

GREEN
Manufacturing

Missouri



Green INDUSTRY

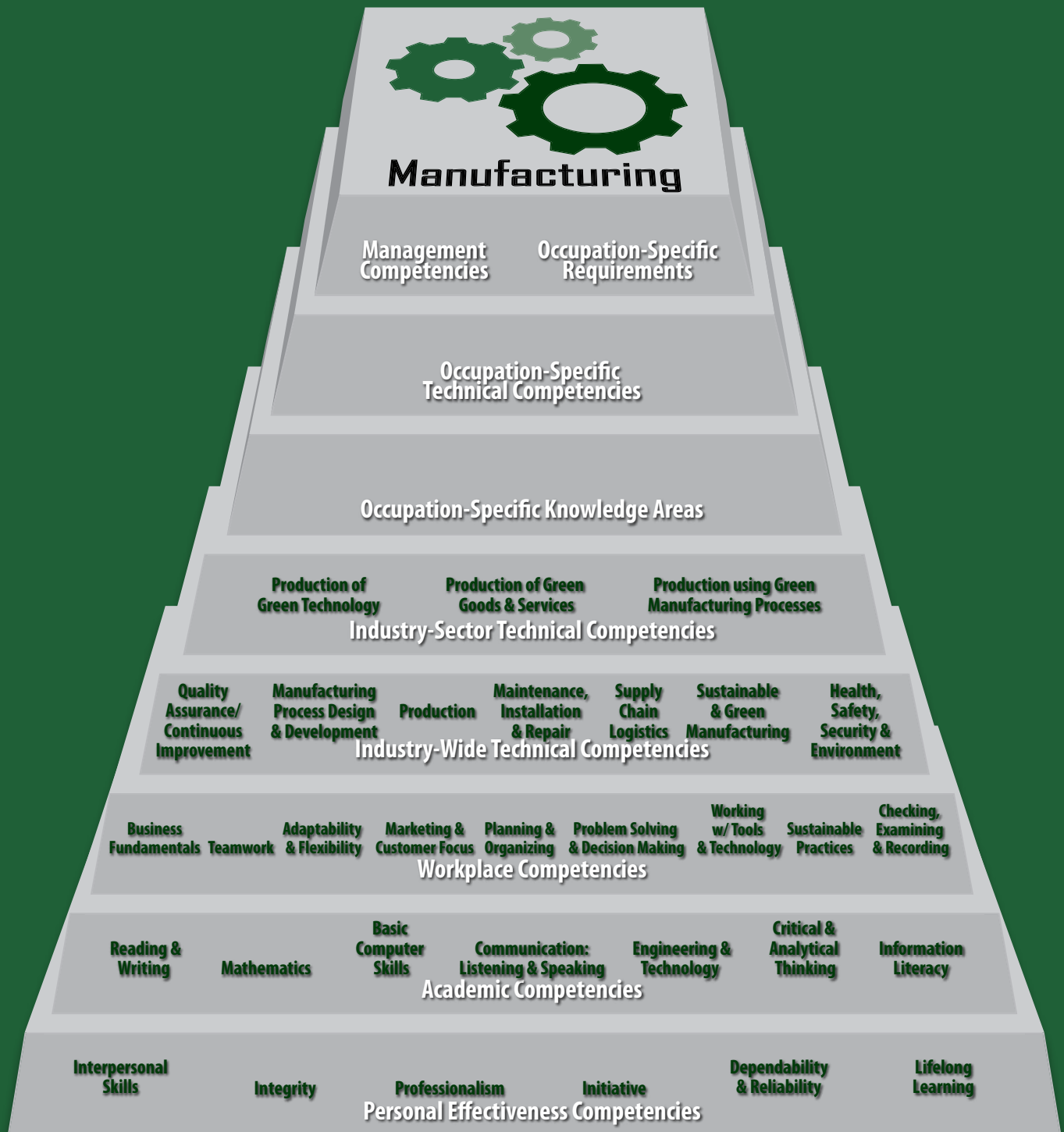
COMPETENCY

MODEL





Green Manufacturing Competency Model



What is Green Manufacturing?

Research, Development and Production of advanced green technology products are the most fundamental drivers of green job creation in Missouri. Potential global demand for this sector's exports is staggering. Growing and keeping entrepreneurship within these technology categories will reap only positive benefits for the state.

Green Manufacturing

In this section the results of the Green Manufacturing Competency Model analysis are discussed. Each tier lists the most essential competencies and each competency is further described in terms of behavioral attributes.

TIER 1—Personal Effectiveness Competencies

| INTERPERSONAL SKILLS | INTEGRITY | PROFESSIONALISM | INITIATIVE | DEPENDABILITY & RELIABILITY | LIFELONG LEARNING |
|----------------------|-----------|-----------------|------------|-----------------------------|-------------------|
|----------------------|-----------|-----------------|------------|-----------------------------|-------------------|

INTERPERSONAL SKILLS

- ▶ Respect the opinions, customs and individual differences of others
- ▶ Interact respectfully with coworkers of different cultures, genders and backgrounds
- ▶ Work cooperatively with others on the job and display a good-natured attitude
- ▶ Resolve conflicts and differences to maintain a smooth workflow

INTEGRITY

- ▶ Apply ethical standards of the industry to workplace/jobsite conduct
- ▶ Treat others with honesty, fairness and respect
- ▶ Demonstrate respect for property of customers, employer and coworkers
- ▶ Take responsibility for accomplishing work goals within accepted timeframes
- ▶ Accept responsibility for one's decisions and actions

PROFESSIONALISM

- ▶ Take pride in one's work and the work of the organization
- ▶ Demonstrate self-control by keeping emotions in check
- ▶ Accept criticism and deal calmly with stressful situations
- ▶ Dress appropriately for the workplace/jobsite
- ▶ Maintain appropriate personal hygiene
- ▶ Refrain from substance abuse

INITIATIVE

- ▶ Pursue work with Manufacturing, drive and effort to accomplish tasks
- ▶ Persist at a task or problem despite interruptions, obstacles, or setbacks
- ▶ Work independently and perform effectively even with little or no supervision
- ▶ Demonstrate the ability to change from one task to another
- ▶ Take initiative to seek out new responsibilities
- ▶ Establish and maintain challenging, but realistic work goals

DEPENDABILITY & RELIABILITY

- ▶ Arrive at work fit and on time each day
- ▶ Avoid absenteeism
- ▶ Work accurately and quickly under pressure
- ▶ Complete assignments and meet deadlines
- ▶ Comply with rules, policies and procedures such as safety, personal hygiene, personal discipline, substance abuse, employee theft and sexual harassment

LIFELONG LEARNING

- ▶ Demonstrate an interest in personal and professional lifelong learning and development.
- ▶ Treat unexpected circumstances as opportunities to learn and adopt new techniques.
- ▶ Seek feedback and modify behavior for improvement.
- ▶ Broaden knowledge and skills through job shadowing and continuing education.
- ▶ Use newly learned knowledge and skills to complete specific tasks and improve work processes.
- ▶ Take charge of personal career development by identifying personal interests and career pathways.
- ▶ Seek and maintain membership in professional associations.
- ▶ Read technical publications to stay abreast of new developments in the industry.
- ▶ Maintain certifications and continuing education credits.



TIER 2—Academic Competencies

| | | | | | | |
|-------------------|-------------|-----------------------|-------------------------------------|--------------------------|--------------------------------|----------------------|
| READING & WRITING | MATHEMATICS | BASIC COMPUTER SKILLS | COMMUNICATION: LISTENING & SPEAKING | ENGINEERING & TECHNOLOGY | CRITICAL & ANALYTICAL THINKING | INFORMATION LITERACY |
|-------------------|-------------|-----------------------|-------------------------------------|--------------------------|--------------------------------|----------------------|

READING & WRITING

- ▶ Read and understand technical and workplace documents such as contracts, regulations, manuals, reports, memos, forms, graphs, charts, tables, calendars, schedules, signs and notices
- ▶ Read and understand operating directions, installation instructions and standard operating procedures
- ▶ Recognize the meaning of specialized words or phrases unique to the industry
- ▶ Apply what is learned from written material to follow instructions and complete tasks
- ▶ Communicate ideas, information and messages which may contain technical material, in a logical manner
- ▶ Prepare documents such as written estimates, work orders, memos and technical reports
- ▶ Fill out forms, reports, records, logs and documents to comply with project requirements

MATHEMATICS

- ▶ Adds, subtracts, multiplies and divides with whole numbers, fractions, decimals and percents; calculates average, ratios, proportions and rates
- ▶ Takes measurement of time, temperature, distance, length, width, height, perimeter etc.
- ▶ Correctly converts from one measurement to another
- ▶ Translates practical problems into useful mathematical expressions and uses appropriate mathematical formulas and techniques
- ▶ Solves simple algebraic equations
- ▶ Is able to determine slope, midpoint and distance
- ▶ Calculates perimeters, areas and volumes of basic shapes and solids
- ▶ Reads, tracks and calculates gauge measurements

BASIC COMPUTER SKILLS

- ▶ Understands and efficiently uses basic computer hardware and software to perform tasks and is familiar with fundamental capabilities of computers
- ▶ Enters data into computer with acceptable degree of accuracy
- ▶ Uses word processing programs to create, edit and retrieve files
- ▶ Uses spreadsheet software to enter, manipulate, edit and format text and numerical data
- ▶ Uses electronic mail applications
- ▶ Uses the internet and web based tools to manage basic workplace tasks

COMMUNICATION: LISTENING AND SPEAKING

- ▶ Listens carefully to others and correctly interprets information provided by others
- ▶ Speaks clearly, in a logical organized and coherent manner
- ▶ Is able to incorporate information into actions

ENGINEERING AND TECHNOLOGY

- ▶ Applies basic engineering principles and the appropriate technical solution to a problem
- ▶ Applies principles of engineering science and technology, techniques, procedures and equipment to the design and production of various goods and services
- ▶ Applies the basics of electricity
- ▶ Identifies and selects the appropriate hand or small electric tools or diagnostic equipment for the work
- ▶ Solves problems where a variety of mechanical, electrical, thermal or fluid faults could be at fault.

CRITICAL AND ANALYTICAL THINKING

- ▶ Identifies inconsistent or missing information
- ▶ Critically reviews, analyzes, synthesizes, compares and interprets information
- ▶ Tests possible hypotheses to ensure the problem is correctly diagnosed and the best solution is found

INFORMATION LITERACY

- ▶ **Locate and Evaluate Information**
 - Locate information efficiently (time) and effectively (sources).
 - Evaluate information critically and competently.
 - Review information obtained for relevance and completeness.
 - Recognize important gaps in existing information.
 - Take steps to eliminate those gaps.
- ▶ **Use and Manage Information**
 - Use information accurately and creatively for the issue or problem at hand.
 - Manage the flow of information from a wide variety of sources.
 - Organize/reorganize information as appropriate to get a better understanding of a problem.
- ▶ **Analyze Media**
 - Understand both how and why media messages are constructed and for what purposes.
 - Examine how individuals interpret messages differently, how values and points of view are included or excluded and how media can influence beliefs and behaviors.

TIER 3—Academic Competencies

| BUSINESS FUNDAMENTALS | TEAMWORK | ADAPTABILITY/FLEXIBILITY |
|------------------------------|-----------------------|-----------------------------------|
| MARKETING & CUSTOMER FOCUS | PLANNING & ORGANIZING | PROBLEM SOLVING & DECISION MAKING |
| WORKING W/TOOLS & TECHNOLOGY | SUSTAINABLE PRACTICES | CHECKING, EXAMINING & RECORDING |

BUSINESS FUNDAMENTALS

- ▶ **Economic/Business/Financial Principles**
 - Economic Terminology
 - Supply/Demand
 - Characteristics of Markets
 - Cost and Pricing of Products
 - Profit and Loss
 - Fundamentals of Accounting
- ▶ **Economic System as a Framework for Decision-making**
 - Understand how one's performance can impact the success of the organization.
 - Consider the relative costs and benefits of potential actions to choose the most appropriate one.
 - Demonstrate an understanding of market trends, the company's position in the market place and defined market segments.
 - Understand the position of the company's product/service in relation to market demand.
- ▶ **Business Ethics**
 - Act in the best interests of the company, your co-workers, your community, other stakeholders and the environment.



- ▶ **Legal/Financial**
 - Comply with the spirit of applicable laws as well as the letter.
 - Properly use company property by minimizing loss and waste and reporting loss, waste, or theft of company property to appropriate personnel.
 - Maintain privacy and confidentiality of company information as well as that of customers and co-workers.
 - Comply with intellectual property laws.
 - Protect trade secrets.
- ▶ **Environmental/Health/Safety**
 - Maintain a healthful and safe environment and report any violations/discrepancies to appropriate personnel.
 - Ensure proper handling and disposal of toxic or hazardous materials.
- ▶ **Social Responsibility**
 - Emphasize quality, customer satisfaction and fair pricing.
 - Deal with customers and colleagues in good faith without bribes, kickbacks, or excessive hospitality.

TEAMWORK

- ▶ **Work With Others**
 - Work as part of a team to achieve mutual goals.
 - Develop and maintain good working relationships with supervisors and co-workers.
 - Choose behaviors and/or actions that best support the team and lead toward the accomplishment of work tasks.
 - Recognize a team's goals and identify ways to accomplish those goals in increasingly complex workplace situations.
- ▶ **Influence/Negotiate**
 - Work through conflict constructively.
 - Persuasively present thoughts and ideas.
 - Respect the views of others.
 - Build toward consensus.
 - Influence, motivate and persuade others in order to achieve company and client objectives.

ADAPTABILITY/FLEXIBILITY

Being open to change (positive or negative) and to considerable variety in the workplace.

- ▶ **Entertain New Ideas**
 - Be open to considering new ways of doing things.
 - Actively seek out and carefully consider the merits of new approaches to work.
 - Willingly embrace new approaches when appropriate and discard approaches that are no longer working.
- ▶ **Deal With Ambiguity**
 - Take effective action when necessary without having to have all the necessary facts in hand.
 - Respond effectively to unpredictable or unexpected events.
 - Effectively change plans, goals, actions, or priorities to deal with changing situations.

MARKETING & CUSTOMER FOCUS

Actively looking for ways to identify market demands and meet the customer or client need.

- ▶ **Understand Customer Needs**
 - Identify internal and external customers.
 - Demonstrate a desire to understand customer needs.
 - Ask questions as appropriate.
 - Demonstrate awareness of client goals.

- ▶ **Provide Personalized Service**
 - Provide prompt and efficient responses to meet the requirements, requests and concerns of customers.
 - Provide thorough, accurate information to answer customers' questions and to meet commitment times or performance guarantees.
 - Actively look for ways to help customers by identifying and proposing appropriate solutions and/or services.
 - Establish boundaries as appropriate for unreasonable customer demands.
- ▶ **Act Professionally**
 - Be pleasant, courteous and professional when dealing with internal or external customers.
 - Develop constructive and cooperative working relationships with customers.
 - Display a good-natured, cooperative attitude; be calm and empathetic when dealing with hostile customers.
 - Uphold the company and product brand in interactions with others.
- ▶ **Keep Customers Informed**
 - Follow up with customers during projects and following project completion.
 - Keep clients up to date about decisions that affect them.
 - Seek the comments, criticisms and involvement of customers.
 - Adjust services based on customer feedback.
 - Address customer comments, questions, concerns and objections with direct, accurate and timely responses.

PLANNING & ORGANIZING

- ▶ Prioritizes various competing tasks and performs them quickly and efficiently according to their urgency
- ▶ Finds new ways of organizing work area or planning work to accomplish work more efficiently
- ▶ Estimates resources needed for project completion; allocated time and resources effectively
- ▶ Anticipates obstacles to project completion and develops contingency plans to address them; take necessary corrective action when projects go off-track
- ▶ Plans and schedules tasks so that work is completed on time
- ▶ Makes arrangements that fulfill all requirements as efficiently and economically as possible
- ▶ Responds to the schedules of other affected by arrangements; giving them complete, accurate and timely information
- ▶ Keeps track of details to ensure work is performed accurately and completely
- ▶ Takes steps to verify all arrangements, recognizes problems, generates effective alternatives and takes corrective actions
- ▶ Effectively coordinates the transition of employees at the beginning and end of each work shift; disseminates crucial information in an organized manner to rapidly bring employees up to speed at the start of their shifts

PROBLEM SOLVING & DECISION MAKING

- ▶ Anticipates or recognizes the existence of a problem
- ▶ Identifies the true nature of the problem by analyzing its component parts
- ▶ Effectively uses both internal and external resources to locate and gather information; examines information obtained for relevance and completeness; recognizes important gaps in existing information and takes steps to eliminate those gaps; recalls previously learned information that is relevant to the problem; organizes information as appropriate to gain a better understanding of the problem
- ▶ Integrates previously learned and externally obtained information to generate a variety of high quality alternative approaches to the problem
- ▶ Skillfully uses logic and analysis to identify the strengths and weaknesses, the costs and benefits and the short and the long-term consequences of different approaches
- ▶ Decisively chooses the best solution after contemplating available approaches to the problem; makes difficult decisions even in highly ambiguous or ill-defined situations; quickly chooses an effective solution without assistance when appropriate



- ▶ Commits to a solution in a timely manner and develops a realistic approach for implementing the chosen solution; observes and evaluates the outcomes of implementing the solution to assess the need for alternative approaches and to identify lessons learned
- ▶ Uses scientific rules and methods to solve problems

WORKING WITH TOOLS & TECHNOLOGY

- ▶ Selection and Application
 - Identify, select and apply appropriate and cost-effective tools or technological solutions.
 - Identify potential hazards related to the use of tools and equipment.
 - Operate tools and equipment in accordance with established operating procedures and safety standards.
 - Use information technology and computer applications to support gathering, storing, manipulating and transferring data and information.
- ▶ Keeping Current
 - Demonstrate an interest in learning about new and emerging tools and technologies.
 - Identify sources of information concerning state-of-the-art tools, equipment, materials, technologies and methodologies.
 - Seek out opportunities to improve knowledge of tools and technologies that may assist in streamlining work and improving productivity.
- ▶ Maintenance and Troubleshooting
 - Perform routine maintenance on tools, technology and equipment.
 - Determine causes of operating errors and take corrective action.
 - Troubleshoot maintenance problems in accordance with established procedures.
 - Perform work functions that require engaging in hands-on activity.

SUSTAINABLE PRACTICES

- ▶ Meeting the needs of the present without compromising the ability of future generations to meet their own needs.
- ▶ Abide by applicable federal, state and local regulations and policies.
- ▶ Safeguard the public interest.
- ▶ Ensure equipment and systems are designed to minimize environmental impact.
- ▶ Seek to upgrade processes beyond pollution control to pollution prevention.
- ▶ Utilize advances in science and technology to upgrade levels of efficiency and environmental protection.
- ▶ Promote sustainable business practices consistent with ISO 14001 International Environmental Management Guidance.

CHECKING, EXAMINING & RECORDING

Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic format.

- ▶ Record data in control system documentation.
- ▶ Compile, code, categorize, calculate, inspect, or verify information or data.
- ▶ Apply systematic techniques for observing and gathering data.
- ▶ Detect and correct errors or inconsistencies, even under time pressure.
- ▶ Organize records and files to maintain data.

TIER 4—Industry-Wide Competencies

| | | | | | | |
|--|--|------------|------------------------------------|------------------------|-----------------------------------|--|
| QUALITY ASSURANCE / CONTINUOUS IMPROVEMENT | MANUFACTURING PROCESS DESIGN & DEVELOPMENT | PRODUCTION | MAINTENANCE, INSTALLATION & REPAIR | SUPPLY CHAIN LOGISTICS | SUSTAINABLE & GREEN MANUFACTURING | HEALTH, SAFETY, SECURITY & ENVIRONMENT |
|--|--|------------|------------------------------------|------------------------|-----------------------------------|--|

QUALITY ASSURANCE/CONTINUOUS IMPROVEMENT

Ensure product and process meets quality system requirements as defined by customer specifications.

- ▶ **Entry-Level Critical Work Functions**
 - Ensure materials, processes and final product meet quality specifications.
 - Support and maintain quality systems.
- ▶ **Entry-Level Technical Content Areas**
 - Quality Assurance
 - ⇒ Meeting Customer Needs
 - ⇒ Quality Management Systems and Tools
 - ⇒ Industry Standards
 - Principles of Lean Manufacturing
 - Improving Quality
 - ⇒ Introduction to Statistical Process Control
 - ⇒ Sampling and Charting
 - ⇒ Problem Solving Tools
 - Inspecting for Quality
 - ⇒ Inspecting Raw/Incoming Materials
 - ⇒ Inspecting In-Process Product
 - ⇒ Inspecting Final Products
 - Continuous Improvement
 - ⇒ Business Process Reengineering
 - ⇒ Systems Analysis
 - ⇒ Data Analysis
- ▶ **Technician-Level Critical Work Functions**
 - Monitor production for product and process quality.
 - Employ audits and inspections to maintain the quality and continuous improvement process.
 - Correct the product and process to meet quality standards.
 - Suggest and/or implement continuous improvement actions.
- ▶ **Technician-Level Technical Content Areas**
 - Probability and Statistics
 - Data Analysis and Presentation
 - ⇒ Presentation Skills
 - ⇒ Query-Based Intermediate Computer Skills
 - ⇒ Facilitation Skills
 - ⇒ Business Case
 - Statistical Process Control Methods
 - ⇒ Factor Analysis
 - ⇒ Capability Analysis
 - ⇒ Inspection/Test/Validation
 - ⇒ Reliability Analysis
 - ⇒ Acceptance Sampling

- Quality Assurance Audits
 - ⇒ ISO 9000
 - ⇒ Audit Procedures
- Corrective and Preventive Actions
 - ⇒ Eliminating Non-Conformities
 - ⇒ Verification and Documentation
 - ⇒ Documentation Creation
- Benchmarking and Best Practice

MANUFACTURING PROCESS DESIGN & DEVELOPMENT

Research, design, implement and continuously improve the manufacturing process to ensure product meets customer needs.

- ▶ **Entry-Level Critical Work Functions**
 - Support manufacturing process design and development.
 - Communicate about and respond to requirements of internal and external customers.
- ▶ **Entry-Level Technical Content Areas**
 - Fundamentals of Research & Development
 - ⇒ Awareness of basic Product R&D
 - ⇒ Awareness of basic Process R&D
 - Technical Drawings and Schematics
 - ⇒ Print Reading
 - ⇒ Interpretation of Drawings
 - ⇒ Interpretation of Schematics
 - ⇒ Geometric Dimensions and Tolerances
 - CAD Drawing Fundamentals
 - ⇒ Creation of Computer Aided Design (CAD) Drawings
 - ⇒ Interpretation of CAD Drawings
 - ⇒ Updating and Editing CAD Drawings
 - ⇒ CAD/CAM/CAE Applications
 - Troubleshooting Processes
 - ⇒ Knowledge of Statistical Process Control
 - ⇒ Problem Solving Skills
 - Process Assessment
 - ⇒ Procedure Analysis and Verification
 - ⇒ Documentation Fault Finding Skills
- ▶ **Technician-Level Critical Work Functions**
 - Interpret and clarify customer expectations and product specifications.
 - Design manufacturing production and production support systems.
 - Exert maximum effort to operate and fully utilize all of the technology and tools used in the manufacturing environment.
- ▶ **Technician-Level Technical Content Areas**
 - Research & Development
 - ⇒ Product R&D
 - ⇒ Process R&D
 - ⇒ Market/Sales/Life Cycle Analysis
 - ⇒ Intellectual Property Protection
 - Product Realization
 - ⇒ Design for Manufacturing and Design for Logistics
 - ⇒ Production System Design and Development

- ⇒ Equipment/Tool Design and Development
- ⇒ Support Systems Design and Development
- ⇒ Development of Prototype Processes and Products
- ⇒ Production System Design, Testing and Costing
- Technology Applications
 - ⇒ Integrated Graphics Technologies
 - ⇒ Machining and Forming Technologies
 - ⇒ Micro and Nano Technologies
 - ⇒ Alternative Energies Technologies
 - ⇒ Hydraulic/Pneumatic Technologies
- Troubleshooting Processes
 - ⇒ Advanced Fault Finding Skills on Actual Equipment
 - ⇒ Setup of SPC
 - ⇒ Data Analysis and Verification
 - ⇒ Data Interpretation and Corrective Action Implementation

PRODUCTION

Set up, operate, monitor, control and improve manufacturing processes and schedules to meet customer requirements.

- ▶ **Entry-Level Critical Work Functions**
 - Understand the various manufacturing types, processes and products.
 - Understand the manufacturing business as a system that integrates multiple disciplines, processes and stakeholders.
 - Manage raw materials/consumables.
 - Operate and control production/lab equipment.
 - Perform manufacturing process applications and operations.
- ▶ **Entry-Level Technical Content Areas**
 - Manufacturing Types
 - Systems
 - Lean Manufacturing/Continuous Improvement
 - Production Materials
 - Precision Measurement
 - Manual Tool & Equipment Operations
 - Basic Automated Systems & Control Operations
 - Basic Manufacturing Process Applications & Operations
 - ⇒ Assembly Processes
 - ⇒ Fabrication Processes
 - ⇒ Electrical/Electronics Manufacturing Processes
 - ⇒ Bulk/Continuous Flow/Line Balancing Processes
 - ⇒ Finishing Processes
 - ⇒ Clean Room Processes
 - ⇒ Experiment Design/Implementation Processes
 - ⇒ Implementation of Approved Protocols
 - ⇒ Material Removal Processes
 - ⇒ Hot and Cold Forming Processes
 - ⇒ Casting, Molding and Stamping Processes
 - ⇒ Heat Treatment Processes
 - ⇒ Joining, Welding and Assembly Processes
 - ⇒ Direct Digital and Additive Manufacturing



- ▶ **Technician-Level Critical Work Functions**
 - Develop manufacturing process plans and documentation.
 - Monitor manufacturing processes and systems.
 - Manage continuous improvement process.
- ▶ **Technician-Level Technical Content Areas**
 - Production Planning and Work Flow
 - Production Components
 - ⇒ Continuous Improvement
 - ⇒ Time, Materials and Costs
 - ⇒ Production Systems
 - Advanced Production/Process Operations
 - ⇒ Assembly Processes
 - ⇒ Fabrication Processes
 - ⇒ Electrical/Electronics Manufacturing Processes
 - ⇒ Process Overview Knowledge
 - ⇒ Finishing Processes
 - ⇒ Continuous Flow/Line Balancing Processes
 - ⇒ Cell Culture/Fermentation/Media Processes
 - ⇒ Recovery/Filtration Processes
 - Production/Process Monitoring
 - ⇒ Controlling Process Flow
 - ⇒ Documentation and Reporting
 - ⇒ Performance of Analytical Tests
 - ⇒ Calibration and Troubleshooting
 - ⇒ Environmental Parameters
 - ⇒ Write/Execute Protocols
 - Manufacturing Management
 - ⇒ Organizational Design and Management
 - ⇒ Project Management
 - ⇒ Personnel Management Methods
 - ⇒ Human Behavior/Motivation/Leadership
 - ⇒ Material and Resource Management
 - ⇒ Training Skills

MAINTENANCE, INSTALLATION & REPAIR

Maintain and optimize manufacturing equipment and systems.

- ▶ **Entry-Level Critical Work Functions**
 - Identify, diagnose and/or repair equipment problems.
 - Communicate with others to ensure maintenance and repairs meet operational needs.
 - Maintain hands-on knowledge of equipment operations.
 - Maintain equipment, tools and workstations.
- ▶ **Entry-Level Technical Content Areas**
 - General Skills
 - ⇒ Use of Hand Tools
 - ⇒ Use of Schematic Drawings and Control Documents
 - ⇒ Use of Calibrated Measuring Instruments
 - ⇒ Knowledge of Basic Hydraulic/Pneumatic Systems
 - ⇒ Knowledge of Basic AC/DC Electrical Systems
 - ⇒ Installation of Parts for Industrial Equipment

- Basic Disassembly/Assembly Skills
- Basic Maintenance and Troubleshooting Skills
 - ⇒ Mechanical Systems
 - ⇒ Electrical Systems
 - ⇒ Electronic Systems
 - ⇒ Hydraulic/Pneumatic Systems
 - ⇒ High Vacuum Systems
 - ⇒ Laser Systems
 - ⇒ Computer Systems
 - ⇒ Machine Automation Systems
 - ⇒ Lubrication Processes
 - ⇒ Bearings and Couplings
 - ⇒ Belt Drives and Chain Drives
- ▶ **Technician-Level Critical Work Functions**
 - Support the installation, customization, or upgrading of equipment.
 - Coordinate preventive maintenance to ensure production process runs smoothly.
- ▶ **Technician-Level Technical Content Areas**
 - Advanced Installation and Repair Skills
 - ⇒ Mechanical Power Transmissions Systems
 - ⇒ Piping Operations
 - ⇒ Hydraulics/Pneumatics Power Transmission Systems
 - Advanced Maintenance and Troubleshooting Skills
 - ⇒ Process Controls
 - ⇒ Pump Systems
 - ⇒ Thermal Systems (HVAC)
 - ⇒ Refrigeration Systems
 - ⇒ Mechanical/Fluid Power Systems
 - ⇒ Separation/Heat Exchange Systems
 - ⇒ Water Treatment/Destruction Systems
 - ⇒ High Voltage/Utility Systems
 - ⇒ Programmable Logic Controlled Industrial Equipment
 - Reliability and Maintainability
 - ⇒ Basic Reliability Models
 - ⇒ Reliability of Systems
 - ⇒ Design for Reliability
 - ⇒ Design for Maintainability
 - ⇒ Investigative Techniques
 - ⇒ Analysis of Failure Data

SUPPLY CHAIN LOGISTICS

Plan and monitor the movement and storage of materials and products in coordination with suppliers, internal systems and customers.

- ▶ **Entry-Level Critical Work Functions**
 - Ship and receive products and materials.
- ▶ **Entry-Level Technical Content Areas**
 - Basics of Supply-Chain Management
 - ⇒ Elements of the Supply Chain
 - ⇒ Just-in-Time/Lean Manufacturing

- Managing Inventory
 - ⇒ Inventory Forecasting
 - ⇒ Ordering Materials and Supplies
 - ⇒ Inventory Monitoring and Audits
 - ⇒ Stock Rotation Requirements
 - ⇒ Expediting
- Work Flow
 - ⇒ Material Handling
 - ⇒ Plant Facility and Capacity
 - ⇒ Production Scheduling
- Production Systems
 - ⇒ Lead and Cycle Time
 - ⇒ Change Orders, Bills of Material, Work Orders, etc.
- Packaging and Distributing Product
 - ⇒ Packaging Product
 - ⇒ Labeling Product- Inventory Tags and Bar Codes
 - ⇒ Warehouse Management Systems
 - ⇒ Transportation Methods
 - ⇒ Customs and Export Control (Basic Paperwork)
- ▶ **Technician-Level Critical Work Functions**
 - Manage purchasing and just-in-time materials flow, shipping and receiving, packaging and transportation.
 - Control inventory of materials and products.
 - Develop and maintain production/delivery schedules and supplier networks.
- ▶ **Technician-Level Technical Content Areas**
 - Supply-Chain Management
 - ⇒ Manufacturing Resources Planning
 - ⇒ Collaborative, Planning, Forecasting and Replenishment
 - ⇒ Vendor Managed Inventory Systems
 - ⇒ Centralized versus Decentralized Control
 - ⇒ E-Business and Direct Shipment
 - Automated Material Handling
 - ⇒ Automated Material Handling and Distribution Systems
 - ⇒ Integrated Supply Chain Information Technology
 - Resources Planning
 - ⇒ Demand Management
 - ⇒ Sales and Operations Planning
 - ⇒ Master Scheduling
 - ⇒ Measuring Business Performance
 - Detailed Scheduling and Planning
 - ⇒ Techniques of Inventory Management
 - ⇒ Detailed Material Planning
 - Executing Operations
 - ⇒ Procurement and External Source of Supply
 - ⇒ Prioritizing and Sequencing Work
 - ⇒ Executing Plans and Implementing Controls
 - ⇒ Evaluating Performance
 - ⇒ Ergonomics
 - ⇒ Sharing and Collaboration across the Supply Chain

- Awareness of Global Impacts
 - ⇒ Global Supply Chain Logistics Life Cycle
 - ⇒ Intellectual Property
 - ⇒ Taxes and Duties
 - ⇒ Shipping, Receiving and Freight
 - ⇒ Customs and Export Control (Legal Aspects)

SUSTAINABLE & GREEN MANUFACTURING

Manufacture products using processes that minimize negative environmental impacts; conserve energy and natural resources; are safe for employees, communities and consumers; and are economically sound.

- ▶ **Entry-Level Critical Work Functions**
 - Strive to minimize waste, improve efficiency and reduce resource use.
 - Operate with a triple bottom line, emphasizing financial profitability, environmental integrity and social equity.
 - Understand life cycle analysis: the environmental and economic effects of a product at every stage of its existence, from extraction of materials through production to disposal and beyond.
- ▶ **Entry-Level Technical Content Areas**
 - Waste Awareness and Reduction
 - ⇒ Fundamentals of solid waste streams and their sources and focusing on the 4Rs — Refuse, Reduce, Reuse, Recycle.
 - Sustainability into Practice
 - ⇒ Developing the business case for implementing a comprehensive environmental management or sustainability program.
 - Energy Management
 - ⇒ Managing energy usage and investing in energy efficiency to cut energy costs and reduce carbon footprint.
 - Water Conservation
 - ⇒ Applying lower-cost and conservation principles/practices in operation and design of water systems.
 - Pollution Solutions
 - ⇒ Improving emission control and environmental management systems and new technologies to reduce air pollution.
 - Green Chemistry
 - ⇒ Applying green chemistry principles and techniques throughout the business.

HEALTH, SAFETY, SECURITY & ENVIRONMENT

Employ equipment, practices and procedures which promote a healthy, safe and secure work environment.

- ▶ **Entry-Level Critical Work Functions**
 - Understand and follow established personal safety, security and environmental practices.
 - Ensure that equipment is being used safely.
 - Comply with local, federal and company health, safety, security and environmental regulations.
 - Identify unsafe or insecure conditions and take corrective action.
- ▶ **Entry-Level Technical Content Areas**
 - Personal Safety
 - ⇒ Understanding and Following Established Safety Practices
 - ⇒ Safety Procedures for Clean and Safe Working Environment
 - ⇒ Use of Personal Protective Equipment and Clothing
 - Regulations
 - ⇒ Hazardous Material Communication (HAZCOM)
 - ⇒ Hazardous Material Handling and Disposal (HAZMAT)
 - ⇒ Hazardous Material Information System Labeling and Storage (HMIS)
 - ⇒ Office of Homeland Security System and Physical Security Regulations (US only)

- ⇒ Regulations Governing Safe Use of Equipment
- ⇒ Role of the Occupational Safety and Health Administration (OSHA), the Environmental Protection Administration (EPA), or Other Appropriate Regulatory Bodies in the Workplace (US only)
- Safety Procedures
 - ⇒ Confined Spaces
 - ⇒ First Aid or First Response Procedures
 - ⇒ Inspecting Material, Equipment and Fixtures for Defects
 - ⇒ Assessing Material, Equipment and Fixtures for Hazards
 - ⇒ Lock /Tag Out Practices
 - ⇒ Material Safety Data Sheets (MSDS)
 - ⇒ Response to Shop Emergencies
 - ⇒ Safe Evacuation of Facility
 - ⇒ Safe Moving of Materials
 - ⇒ Safe, Prescribed Operation of Equipment and Tools
 - ⇒ Use, Maintenance and Inspection of Machine Safeguards
 - ⇒ Use of Safety Equipment
- ▶ Technician-Level Critical Work Functions
 - Conduct health, safety and/or environmental incident and hazard investigations.
 - Conduct preventive health, safety and/or environmental incident and hazard inspections.
 - Implement continuous improvement in health, safety, security and/or environmental practices.
- ▶ Technician-Level Technical Content Areas
 - Continuous Improvement in Health, Safety, Security and Environment
 - ⇒ Analysis of Health/Safety/Security/Environmental Data
 - ⇒ Identification of Projects and Priorities
 - ⇒ Root Cause Analysis
 - Environmental Protection/Waste Management
 - ⇒ Chemical Hazard Assessment
 - ⇒ Design to Minimize Environmental Impact
 - Incident and Hazard Investigations
 - ⇒ Investigations for Health, Safety, Security, or Environmental Incidences/Hazards
 - ⇒ Developing Corrective Actions
 - ⇒ Documentation of Findings
 - ⇒ Follow-up Investigation
 - ⇒ Insurance (Property)
 - ⇒ Violations Reports to Proper Authorities
 - ⇒ Workers Compensation
 - Preventive Health, Safety, or Environmental Inspections
 - ⇒ Audit of Records and Documentation
 - ⇒ Conducting Inspections
 - ⇒ Clean Room Protocol
 - ⇒ Documentation of Inspection Findings
 - ⇒ Emergency Response Preparedness
 - ⇒ Fire Protection and Control
 - Standards
 - ⇒ International Environmental Management Guidance (ISO14001)
 - Additional Knowledge
 - ⇒ Life Safety Code/National Fire Protection Association 101
 - ⇒ Engineering Principles for Safety

TIER 5—Industry—Sector Competencies

PRODUCTION OF GREEN TECHNOLOGY

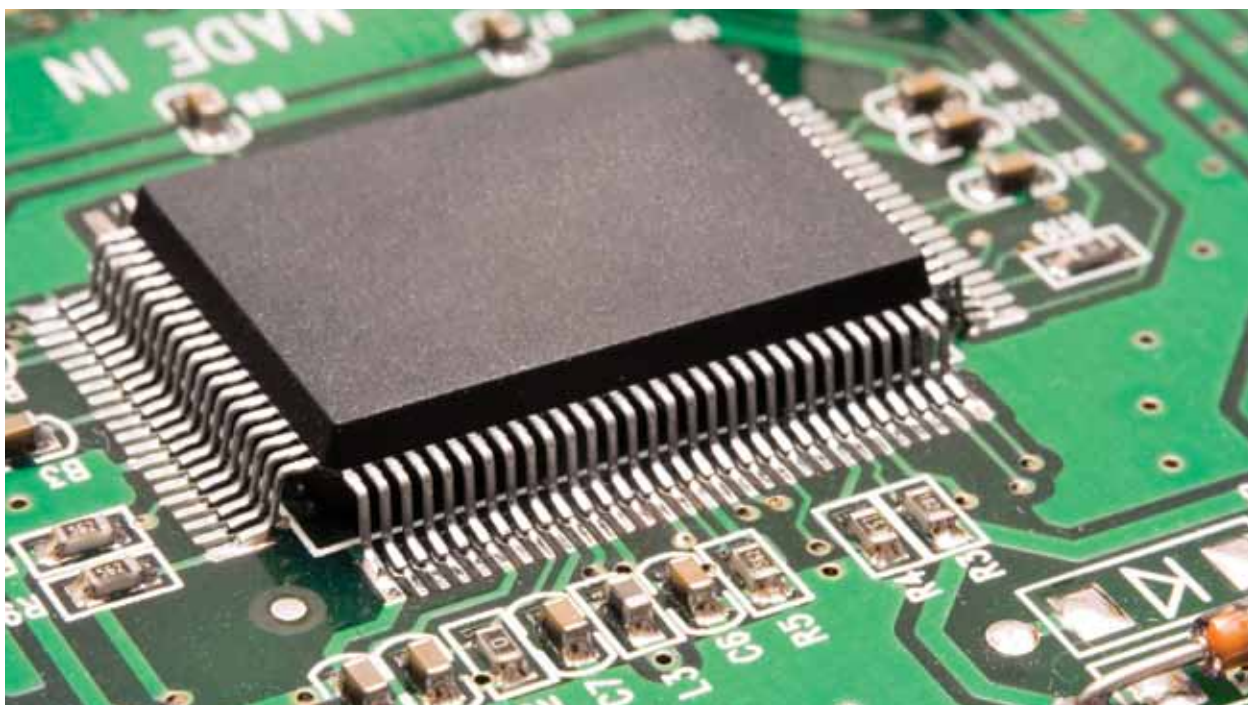
PRODUCTION OF GREEN GOODS & SERVICES

PRODUCTION USING GREEN MANUFACTURING PROCESSES

TARGET OCCUPATIONS

The analysis in the section that follows will be focused on the Target Occupations (does not include the all occupations in this industry) within Green Manufacturing that were identified by creating a custom industry staffing pattern for this industry cluster in Missouri. This was then sorted by each occupation’s impact on the economy and then mapped against the US DOL’s In Demand occupation list for Green Manufacturing. The Target Occupations for this sector are:

| D*NET SOC Code | Title |
|-----------------------|--|
| 49-3023 | Automotive Speciality Technicians |
| 17-2071 | Electrical Engineers |
| 17-3029 | Electrical, Electromechanical, Electronics, Manufacturing Engineering, Manufacturing Production, Mechanical Engineering and Industrial Engineering Technologists Including Nanotechnology, Photonics and Fuel Cell Technicians |
| 17-2072 | Electronics Engineers, Except Computer |
| 11-9041 | Engineering Managers and Biofuels/Biodiesel Technology & Product Development |
| 49-9041 | Industrial Machinery Mechanics |
| 49-9042 | Maintenance and Repair Workers, General |
| 17-2141 | Mechanical, Automotive and Fuel Cell Engineers |



TIER 6—Occupation-Specific Knowledge Areas

| | |
|---|--|
| <p>AUTOMOTIVE SPECIALTY TECHNICIANS</p> <ul style="list-style-type: none"> ⇒ Mechanical ⇒ Customer and Personal Service ⇒ Engineering and Technology ⇒ Administration and Management ⇒ Sales and Marketing ⇒ Computers and Electronics ⇒ Education and Training ⇒ Mathematics | <p>ELECTRICAL ENGINEERS</p> <ul style="list-style-type: none"> ⇒ Engineering and Technology ⇒ Design ⇒ Computers and Electronics ⇒ Mathematics ⇒ Physics ⇒ English Language ⇒ Mechanical ⇒ Administration and Management ⇒ Public Safety and Security |
| <p>ELECTRICAL, ELECTROMECHANICAL, ELECTRONICS, MANUFACTURING ENGINEERING, MANUFACTURING PRODUCTION, MECHANICAL ENGINEERING AND INDUSTRIAL ENGINEERING TECHNOLOGISTS INCLUDING NANOTECHONOLOGY, PHOTONICS AND FUEL CELL TECHNICIANS</p> <ul style="list-style-type: none"> ⇒ Mechanical ⇒ Productions and Processing ⇒ Engineering and Technology ⇒ Mathematics ⇒ Design ⇒ Computer and Electronics ⇒ English Language | <p>ELECTRONICS ENGINEERS, EXCEPT COMPUTER</p> <ul style="list-style-type: none"> ⇒ Engineering and Technology ⇒ Design ⇒ Computers and Electronics ⇒ Mathematics ⇒ English Language ⇒ Production and Processing ⇒ Physics ⇒ Administration and Management ⇒ Mechanical |
| <p>ENGINEERING MANAGERS AND BIOFUELS/BIODIESEL TECHNOLOGY & PRODUCT DEVELOPMENT</p> <ul style="list-style-type: none"> ⇒ Engineering and Technology ⇒ Design ⇒ English Language ⇒ Mathematics ⇒ Computers and Electronics ⇒ Administration and Management ⇒ Physics . ⇒ Customer and Personal Service ⇒ Production and Processing ⇒ Personnel and Human Resources | <p>INDUSTRIAL MACHINERY MECHANICS</p> <ul style="list-style-type: none"> ⇒ Mechanical ⇒ Mathematics ⇒ Engineering and Technology ⇒ Design ⇒ English Language ⇒ Production and Processing ⇒ Building and Construction |
| <p>MAINTENANCE AND REPAIR WORKERS, GENERAL</p> <ul style="list-style-type: none"> ⇒ Mechanical ⇒ Building and Construction ⇒ Public Safety and Security ⇒ Design ⇒ Engineering and Technology ⇒ English Language ⇒ Mathematics ⇒ Education and Training | <p>MECHANICAL, AUTOMOTIVE & FUEL CELL ENGINEERS</p> <ul style="list-style-type: none"> ⇒ Engineering and Technology ⇒ Design ⇒ Mechanical ⇒ Mathematics ⇒ Physics ⇒ Production and Processing ⇒ Computer and Electronics ⇒ English Language ⇒ Customer and Personal Service ⇒ Administration and Management |

TIER 7—Occupation-Specific Technical Competencies

AUTOMOTIVE SPECIALTY TECHNICIANS

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|---|--|
| <ul style="list-style-type: none"> ⇒ Pneumatic vacuum equipment — Brake bleeders; Hydraulic bleed tools; Pneumatic fluid evacuators; Pressure brake bleeders ⇒ Pressure indicators — Diesel modulator shift testers; Engine oil pressure testers; Manifold gauge sets; Tire pressure gauges ⇒ Pullers — Gear pullers; Hand pullers; Power pullers; Slide hammers ⇒ Specialty wrenches — Filter wrenches; Lug wrenches; Oil filter wrenches; Ratcheting gear wrenches ⇒ Voltage or current meters — Alternator testers; In-line ignition spark testers; Spark plug testers; Voltmeters | <ul style="list-style-type: none"> ⇒ Accounting software — ARSIS Automotive Repair Shop Invoice System software ⇒ Analytical or scientific software — Hunter WinAlign; Nexiq Tech HDS Suite for Palm ⇒ Data base reporting software — Genisys Fast Fixes; Pathfinder software; Tech manual database software ⇒ Facilities management software — Alliance Automotive Shop Controller; Mitchell OnDemand5 Manager; Scott Systems MaxxTraxx Pro; Snap-On ShoKey ⇒ Project management software — Estimating software |

ELECTRICAL ENGINEERS

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|---|--|
| <ul style="list-style-type: none"> ⇒ Laboratory evaporators — Electron beam evaporators; Filament evaporators; Metal evaporation systems; Vacuum system/thermal evaporators ⇒ Semiconductor process systems — Spin-coaters; Wafer steppers; Wet chemical clean benches; Wire bonders ⇒ Signal generators — Programmable function generators; Synthesized continuous wave CW generators; Vector signal generators ⇒ Spectrometers — Auger electron spectrometers; Electrochemical CV dopant profilers; Photoluminescence spectrometers; X ray photoemission spectrometers ⇒ Tube furnaces — Doping tubes; Oxidation tubes; Vertical furnaces | <ul style="list-style-type: none"> ⇒ Analytical or scientific software — Finite element method FEM software; Synopsys PrimeTime; Tektronix EZ-TEST; The Mathworks MATLAB ⇒ Computer aided design CAD software — Autodesk AutoCAD software; Cadence Encounter Test; Mento Graphics software; OrCAD Capture ⇒ Development environment software — C; Microsoft Visual Basic; Programmed logic controller PLC code generation software; VHSIC hardware description language VHDL ⇒ Object or component oriented development software — C++; JHDL; Practical extraction and reporting language Perl; Python ⇒ Program testing software — Debugging software; Defect tracking software |

ELECTRICAL, ELECTROMECHANICAL, ELECTRONICS, MANUFACTURING ENGINEERING, MANUFACTURING PRODUCTION, MECHANICAL ENGINEERING AND INDUSTRIAL ENGINEERING TECHNOLOGISTS INCLUDING NANOTECHONOLGY, PHOTONICS AND FUEL CELL TECHNICIANS

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|---|---|
| <ul style="list-style-type: none"> ⇒ Calipers — Dial calipers; Digital calipers; Vernier calipers ⇒ Gage block set — Gauge blocks; V blocks ⇒ Gauges or inspection fixtures — Angle plates; Dial indicators; Pin gauges ⇒ Integrated circuit testers — Digital logic analyzers; Digital logic probes ⇒ Screwdrivers — Phillips head screwdrivers; Straight screwdrivers | <ul style="list-style-type: none"> ⇒ Analytical or scientific software — Cadence PSpice; Minitab software; National Instruments Multisim ⇒ Enterprise resource planning ERP software — Plant maintenance software; SAP software ⇒ Label making software — Labeling software ⇒ Office suite software — Microsoft Office software ⇒ Word processing software — Microsoft Word |



TIER 7—Occupation-Specific Technical Competencies

ELECTRONICS ENGINEERS, EXCEPT COMPUTER

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|--|--|
| <ul style="list-style-type: none"> ⇒ Counters — Electronics counters ⇒ Electrical inductance sensors — Inductance capacitance resistance LCR meters ⇒ Electronic measuring probes — Electronics probes ⇒ Microcontrollers — Programmable logic controllers PLC ⇒ Microprocessors | <ul style="list-style-type: none"> ⇒ Analytical or scientific software — Ansoft Simplorer; Cadence PSpice; Synopsys Saber; The Mathworks MATLAB ⇒ Computer aided design CAD software — Autodesk AutoCAD software; OrCAD Capture; SolidWorks CAD software; Xilinx Integrated Software Environment ISE ⇒ Development environment software — C; National Instruments LabVIEW; Very high-speed integrated circuit VHSIC hardware description language VHDL; Visual Numerics PV-WAVE ⇒ Object or component oriented development software — C++; Microsoft Visual Basic.NET; Microsoft Visual C# .NET ⇒ Operating system software — Hewlett-Packard HP OpenVMS; Real time operating system RTOS software |

ENGINEERING MANAGERS AND BIOFUELS/BIODIESEL TECHNOLOGY & PRODUCT DEVELOPMENT

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|---|---|
| <ul style="list-style-type: none"> ⇒ Desktop computers ⇒ Graphics tablets — Drawing tablets ⇒ Notebook computers ⇒ Personal digital assistant PDAs or organizers — Personal digital assistants PDA ⇒ Tablet computers | <ul style="list-style-type: none"> ⇒ Analytical or scientific software — HEC RAS *; HEC-1 *; SPSS software; Water surface pressure gradient WSPG software ⇒ Computer aided design CAD software — Autodesk AutoCAD software; Hewlett-Packard HP SolidDesigner; Pro-E CAD software; SolidWorks CAD software ⇒ Enterprise resource planning ERP software — Made2Manage software; Microsoft Dynamics NAV ⇒ Project management software — Autodesk Buzzsaw; Microsoft Project; Primavera Systems software; The Gordian Group PROGEN Online ⇒ Word processing software — Microsoft Word |

INDUSTRIAL MACHINERY MECHANICS

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|--|---|
| <ul style="list-style-type: none"> ⇒ Hoists — Chain falls; Chain hoists ⇒ Lathes — Engine lathes; Turning lathes ⇒ Power grinders — Cylindrical grinders; Grinding wheels; Precision grinders ⇒ Welders — Arc welders; Electric welding equipment; Spot welders ⇒ Workshop presses — Drill presses; Hydraulic squeezers; Punch presses | <ul style="list-style-type: none"> ⇒ Computer aided design CAD software ⇒ Computer aided manufacturing CAM software — Extranet Machine Tools Suite ⇒ Data base user interface and query software — Maintenance planning and control software ⇒ Industrial control software — BIT Corp ProMACS PLC; KEYENCE PLC Ladder Logic ⇒ Word processing software — Microsoft Word |

TIER 7—Occupation-Specific Technical Competencies

MAINTENANCE AND REPAIR WORKERS, GENERAL

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|--|---|
| <ul style="list-style-type: none"> ⇒ Drain or pipe cleaning equipment — Drain augers; Drain cleaning cables; Hand spinners; Power drain cleaners ⇒ Pipe or tube cutters — Copper cutting machines; Ratcheting polyvinyl chloride PVC cutters; Soil pipe cutters; Tubing cutters ⇒ Power drills — Cordless power drills; Direct tap machines; Hand drills; Right-angle drills ⇒ Power saws — Circular saws; Radial arm saws; Reciprocating saws; Tile saws ⇒ Pullers — Bearing pullers; Chain pullers; Comealongs; Tub drain removers | <ul style="list-style-type: none"> ⇒ Calendar and scheduling software — Computerized time management systems ⇒ Facilities management software — Computerized maintenance management system CMMS software ⇒ Industrial control software — Digital Direct Control DDC Energy Management software ⇒ Spreadsheet software — Microsoft Excel ⇒ Word processing software — Microsoft Word |

MECHANICAL, AUTOMOTIVE AND FUEL CELL ENGINEERS

| TOOLS USED IN THIS OCCUPATION | TECHNOLOGY USED IN THIS OCCUPATION |
|---|--|
| <ul style="list-style-type: none"> ⇒ Cold forming presses — Fused deposition modeling machines; Rapid thermal processing systems ⇒ Flowmeters — Digital particle image velocimeters; Laser Doppler anemometers; Laser Doppler velocimeters LDV; Pitot tubes ⇒ Interferometers — Interferometric microscopes; Spectrum analyzers ⇒ Machine mounts or vibration isolators — Vibration control systems; Vibration isolators ⇒ Semiconductor process systems — Spin-coaters; Wafer bonding systems; Wafer dicing saws; Wire bonders | <ul style="list-style-type: none"> ⇒ Analytical or scientific software — ANSYS software; Sigmatrix CETOL 6 Sigma; Statistical energy analysis SEA software; The Mathworks MATLAB ⇒ Computer aided design CAD software — Autodesk AutoCAD software; SolidWorks CAD software; UGS I-DEAS; Zeemax software ⇒ Development environment software — Ladder Logic; Microsoft Visual Basic; National Instruments LabVIEW; Rockwell Software ⇒ Industrial control software — Computer numerical control CNC software; Human machine interface HMI software ⇒ Object or component oriented development software — C++; G-code |



TIER 8—Occupation Specific Requirements

| SOC CODE | OCCUPATION | CIP CODE | CIP TITLE |
|----------|----------------------------------|----------|--|
| 49-3023 | Automotive Specialty Technicians | 15.0803 | Automotive Engineering Technology/Technician |
| | | 47.0612 | Vehicle Emissions Inspection & Maintenance Technology/Technician |
| | | 47.0614 | Alternative Fuel Vehicle Technology/Technician |
| 17-2071 | Electrical Engineers | 14.1001 | Electrical, Electronics and Communications Engineering |

TIER 8—Occupation Specific Requirements

| SOC CODE | OCCUPATION | CIP CODE | CIP TITLE |
|----------|---|----------|--|
| 17-3029 | Electrical, Electromechanical, Electronics, Manufacturing Engineering, Manufacturing Production, Mechanical Engineering and Industrial Engineering Technologists Including Nanotechnology, Photonics and Fuel Cell Technicians | 15.0101 | Architectural Engineering Technology/Technician |
| | | 15.0304 | Laser and Optical Technology/Technician |
| | | 15.0503 | Energy Management and Systems Technology/Technician |
| | | 15.0505 | Solar Energy Technology/Technician |
| | | 15.0599 | Environmental Control Technologies/Technicians, Other |
| | | 15.0607 | Plastics Engineering Technology/Technician |
| | | 15.0611 | Metallurgical Technology/Technician |
| | | 15.0901 | Mining Technology/Technician |
| | | 15.0999 | Mining and Petroleum Technologies/Technicians, Other |
| | | 15.1103 | Hydraulics and Fluid Power Technology/Technician |
| | | 15.9999 | Engineering Technologies/Technicians, Other |
| | | 15.0702 | Quality Control Technology/Technician |
| | | 15.0703 | Industrial Safety Technology/Technician |
| | | 41.0204 | Industrial Radiologic Technology/Technician |
| | | 15.0303 | Electrical, Electronic & Comm. Engineering Tech |
| | | 15.0403 | Electromechanical Tech./Electromechanical Engineering |
| | | 15.0612 | Industrial Technology/Technician. |
| | | 15.0613 | Manufacturing Technology/Technician. |
| | | 15.0805 | Mech. Engineering/Mech. Technology/Technician |
| | | 15.0304 | Laser and Optical Technology/Technician |
| 15.0613 | Manufacturing Technology/Technician | | |
| 14.1901 | Mechanical Engineering | | |
| 15.9999 | Engineering Technologies/Technicians, Other | | |
| 17-2072 | Electronics Engineers, Except Computer | 14.1001 | Electrical, Electronics and Communications Engineering |
| 11-9041 | Engineering Managers and Biofuels/Biodiesel Technology & Product Development <i>(continued on next page)</i> | 03.0104 | Environmental Science |
| | | 04.0301 | City/Urban, Community and Regional Planning |
| | | 04.0401 | Environmental Design/Architecture |
| | | 04.0501 | Interior Architecture |
| | | 04.0601 | Landscape Architecture (BS, BSLA, BLA, MSLA, MLA, PhD) |
| | | 14.0101 | Engineering, General |
| | | 14.0201 | Aerospace, Aeronautical and Astronautical Engineering |
| | | 14.0301 | Agricultural/Biological Engineering and Bioengineering |
| | | 14.0401 | Architectural Engineering |
| | | 14.0501 | Biomedical/Medical Engineering |
| | | 14.0601 | Ceramic Sciences and Engineering |
| | | 14.0701 | Chemical Engineering |
| | | 14.0801 | Civil Engineering, General |
| | | 14.0802 | Geotechnical Engineering |
| | | 14.0803 | Structural Engineering |
| | | 14.0804 | Transportation and Highway Engineering |
| | | 14.0805 | Water Resources Engineering |
| | | 14.0899 | Civil Engineering, Other |
| | | 14.0901 | Computer Engineering, General |
| | | 14.0902 | Computer Hardware Engineering |

TIER 8—Occupation Specific Requirements

| SOC CODE | OCCUPATION | CIP CODE | CIP TITLE |
|----------|---|----------|--|
| 11-9041 | Engineering Managers and Biofuels/Biodiesel Technology & Product Development <i>(continued from previous page)</i> | 14.0903 | Computer Software Engineering |
| | | 14.0999 | Computer Engineering, Other |
| | | 14.1001 | Electrical, Electronics and Communications Engineering |
| | | 14.1101 | Engineering Mechanics |
| | | 14.1201 | Engineering Physics |
| | | 14.1301 | Engineering Science |
| | | 14.1401 | Environmental/Environmental Health Engineering |
| | | 14.1801 | Materials Engineering |
| | | 14.1901 | Mechanical Engineering |
| | | 14.2001 | Metallurgical Engineering |
| | | 14.2101 | Mining and Mineral Engineering |
| | | 14.2201 | Naval Architecture and Marine Engineering |
| | | 14.2301 | Nuclear Engineering |
| | | 14.2401 | Ocean Engineering |
| | | 14.2501 | Petroleum Engineering |
| | | 14.2701 | Systems Engineering |
| | | 14.2801 | Textile Sciences and Engineering |
| | | 14.3101 | Materials Science |
| | | 14.3201 | Polymer/Plastics Engineering |
| | | 14.3301 | Construction Engineering |
| 14.3401 | Forest Engineering | | |
| 14.3501 | Industrial Engineering | | |
| 14.3601 | Manufacturing Engineering | | |
| 14.3801 | Surveying Engineering | | |
| 14.3901 | Geological/Geophysical Engineering | | |
| 14.9999 | Engineering, Other | | |
| 26.1201 | Biotechnology | | |
| 49-9041 | Industrial Machinery Mechanics | 47.0303 | Industrial Mechanics and Maintenance Technology |
| | | 47.0399 | Heavy/Industrial Equipment Maintenance Technologies, Other |
| 49-9042 | Maintenance and Repair Workers, General | 46.0412 | Building/Construction Site Management |
| 17-2141 | Mechanical, Automotive and Fuel Cell Engineers | 14.1901 | Mechanical Engineering |

TIER 9—Management Competencies

- | | |
|----------------------|---------------------------------------|
| ⇒ Manpower Planning | ⇒ Developing & Monitoring |
| ⇒ Delegating | ⇒ Preparing and Managing Budgets |
| ⇒ Managing Work Flow | ⇒ Team Building |
| ⇒ Entrepreneurship | ⇒ Developing an Organizational Vision |
| ⇒ Leadership | ⇒ Managing Resources |



Department of Economic Development

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