



**PROGRAM NAME**

The Missoula College RevUp Energy Technology Program consists of three Certificate of Technical Skills programs: Electrician Helper; Energy Auditor/Commissioning Agent; and Recycling Technology

**DEVELOPING COLLEGE**

Missoula College

**CREDENTIAL/TOTAL CREDIT HOURS**

Each program requires a different number of credit hours for the Certificate of Technical Skills:

- Electrician Helper – 17 Credits
- Energy Auditor/Commissioning Agent – 19 Credits
- Recycling Technology – 16 Credits

**OVERVIEW AND PURPOSE**

The Electrician Helper CTS allows students to enter the workforce as an electrician’s helper and/or to enter into an apprenticeship.

The Energy Auditor/Commissioning Agent CTS provides students with knowledge to perform the duties of an energy auditor or assist with building commissioning, or to enter into an electrician apprenticeship. Program graduates work in electricity distribution and wind and solar energy fields.

The Recycling Technology CTS provides students with knowledge and skills to enter into the growing recycling and reclamation industries. Moving recyclables from waste bins to manufacturers requires a variety of skilled workers.

**CURRICULUM**

**Electrician Helper Courses**

- DC Circuit Analysis
- AC Circuit Analysis
- NCCER Electrician Level 1 & NCCER Core
- Safety/Rigging + OSHA 30
- Technical Math



# Curriculum Development

## ENERGY TECHNOLOGY PROGRAM OVERVIEW



### Energy Auditor/Commissioning Agent Courses

- College Algebra
- Intro to Business
- Intro to Sustainable Energy
- Power Systems Technology
- Building Energy Efficiency (HERS)
- Energy Practicum

### Recycling Technology Courses

- Issues in Sustainability
- Project Management
- Intro to Sustainable Energy II
- Recycling Technology (ANSI)
- Alternative Fuels

### ENTRANCE REQUIREMENTS

There are no program level entrance requirements. Some courses may have prerequisites.

### COMPLETION REQUIREMENTS

Students must earn a grade of "C-" (70%; 2.0 GPA) or better in all required courses.

### PROGRAM DESIGN REFERENCES AND SOURCES

#### Industry DACUMs

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#### Technical Advisory Committees

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#### Other organizations

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### COURSE-LEVEL LEARNING OUTCOMES: Electrician Helper

#### DC Circuit Analysis

1. Use scientific notation to represent numeric values.





2. Use metric notation to represent measured and calculated electrical values.
3. Describe the characteristics of electrical current flow.
4. Identify the value of passive components by color code and other markings.
5. Use Ohm's law and Watt's law to calculate values of voltage, current, resistance, and power in an electrical circuit.
6. Describe the characteristics of resistors and resistor applications.
7. Identify and design series, parallel, and series-parallel electrical circuits.
8. Use circuit theorems and conversions in circuit design and analysis.
9. Describe the principles of magnetism and electromagnetism. (Start in DC and continue in AC.)

### **AC Circuit Analysis**

1. Describe the principles of magnetism and electromagnetism.
2. Describe the characteristics of capacitors and inductors, and identify and design capacitor and inductor circuits.
3. Describe the characteristics of transformers, and identify and design transformer circuits.
4. Describe the characteristics of simple passive filters, and identify and design simple passive filter circuits.
5. Be prepared to proceed to the hands-on EET113 lab course.

### **NCCER Electrician Level 1 & NCCER Core**

- 1.

### **Safety/Rigging + OSHA 30**

1. Complete the requirements for an OSHA 30 certification.
2. Recognize the four fatal hazards.
3. Demonstrate the ability to perform CPR, proper application of AED, and perform basic first aid.
4. Demonstrate the ability to properly construct and use a scaffold system.
5. Identify the equipment needed and properly perform the task of shifting heavy loads using winches, cranes, and other similar equipment.
6. Demonstrate the ability to safely secure loads for transport.
7. Demonstrate the ability to properly use fall restraint gear.
8. Safely ascend a ladder with properly donned fall restraint and arrest equipment.
9. Demonstrate the ability to recognize and avoid electrical hazards
10. Demonstrate the ability to recognize and avoid potential hazards in the workplace.
11. Recognize hazardous materials and know how to use Safety Data Sheets (SDS).
12. Recognize and minimize the hazards of confined spaces.

### **Technical Mathematics**

1. Utilize and apply mathematical operations, measurement (English and Metric Systems), introductory geometric principles and applied algebra into technical applications in academic and workplace situations
2. Read, interpret, and produce solutions to applications at the introductory technical mathematics level



3. Apply ratio and proportion concepts to introductory technical mathematics situations
4. Apply appropriate technology in a mathematical situation
5. Determine the validity of results and data
6. Solve any component of a right triangle with any two components given

**COURSE-LEVEL LEARNING OUTCOMES: Energy Auditor/Commissioning Agent**

**College Algebra**

1. Use factoring to solve, find zeros or x-intercepts of polynomial functions.
2. Solve linear, quadratic, exponential and logarithmic equations and use them to solve applied problems.
3. Use function notation; identify domain, range, and intervals of increasing/decreasing/constant values.
4. Find zeros, asymptotes, and domain of rational functions.
5. Evaluate and sketch graphs of piecewise functions and find their domain and range.
6. Use algebra to combine functions and form composite functions, evaluate both combined and composite functions and determine their domains.
7. Identify one-to-one functions, find and verify inverse functions, and sketch their graphs.
8. Graph linear, polynomial, radical, rational, exponential and logarithmic functions.

**Intro to Business**

1. Analyze economic systems including capitalism, socialism, and communism and compare development of economic systems; how businesses operate within those systems; and the impact on business, society, and the individual.
2. Demonstrate understanding of the profound technological and economic changes over the past 100 years particularly in the areas of globalization and international business and the impact on work and social structure.
3. Discuss and create solutions to case studies relative to management, motivation, and leadership theories.
4. Identify the processes used to accomplish organizational goals through planning, organizing, leading, and controlling people and other organizational resources.
5. Differentiate among Theories X, Y, and Z; Taylor's Scientific Management Theory; Hawthorne Theory; Herzberg Theory; and Expectancy, Reinforcement, and Equity Theories to explore the relationships between businesses and their stakeholders.
6. Explore changes in social demographics, demographic trends, and their effects on businesses.
7. Apply concepts of social responsibility in relation to business ethics, environmental concerns, and equal opportunity in employment.
8. Analyze concepts of business financial control including accounting, banking, management, budgets, and investments.
9. Analyze marketing concepts including product, pricing, promotion, wholesaling, retailing, and distribution.





10. Problem-solve and formulate appropriate business responses to a variety of social issues such as multi-cultural/diverse populations, globalization, social responsibility, ethics, and environmental sustainability.
11. Produce projects which require research, data compilation, data interpretation, and evaluation.
12. Integrate into projects the concepts of price-market mechanisms, stock markets, unions, marketing, entrepreneurial ventures, forecasts, trends, and financial institutions as they impact business and society.

### **Intro to Sustainable Energy**

1. Understand the importance of energy in our current technological society;
2. Understand the physical and technical aspects of energy and energy supply/demand systems;
3. Identify the technologies, their key elements and basic principles, that we use to capture, convert, store, and distribute energy;
4. Identify factors that contribute to the economic viability of energy generation, and evaluate the efficacy of conservation and efficiency measures;
5. Discuss the problem of sustainability in the context of energy and identify technical and social barriers and solutions to energy use;
6. Assess the costs and benefits associated with different energy sources and technologies;
7. Perform basic energy-related calculations;
8. Undertake first-order economic analyses of an energy project, taking into account the effect of such factors as discount rates and project lifetimes;
9. Develop a strong practical and theoretical knowledge of the full suite of conventional energy systems and apply that knowledge to real world situations.

### **Power Systems Technology**

1. Understand the importance of safety in electrical systems.
2. Describe the operation of transformers.
3. Compute of transformer primary and secondary electrical quantities.
4. Describe the operation of three-phase power.
5. Compute wye-connected and delta-connected electrical quantities.
6. Describe the operation of single-phase and three-phase AC motors.
7. Compute starting torque and starting current of AC motors from locked rotor tests.
8. Describe the operation of three-phase alternators, and compute voltage regulation under load.
9. Describe the operation of DC motors and generators.
10. Describe the compare and contrast the operation of motors, alternators, and generators
11. Describe the types and fundamentals of AC motor control, DC motor control, and solid-state motor control.
12. Implement previous learning by applying math skills, writing skills, teamwork skills, and research techniques.



**Building Energy Efficiency (HERS)**

1. Understand and apply fundamental concepts of energy and utilities as related to the built environment: Heat Transfer, Fluid Mechanics, Moisture Control, Ventilation and Indoor Environmental Quality (IEQ) Control, Energy Efficiency
2. Communicate the potential of building energy efficiency to impact the nation's energy future, especially as it applies to climate change.
3. Describe the objectives and general framework of building energy efficiency standards such as the ENERGY STAR for Homes Program.
4. Become familiar with Passivhaus standards.
5. Describe the objectives and procedures of energy and IEQ focused rating systems such as the Home Energy Rating System.
6. Feel prepared to take the BPI Infiltration and Duct Leakage (IDL) Certification exam, with some additional self-directed preparation as needed.
7. Perform basic heat transfer and load calculations as they relate to the built environment.
8. Describe building tightness testing procedures using a blower door.
9. Describe duct tightness testing procedures using a duct blaster or other industry standard means.
10. Identify mechanical ventilation issues and improvement opportunities in buildings.
11. Gain hands-on experience with HVAC controls and maintenance.
12. Communicate the energy implications of various HVAC and water heating systems.
13. Identify the objectives and challenges in designing and building highly efficient or zero energy buildings.
14. Explain the approaches of the two primary national residential green building programs (LEED for

**Energy Practicum**

1. Complete an individual or group project designed to advance climate change mitigation and/or adaptation,
2. Integrate and apply information and techniques learned in Energy Technology Program,
3. Gain hands-on experience working on real-world climate challenges using various technological approaches,
4. Acquire a practical understanding of the opportunities and challenges related to climate change solutions,
5. Build partnerships with Climate Change Studies students to advance projects and learn valuable skills in collaboration,
6. Practice communicating their knowledge and experience through a written report and oral presentation.

**COURSE-LEVEL LEARNING OUTCOMES: Recycling Technology**

**Issues in Sustainability**

1. Define sustainability; identify facets of conventional vs. natural capitalism
2. Delineate natural cycles and ecosystem services and discuss human impact on environment





3. Using metrics to calculate Ecological Footprint and carbon footprint; identify ways to mitigate impact
4. Identify key issues surrounding climate change and discuss adaptation vs. abatement policies
5. Identify characteristics of sustainable corporations and critically examine alignment of sustainability and economic development objectives; examine biomimicry as an innovative method of adapting nature's best ideas for human use
6. Outline principles of triple bottom line [3E] and the Natural Step framework
7. Identify objectives and key indicators of corporate social responsibility
8. Discuss social responsibility investing
9. Identify trends shaping global markets; discuss product/process design considerations in a sustainable environment
10. Articulate how the trend towards business sustainability is impacting markets, management and product innovation
11. Critically analyze sustainability as a social vision and enumerate/discuss facets of a sustainable lifestyle

#### **Project Management**

1. Define a project and the role of a project manager.
2. Describe and develop the skills and knowledge required of a Project Manager.
3. Consider stakeholders, organizational culture and framework relationships to successful project completion.
4. Describe the process of selecting a project.
5. Develop a plan to execute a project.
6. Understand the importance of effective project management communications and scheduling.
7. Understand aspects of managing project scope, time, budgets, quality and human resources.
8. Use MS Project software in a project management context.
9. Assess, identify and manage risks associated with a project.
10. Understand aspects of successful project completion.

#### **Intro to Sustainable Energy II**

1. Quantify the rate of global and regional human metabolic and technological energy consumption;
2. Put the current rate of consumption into context with historical and prehistoric consumption rates;
3. Evaluate the physical and technical aspects of renewable energy and energy supply/demand systems;
4. Identify the technologies, their key elements and basic principles, that we use to capture, convert, store, distribute energy;
5. Identify factors that contribute to the economic viability of energy generation from renewable sources, and evaluate the efficacy of conservation and efficiency measures;
6. Discuss the problem of sustainability in the context of renewable energy and identify technical and social barriers and solutions to the use of renewable energy sources;



7. Assess the costs and benefits associated with different renewable energy sources and technologies;
8. Perform fundamental energy-related calculations such as those involving the laws of thermodynamics and energy conversion efficiencies;
9. Undertake elementary economic analyses of a renewable energy project, taking into account the effect of such factors as discount rates and project lifetimes;
10. Develop a practical and theoretical knowledge of the full suite of renewable energy systems and apply that knowledge to real world situations.

**Recycling Technology (ANSI)**

1. Communicate the potential of recycling technology to impact the nation's energy future, especially as it applies to climate change.
2. Describe the objectives and general framework of the ANSI and or IREC standards for recycling.
3. Become familiar with basic triage methods for post-consumer waste.
4. Gain hands-on experience with industrial scale materials processing equipment.
5. Work at the community scale to understand barriers to responsible waste management.
6. Explain the energy and financial economics of recycling technology.

**Alternative Fuels**

1. Broad comprehension of alternative transportation fuels and their production technologies.
2. Advantages and disadvantages associated with each fuel.
3. Field experience of a commercial alternative fuel facility.
4. Environmental assessment of alternative fuels.
5. Economic considerations of alternative fuels.