Super tech
Supply-side energy analyst
Technologist
Troubleshooter
Waste management recycling coordinator

Nuclear

Community relations specialist
Controls tech
Draftsperson
Fire suppression specialist
Mechanical tech
Medical tech
Nuclear waste manager
Power plant tech
Quality control tech
Radiation safety specialist
Structural inspector
Water tech
Welder

JOBS

Smart Grid

Computer programmer
Computer specialist/analyst
Grounds man
Lineman
Meter installer
Meter mechanic

Solar

Battery tech
Design tech/daylight
Electrician
Panel installer
Plumber/pool installer
Roofer
Sheet metal fabricator/tester
Stamp machine operator
System designer
Thermal installer

Weatherization

Carbon footprint auditor
Energy auditor
Energy inspector
Energy management analyst
Installation tech
Program manager
Weatherization specialist

Wind

Crane operator
Derrick operator
Drill shaft installer
Installer
Mechanical designer
Rigging specialist
Survey & mapping tech
Turbine tech/mechanic
Well head operator

OCCUPATIONAL DATA

Labor Market Data Resources

Banner Center reports
Bureau of Labor Statistics—U.S. Department of Labor
Central Florida Development Council reports
Enterprise Florida Economic Development reports
Florida Hi-Tech Council reports
Florida Registered/Targeted Occupational reports (WFI-AWI-DOL)
Florida Trends reports
Green Force Florida—Florida Department of Education
O*NET—U.S. Department of Labor
Maddux Report (Florida)
PEW Research Center reports
Sun Biz

Best Practices

Daytona State (CNC)
Florida State College at Jacksonville (Cisco, construction, solar)
Florida State Energy Center (PV, building efficiency, energy auditor)
Hillsborough Community College maintenance and water treatment (Plant City)
Indian River Community College—Banner Center of Energy (nuclear)
Key West High School Alternative Energy Center
Marion Technical Institute (lineman)
Pinellas Technical Center (welding)
Polk State College/Banner Manufacturing Center (industrial maintenance)
TECO Energy—Powerhouse Professional
St. Petersburg College—Florida Green Building Council online courses, networking, solar installation online courses
University of Central Florida—Banner Center for Alternative Energy
University of Southern Florida—Research & Development Energy Institute & Solar Energy Ctr
Washington Holmes Technical Center (biodiesel)
Westside Technical Center (solar/biodiesel)

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SOUTHWEST ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

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FASTEST-GROWING JOBS IN THE SOUTHWEST U.S.

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- Alternative Fuel Vehicle (AFV) repair/maintenance tech (tie for #1)
- Energy auditor (tie for #1)
- Renewable energy systems installer (tie for #1)
- Solar photovoltaic tech (tie for #1)
- Electrical controls tech
- Home Energy Rating System (HERS) rater
- Wind turbine tech
- Retrofitting tech (energy efficiency)
- Maintenance tech
- Small systems designer
- Utility worker (lineman)
- Alternative financing specialist
- Energy-efficient construction tech
- Energy project developer/manager
- Environmental safety and health tech
- Infrastructure/construction worker
- Lighting specialist
- Salesperson
- Commissioning tech
- Energy cost analyst
- Energy regulations specialist
- Fuel cell tech
- Instrument/control tech & process operator
- LEED AP (Accredited Professional)
- Performance monitoring/continuous commissioning tech
- Permit specialist
- Program/project coordinator
- Solar resource assessor
- Surveyor/site assessor

JOBS

Buying & Selling Energy

Alternative financing specialist (government incentives) (limited tasks at tech level)
Billing analyst/rate analyst
Customer service representative
Salesperson
Sales representative (utility & private)

Energy Assessment

Energy analyst
Energy auditor
Environmental site assessment tech
Home Energy Rating System (HERS) rater
Measurement & verification tech*
Renewable energy site assessment tech,* including:

- Geothermal
- Hydropower
- Ocean energy
- Solar
- Windfield site

Energy Efficient Building Construction, Project Engineering, & Implementation

Architecture tech
Commissioning tech
Energy-efficient construction tradesperson/site foreman*
Energy project developer/manager

- Scheduler
- Engineering tech
- CAD/CAM tech/draftsperson
- GIS tech
- **Estimator**

LEED AP (Accredited Professional)
Project developer (meeting RPS standards)
Renewable energy systems installer*
Retrofitting tech (energy efficiency)
Site & building exterior manager

- Xeriscaping
- Shading
- **Lighting**

Testing, Adjusting, & Balancing (TAB) tech
Testing/commissioning tech (including HVAC)

Exploration

Crop yield/biomass analyst (agriculture, aquaculture, & silviculture)
Geology tech
Geospatial tech **(GIS)**
Oil & gas exploration tech
Solar resource assessor
Surveyor/site resource assessor
Uranium prospector
Wind resource assessor

Generation & Utility-Scale Construction

Biofuels processing tech*
Boiler tech
Carbon sequestration tech
Coal gasification tech
Coal miner
Cogeneration tech
Combustion tech
Energy crop farmers
Environmental impact assessment tech
Fuel cell tech*
Generator tech
Geothermal tech
Hydropower tech
Infrastructure/construction tech (installation)
Instrument/control tech & process operator
Nuclear fuel enrichment & reprocessing tech
Nuclear reactor tech
Oil & shale & tar sand processing tech
Oil refinery/process tech
Renewable energy small systems design tech
Solar photovoltaic tech
Solar thermal tech
Utility-scale renewable energy installation tech
Waste-to-energy tech
Wind turbine tech

Operations & Maintenance

Building systems tech
Direct digital control (DDC) programmer
Electrical controls tech
Energy cost analyst
Energy manager
Industrial process equipment maintenance & operations specialist
Lighting specialist
Maintenance tech
Performance monitoring/continuous commissioning tech
Program/project coordinator
Renewable energy maintenance tech
Resource conservation/efficiency manager
Waste management/recycling tech

Regulatory Affairs

Code inspector (municipal, county, & state)
Compliance specialist (municipal, county, state, & federal)
Energy regulation specialist
Energy technology program specialist (state & federal)
Fuel testing/verification tech
Incentive auditing (verification)
Legislative aide
OSHA compliance tech
Permit specialist

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SOUTHWEST ENERGY CONVERSATION (cont.)

Transmission & Distribution

Electrical energy storage/distribution tech*
Emergency response
Environmental safety & health
Equipment operator/controls operator
Fuel storage tech
Infrastructure/construction worker
Metering tech
Outage reporting (including smart monitoring)
Utility worker (lineman)

Transportation (Mobile) Services

Alternative fuel vehicle (AFV) repair/
maintenance tech (including electric vehicle)
Emissions testing & repair tech
Fleet manager
Fuel contamination remediation tech
Transportation, warehousing, & logistics tech
(geospatial, planning, public transportation,
multi-modal transportation, expediting)
Vehicle & storage tank inspector

OCCUPATIONAL DATA

Labor Market Data Resources

Air Quality Management Districts
American Solar Energy Society
American Wind Energy Association
Apollo Alliance
California Energy and Utility Workforce
Consortium
East LA Skill Center, University of Southern
California
Green for All/Green Jobs Now
Green Jobs Council
Green Workforce Collaborative, South Bay
WIB
Global Green
Go Solar California
Industry surveys, reports, resources,
references, links, etc.—Centers of
Excellence for California Community
Colleges (www.coeccc.net)
NEXT 10 (California)
“Opportunities to Conserve Water in LA
Schools” survey—Infrastructure Academy
Solar Energy Industry Association
U.S. Green Building Council
Utility programs
Workforce Investment Boards, regional

Best Practices

Collaboration with industry to ensure
knowledgeable instructors & training
programs and that meet industry-set
standards
Certification process through apprenticeship
programs

Community outreach programs (with industry
reps) to build awareness
Curriculum replicability
Energy Training Center, Southern California
Edison
Green Ambassadors, California environmental
charter high schools
Hands-on training
Helmets to Hardhats
Internships, hands-on & both locally &
nationally supported
Job placement program
Kern Wind Energy Association
Million Solar Roofs Project
Partnership examples:
• Airstreams Renewables
• Cero Coso College
• East LA Skills Center
• LA City College
• LA Trade Tech
• Mesalands Community College
• PG&E
Placement/performance measures & metrics,
certifications
Power Pathways, PG&E
Program sustainability
Science, Technology, Engineering, & Math
(STEM) preparation
Small business support
Stockton Energy Train/Pacific Energy Center,
PG&E
Support for day students
Thirty percent local worker participation
University of California at LA

JOBS

WESTERN ENERGY CONVERSATION

JOB CATEGORIES AND TITLES

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FASTEST-GROWING JOBS IN THE NORTHWEST U.S.

Energy Conversation participants identified the following occupations as high-demand and rapidly growing jobs in their region. The jobs in black were ranked highest.

- Energy auditor
- Solar manufacturing production tech
- Wind manufacturing production tech
- Wind turbine mechanic
- Applied wind research assistant
- Auditing tech (utilities)
- Building inspector
- Building systems tech
- Carbon emissions analyst/reducer
- Carbon sequestration tech (terrestrial)
- Drill rig crew (geothermal)
- HAZMAT tech
- Hydropower/micro tech
- Instrumentation/calibration tech
- Inverter specialist
- Process control/board operator
- Smart grid tech
- Solar panel installer
- Solar site assessor
- Wind maintenance tech
- Wind tower installer
- Building analyst
- Power quality engineer
- Facility tech
- HVAC tech
- Lineman
- Sealing & insulation specialist
- Solar maintenance tech
- Solar panel repair tech
- Transmission tech
- Wind site assessor

JOB S

WESTERN ENERGY CONVERSATION (cont.)

Biomass

Agricultural tech
Biomass mill tech
Biomethane gas collector/plant operator
Harvester
Pipefitters
Process control/board operator

Building Science (new/retrofit)

Building inspector
Building/land xeriscaper
Building systems tech
Energy auditor
Energy management optimization specialist
Facility tech
Green data center/IT tech
LEED certifier
Renewable energy small systems trainer

Conventional Energy

Air quality monitor
Automobile engine conversion tech
Automobile mechanic
Carbon capture & sequestration systems installer
Carbon emissions analyst/reducer
CO₂ analyst
Diesel mechanic
Environmental impact analyst
Fuel blending tech
Fuel mix optimizer
Fuel quality assurance/control/efficiency tech
Fuel transition analyst
Gasification tech
Government regulator/inspector (code compliance)
Green sustainability event coordinator
Heavy metal clean-up
Land reclamation specialist
Manual extraction audit specialist
Oil sand tech
Oil slick tech
Process tech
Terrestrial carbon sequestration tech
Transmission tech
Wastewater contamination analyst
Wastewater treatment operator
Scrubber operator

Cross-Cutting

CAD tech
Civil engineering tech (construction, surveyor, etc.)
Construction trades worker
Cost analyst
Data analyst
Energy analyst
Environmental compliance tech
GIS tech
Heavy equipment operator
Land survey specialist
Logistics coordinator (transportation & warehousing)
Machinist
Manufacturing production worker
Permitting tech
Procurement specialist
Quality inspector
Reliability assessor
Safety specialist
Transportation tech (truck driver)

Geothermal

Drill rig crew

Hydropower

Hydropower/micro tech
Tidal wave energy tech

Laboratory/Research

Applied wind research assistant
Genetics tech
Instrumentation/calibration tech
Photonics tech

Solar

Solar panel installer
Solar panel repairer
Solar reclamation tech
Solar site assessor

Solar/Wind (Combined)

Environmental engineering tech
Inverter specialist
Maintenance planner
Maintenance tech
Manufacturing production tech
Project tech (installer)
Remote SCADA operator
Sales associate
Small-scale wind/photovoltaic installer

JOBS

Utilities

Accounting tech

Auditing tech
Electronics tech (install, monitor, & control)
Lineman
High-voltage DC operator
Permitting specialist

Power quality engineer

SCADA interface tech

Smart grid tech

Utility bill interpreter

Weatherization

Building analyst
HAZMAT tech
HVAC tech
Sealing & insulation specialist

Wind

Fiberglass repair tech
Labor billing specialist
On-the-Job (site) trainer
Sourcing & parts acquisition tech
Tower installer
Wind site assessor
Wind turbine mechanic

OCCUPATIONAL DATA

Labor Market Data Resources

American Solar Energy Society report
American Wind Energy Association reports, including white paper for Department of Energy
“Analysis of Denver Metro Region” (www.metrodenver.org)—U.S. Department of Labor
(WIRED)
“California Green Jobs Handbook”
Center for Best Practices reports—National Governor’s Association
“The Clean Energy Economy”—Pew Trust Report
Colorado Department of Labor and Employment labor information
Energy sectors (www.e-colorado.org)
Industry surveys, reports, resources, references, links, etc.—Centers of Excellence for
California Community Colleges (www.coecc.net)
Larimer County employers survey
LMI Gateway, Colorado
O*NET (onet.org/report/green)—U.S. Department of Labor
State workforce Web sites—Oregon or Washington
“Twenty percent by 2030”—U.S. Department of Energy
Upstate/Northern Colorado Economic Development Corp.—underemployed statistics

Best Practices

Advanced Technology Environmental and Energy Center (ATEEC)—Energy resources
AIMS, non-credit/short-term—MIST
Biodiesel Co-op of Denver
Biodiesel Reactor, Photovoltaic & Solar Thermal programs—Golden West Community College
Building Efficiency Management, Power Plant Technology, & CNC programs—Colorado
Northwestern Community College
CARE program—Victor Valley College
Clean Energy Technician program; Energy Boost, short-term—Front Range Comm. Coll.
Energy efficiency training—Veterans Green Jobs
Green Building program & BPI certification—Colorado Mountain College
Lineman programs—Manhattan Technical College, Trinidad State Junior College, Pratt
Community College
NABCEP-approved training
Smart Grid Institute—Colorado State University/Spirae
Solar program, non-credit/short-term—Arapahoe Community College
Solar Technology, Process Technology, & Energy Auditing programs—Red Rocks Comm. Col.
Weatherization/Building Science & Energy Auditing programs—Lane Community College
Wind Technology program—Laramie County Community College

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ADDITIONAL OCCUPATIONAL INFORMATION

CERTIFICATIONS (INCLUDES MANDATED AND VOLUNTARY)

Automotive

- Alternative Fuel Vehicles (AFV): Chemical Safety Assessment (CSA) America—Compressed Natural Gas (CNG) Tank Inspection certification
 - Characteristics of CNG
 - Codes & standards of CNG cylinders, valves, pressure relief ducts
 - Cylinder installation/disposal/inspection
 - Electrical diagnostics
 - Fuel system inspection
 - System defueling
 - Tank safety/inspection
- American Society of Engineers—hybrid vehicle certification
- American Society of Engineers—hydraulic
- BQ-9000 certification (biodiesel)
- International Society of Automation (ISA)—instrumentation & process control
- National Alternative Fuels Training Consortium
- National Automotive Technicians Education Foundation/ Automotive Service Excellence (NATEF/ASE)

Building science

- American Institute of Certified Planners (AICP)
- Association of Energy Engineers (AEE)—energy auditor power quality operator (5 years of experience); energy manager (in-training)
- Building Operator Certification (BOC)
- Building Performance Institute (BPI)—energy auditor
- Chicago Climate Exchange—Carbon Foot Printer Verifiers
- Energy Star Homes
- HERS (Home Energy Rating System) Rater—Home Energy Auditors certification
- Green Advantage
- International Building Code (IBC)—electrical, HVAC, plumbing, construction science
- International Maintenance Institute
- International Society of Automation (ISA) Control System Technician
- Instrumentation certification
- LEED (Leadership in Energy and Environmental Design) Green Building Rating System
- Logistics technician certification
- Master arborist
- Master forester
- National Center for Construction Education and Research (NCCER) construction curriculum
- Real estate industry home inspectors required to be licensed
- RESNET (Residential Energy Services Network)—new construction

Building trades (residential, commercial, industrial)

- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) certification
- Equipment operator
- Forklift
- HVAC
- National Geothermal Association—well driller certification
- Pipefitting
- Plumbing
- Roofer
- Stationary operator engineering license (by state)
- Welding

Carbon credits—ISO 14000, 5000

Career preparedness—National Careers Readiness Certification

- ACT WorkKeys®
- Math, reading, information search

Electrical

- Electrician—4 to 5-year apprenticeship; not mandated
- Continuing Ed—CEUs vary by jurisdiction
- Journeyman—licensing varies by jurisdiction
- Master license

INPO (Institution for Nuclear Power Operation)

Internal training/certification

Licensed home improvement contractor

Manufacturing certifications (trade-specific)

- QA/QC (quality assurance/quality control)
- SME (Society of Mechanical Engineers)—certified manufacturing technician

Safety/OSHA requirements

- 10-hour safety certification
- Confined space rescue
- CPR
- First aid
- Forklift
- HAZMAT
- Radiation/health certification for nuclear

Site Assessment

- Biomass licensed surveyor
- Midwest Renewable Energy Association (MREA)
- Site assessors and inspectors—emerging (by state)

Solar

- Limited renewable energy tech (currently only for PV, certified by State of OR)
- NABCEP (North American Board of Certified Energy Practitioners) certification—PV & thermal

Transmission and distribution

- Fall arrest & high angle rescue (also for wind)
- Lineman—apprenticeship & journeyman
- Regional power operators requiring certification of transmission system operator

U.S. Department of Transportation—certification for:

- Commercial Drivers License (CDL)
- Hazard Communication (HAZCOM)
- OQ licenses (transport of hazardous waste, etc.)

Water

- Wastewater management
- Wastewater operator

Wind

- American Wind Energy Association (AWEA)—U.S. certification in progress/B2EE, German wind certification
- High voltage & switching safety certification for utility-scale wind
- NABCEP certification—small wind (pending)

ADDITIONAL OCCUPATIONAL INFORMATION (cont.)

CROSS-CUTTING TECHNICAL KNOWLEDGE AND SKILLS

- Business ethics
Business fundamentals
- Budgets
 - Energy economics
- Cable splicing and fabrication
Carpentry, basic
Characteristics of materials
Codes, regulations, & laws (application)
Computer systems
- CAD/CAM basics
 - Data recording
 - Internet use
 - Keyboard
 - Modeling applications
 - MS Office programs
 - Programming (PLCs)
 - Simulation programs
 - Spreadsheets, word processing
- Conducting feasibility studies
Construction, basic (windows, doors, etc.)
Control systems, basic
Customer service
Diagnostics
Drafting
Drivers license/CDL
Electricity/electronics theory, basic
Electrical/mechanical systems & integration
Emergency response
Energy literacy (basic knowledge)
- Applied
 - Economics
 - Engineering
 - Sources & distribution
- Environmental/energy laws & regulations
- Policy tax incentives
- Environmental/sustainability concepts, basic
Environmental requirements (e.g., HAZMAT, waste disposal)
Exposure to field work
Hand tools/power tools/large equipment
HVAC, basic
Hydraulics/pneumatics
Industry maintenance practices
Industry principles & concepts
Interdisciplinary knowledge
Kinesthetic learning aptitude (hands on)
Lab skills
Legacy skills (systems)
Lifecycle analysis
Logistics/supply chain management, basic
- Machining
Measurement/metrology
Mechanical/electrical connections
Materials handling
Math & science, applied
- Chemistry, basic
 - College-level algebra
 - Data analysis
 - Construction calculations (e.g., estimation)
 - Degree of competency
 - Geometry
 - Physics, applied
 - Thermodynamics, basic
 - Translated/applied math
 - Trigonometry, pre-calculus
 - Return-on-Investment (ROI) calculation
- Measure/estimate energy use
Mechanical equipment (diagnose & repair)
Mechanics/hydraulics, basic
Motors & controls
Planning & organizing
Plumbing
Power systems
Presentation abilities
Problem-solving & critical thinking skills (exposure to scientific methodology)
- Research
 - Scientific method
- Process controls/instrumentation systems
Print reading
Quality assurance/quality control (QA/QC)
Quality continuous improvement
Read blueprints/schematics
- Mechanical
 - Electrical
 - Landscape
- Read plans (energy terminology/acronyms/ units of energy)
Read engineering drawings
Records/bookkeeping
Safety & health (awareness, training, & practices)
- Electrical & electrical metering safety (NFPA 70E)
 - Electrical/fire code compliance (NEC)
 - First aid/CPR
 - HAZMAT
 - Instrumentation
 - OSHA 10-hour training
 - Personal, environmental, & facility applications
 - Rooftop safety

CROSS-CUTTING TECHNICAL KNOWLEDGE AND SKILLS (cont.)

- Sheet metal fabrication
- Sustainability awareness
- Tool use (hand, power, ladder)
- Troubleshooting
- Technical aptitude/mechanically inclined/spatial relationship
- Waste management
- Welding
- Wind-specific basics, not covered above:
 - Basic rigging
 - Climbing
 - Torque & tensioning certification
 - Tower rescue

CROSS-CUTTING EMPLOYABILITY KNOWLEDGE AND SKILLS

ACT WorkKeys® foundation skills:

- Applied math
- General writing
- Listening
- Locating information
- Observation
- Reading for information
- Technical writing

Communication

- Cell phone/technology etiquette
- Data recording accuracy (notebooking skills)
- Email/text
- Language skills
 - Good English-speaking skills (applicable to the needs of job)
 - Need to have appropriate language skills for safe & proper work
- Listening
- Networking
- Reading with comprehension
- Speaking (e.g., interpersonal, public presentations)
- Writing, technical & report

Interpersonal

- Collaboration/team building
- Conflict resolution
- Desire to participate
- Empathy
- Intergenerational interaction
- Respectfulness
- Tolerance of diversity (e.g., race, age, culture)

Miscellaneous

- Encourage more than English speakers (English speakers to adopt second language)
- Entrepreneurial skills
- Sustainability awareness/practices

Personal effectiveness

- Ability to learn
- Accountability
- Balance of long-term goals & instant gratification
- Dependability
- Ethics/social responsibility
- Flexibility & adaptability
- Integrity
- Personal hygiene
- Professionalism
- Motivation
- Reliability
- Self-care (physical & mental health)
- Self-development (ongoing)

Professional development

- Career awareness/networking (Web navigating)
- Interview skills
- Leadership/initiative
- Lifelong learning

Professionalism

- Appropriate workplace dressing
- Business etiquette (bosses, clients)
- Marketing (e.g., company, oneself, networking)
- Office etiquette (e.g., noise, food, cleanliness)
- Plays well with others
- Promptness (Be on time.)

Work skills (requires high school introduction/reinforcement)

- Critical thinking
- Decision-making
- Flexibility (organizational fit)
- Long-term thinking
- Planning, organizing, & scheduling
- Problem-solving
- Research skills
- Time-On-Task (TOT)
 - Deadlines
 - Learn how to make time
 - Prioritization
 - Stay ahead of the game
 - Timelines
 - Time/project management
- Working with tools & technology

ADDITIONAL OCCUPATIONAL INFORMATION (cont.)

CROSS-CUTTING EMPLOYABILITY KNOWLEDGE AND SKILLS

Workplace requirements

- Bigger picture thinking
- Business fundamentals
- “Chain of command” skills & group culture
- Cross-functional teams/matrix management
- Following directions
- High school/GED
- Teamwork
- Pass a drug test
- Safety consciousness & practice
- Sales techniques
- Security/background check
- Supervising others
- Working with clients



FUTURE TRENDS

Aging systems in the field will need updating (materials, mechatronics, electronics, etc.)
Battery (storage) technology development
Better building energy codes
Biodiesel heavily dependent on oil prices & government direction
Biomass exchanges
Building codes
CAFE standards
California State Bill 811, homeowner incentives for renewable energy
Cap & trade
Carbon analyst may eventually be a technician-level position
Carbon regulations
Carbon sequestration
Carbon tax
Car-sharing memberships
Change in economies of scale
Changes in degree completion
Class enrollments
“Clean” energy definition (e.g., to include nuclear or not)
Climate change issues
Collaborations—examples:

- Biofuels and petrochemicals
- Biotechnology and refining
- Field instrumentation and lab instrumentation

Colorado solar tax credits
Company incentives from state/federal government
Concentrated solar—discussion about efficacy
Consumer sales

- Educate the public
- Represent the product/service
- Talk the green talk

Continuing hydrogen research (possible non-interest by government, public vs. private funding for research)
Cross-disciplinary movement—technicians will operate across disciplines
Cultural/social change
Decoupling of utilities
Desalinization
Distributed generation with renewables

- 1 to 5 megawatts throughout region
- Homeland Security

Economic vs. workforce development
Economies of learning (better, cheaper, more efficient)
Electrical energy storage

Electrical grid development, smart grid/national grid/grid growth
Electric vehicle car conversion, charging stations
Emerging regulatory issues (environment, safety, livability)
Energy auditing (legislation may increase need)
Energy education

- Educate delivery systems
- Accountability—getting performance & metrics in need
- Energy educators—need more, quantity & quality
- Energy efficiencies at all levels:
 - o Design & construction
 - o Insulation
 - o Lighting, appliances, HVAC
 - o Residential/commercial/industrial
 - o Retrofitting

Energy management/Smart Grid
Energy measurement (e.g., smart meters)
Energy programs in high schools
Equipment investments
Excitement in the change/social movement
Existing business community into green business
Expanded performance contracting
Expanding markets
Farmers adding renewable energy
Federal tax policy
Feed-in tariffs (ART)
Fuel cells/energy storage
Gas/oil cost to drive much of the direction
Globalization
GMO/NQNO technology > biomass
Green economy—public demand for green products/services.
Greenhouse gas regulations
Green mortgage availability
Heating & cooling district utilities
Hybrid cars—heavy use
Increased clean air regulations (e.g., CAFE standards)
Increased efficiency of PV technologies
Increased energy efficiency
Increased federal support
Increased freight rail transportation of wind blades
Increased interest in sustainability
Increased siting/land use conflicts
Increased solar thermal use

FUTURE TRENDS

FUTURE TRENDS (cont.)

- Increased venture capital investment for new green technologies
- Industry capital investment incentives
- Infrastructure—can't forget immediate needs
- Innovation integration
- "Ipod'ing" of the world—avoid form over function (e.g., energy sales, education)
- Large-scale transmission build-out
- LED lighting
- Legislation
 - Economic recovery—incentives/funds
 - Tax credits, incentives, & subsidies—given to all sectors
- Lifecycle analysis—educating business on green economy
- Looming disaster (moves society to action)
- Manufacturing (PV, wind, etc.)
- Mass transit/smart growth
- Measured entry into business (not too quick)
- Mentoring/volunteerism
- Municipal governments as energy planners
- National transmission policy
- Net metering
- New business models (renewables)
- New manufacturers (e.g., Pittsburgh model one or two small green technologies)
- Non-traditional biomass markets (equipment/high tech)
- Nuclear—Mid-Atlantic is hotspot for the nation
- Nuclear plants—question of new builds
- Offer quality programs
- Offshore oil & gas exploration
- Online training
- Paraprofessionals enabled by technology to do tasks formerly done by professionals
- PATH MAPP T-line projects
- Policy shifts that support renewable energy—tenants/owners
- Public demand—solar
- Public education
 - Energy at K-12 level
 - Social awareness
 - Technician training (career opportunities)
- PV storage technology (efficiency—incentives)
- R&D leading to lower costs
- Rapid changes in regulations
- Redesign/retrofit tech (to address new needs)
- Regional energy management
- Regulatory requirements of utilities—30% rule
- Renewable energy distribution/energy security issues
- Renewable fuel students
- Renewable Portfolio Standards
- Retirements (estimated 50% over next 10 years)
- Retrofitting existing homes
- Reuse of wind turbines
- Simulations
- Small businesses like to use technicians at times & experienced retired experts at other times.
- Small contractors (e.g., plumbers, electricians, HVAC) will add 1 to 5 jobs per company to add solar, small wind, geothermal
- Smaller house sizes
- Small wind power safety & performance standard
- Smart energy storage
- Smart grid (appliances, homes, meters, vehicle-to-grid)
- Smart-grid development
- Smart grid—new generation—real-time consumer awareness
- Smart growth—transit-oriented development, land development, urban planning (e.g., Reston model, mixed-use)
- Social networking (increased value)
- Solar—large-scale utility-based
- Solar-/wind-powered EVs
- State support linkage to markets & retooling
- Time-of-Use metering
- Training/education system—ongoing flux
- Training for local jobs
- Transient workforce/home ownership
- Transition movements—planning
- Transportation investments
- Union issues
- Upward trends of solar PV
- Utilities-owned renewables
- Waste disposal/recycling of building materials
- Water—becoming an environmental & energy priority
- Water conservation (e.g., brown/black water, reclamation, reuse, sustainable landscape)
- Water scarcity (includes U.S., not just global)
- Water use/energy relationship will further promote energy pathway—more discussion
- Wave/ocean energy
- Weatherization—small businesses & agencies
- Workplace policies (e.g., schedules, telecommuting)

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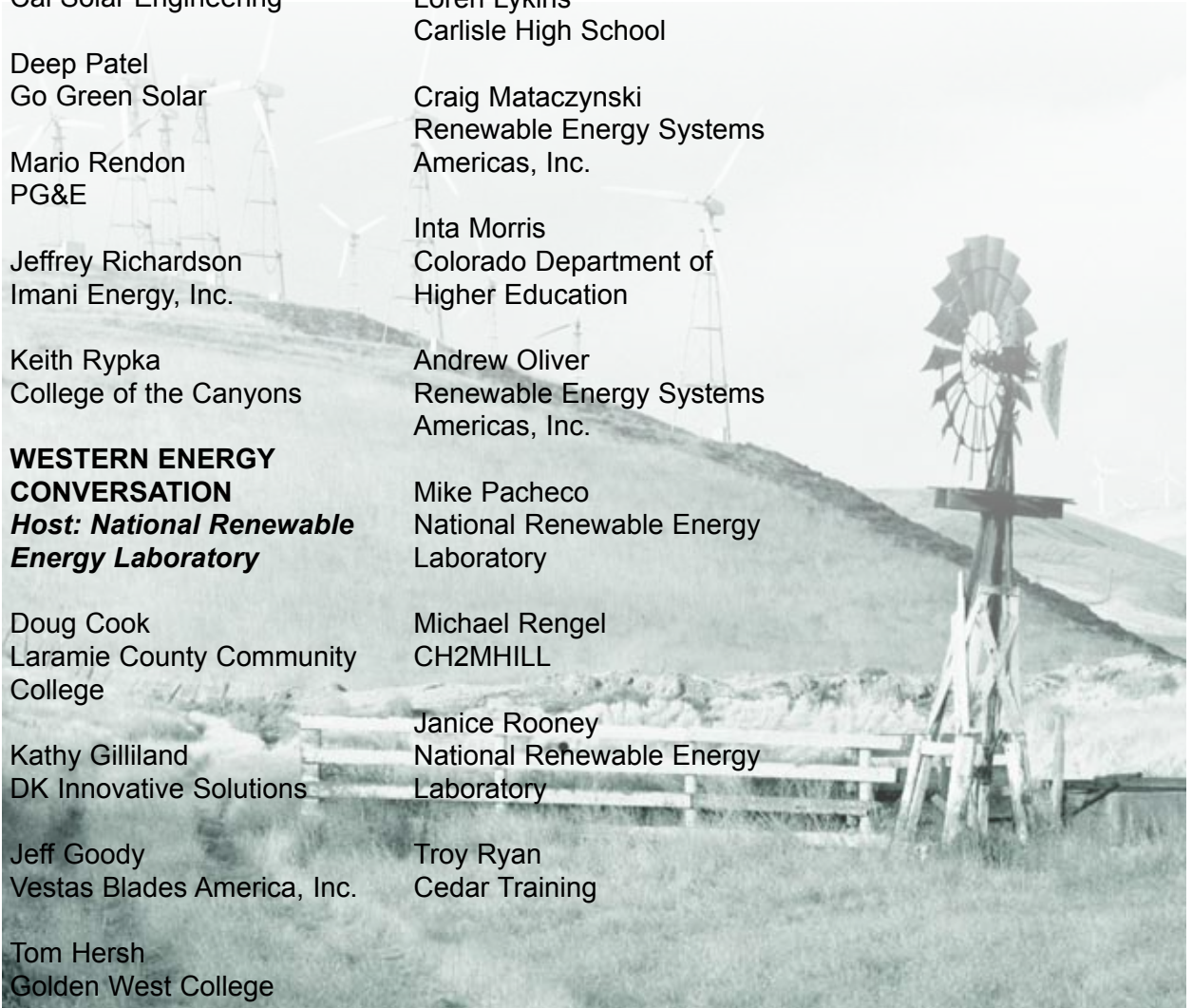
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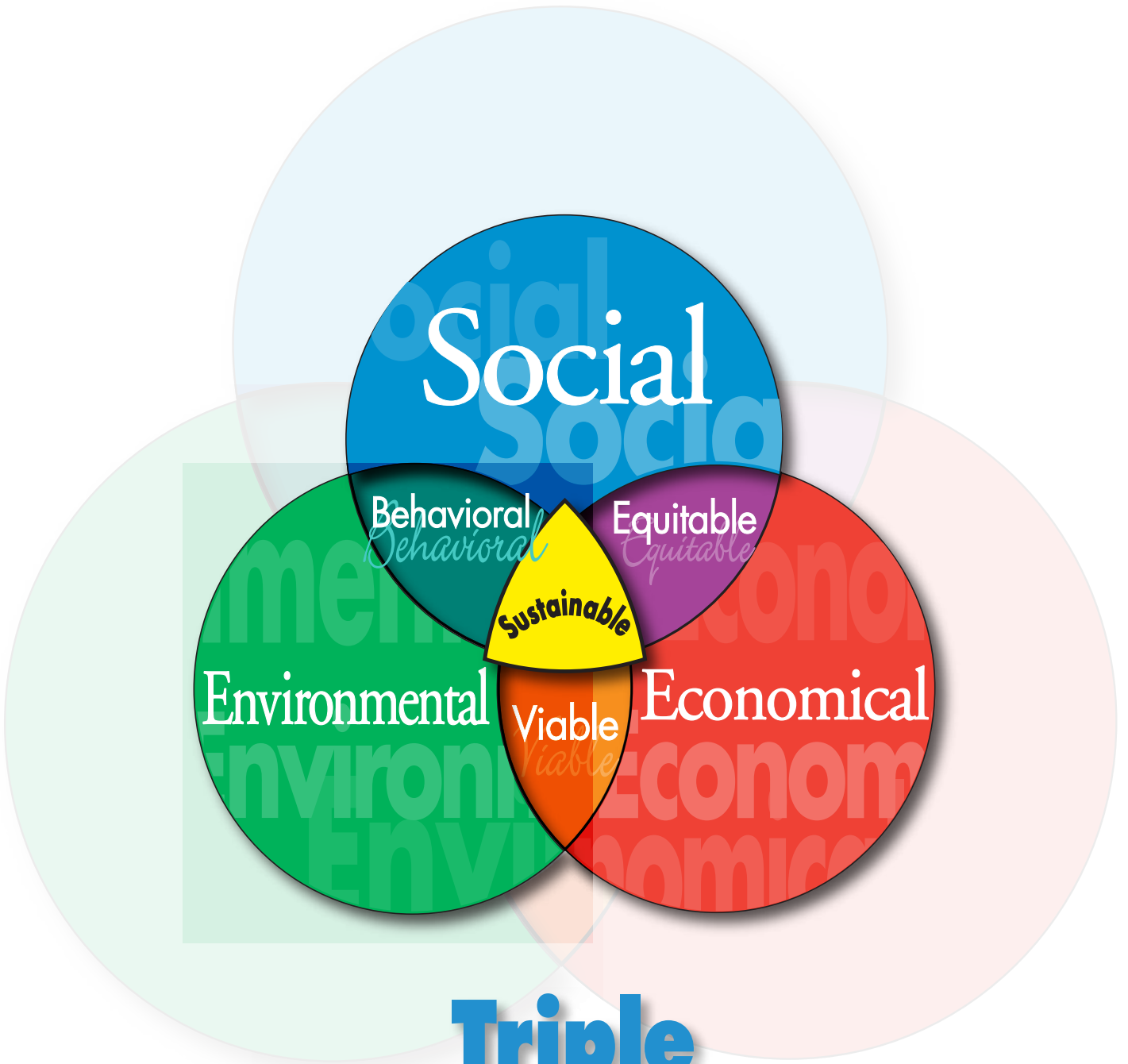
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**Triple
Bottom Line of
Sustainability**

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