Ohio CTE: Agricultural and Environmental Systems

Energy

Energy Sources: Identify energy sources according to their economic viability, sustainability, and environmental impact. 9.1

1. **Identify, compare, and contrast fossil fuel sources (e.g., oil, natural gas, and coal) and the technology used to generate energy.** 9.1.1
2. **Identify, compare, and contrast renewable energy sources and the technology used to generate energy.** 9.1.2
3. **Identify, compare, and contrast alternative and emerging energy sources and technology used to generate energy (e.g., fuel cells, hydrogen, nuclear).** 9.1.3
4. **Identify the social, economic, and environmental drivers and barriers that influence the development and use of energy sources.** 9.1.4
5. **Identify and describe energy density properties of different types of fuel sources according to industry standards.** 9.1.5
6. **Trace the transformations of energy within a system (e.g., mechanical to electrical, chemical to mechanical).** 9.1.6
7. **Identify and describe best management practices (e.g., carbon sequestration, conservation, animal safety, efficiency) that lessen environmental impact.** 9.1.7
8. **Calculate the theoretical available energy given specific wind and solar conditions and derate actual power versus theoretical power.** 9.1.8
9. **Calculate and determine the total solar resource factor for the array.** 9.1.9
10. **Identify and describe the various stages involved and utilized within a charge controller.** 9.1.10

Crude Oil and Natural Gas: Describe the processes for exploring, drilling, producing, transporting, refining, and marketing products of crude oil and natural gas. 9.2

1. **Describe the role of geology in the formation, migration, and trapping of crude oil and natural gas.** 9.2.1
2. **Assess how crude oil and natural gas wells are placed, designed, and installed.** 9.2.2
3. **Identify and explain the processes associated with drilling (e.g., rig types, blowout prevention, drilling fluids, casing, cementing).** 9.2.3
4. **Evaluate different environmental and safety procedures for the storage, containment, transporting, recycling, processing, and disposing of drilling liquids (e.g., drilling fluids, brine, flow-back).** 9.2.4

	5 Identify and apply the appropriate permits and governance associated with crude oil and natural gas production. 9.2.5
	6 Identify the different processes for producing, treating, transporting, processing crude oil, and natural gas byproducts. 9.2.6
	7 Identify and describe equipment used in the extraction and processing of crude oil and natural gas for up, mid, and down streams process. 9.2.7
	8 Identify the products and byproducts of crude oil and natural gas. 9.2.8
Biomass: Describe and manage processes required to extract energy from biomass. 9.3	1 Identify applications for biomass energy production. 9.3.1
	2 Describe the thermal, chemical, and biochemical methods of converting biomass into energy. 9.3.2
	3 Identify feedstock materials used to produce biofuels and compare the energy potential of each material. 9.3.3
	4 Identify and differentiate the aerobic and anaerobic digestion of biomass. 9.3.4
	5 Test source materials and final products and compare the results to industry standards. 9.3.5
	6 Process source materials for energy conversion. 9.3.6
	7 Identify and describe technical standards and governance for placing agricultural, commercial, and industrial biomass operations. 9.3.7
	8 Identify the byproducts generated in the production of biofuels and their use and disposal according to industry standards. 9.3.8
	9 Identify and describe storage and distribution systems for biofuels. 9.3.9
Solar Energy: Plan, install, and maintain a solar array that can collect, store, and distribute solar energy. 9.4	1 Identify the different types of solar energy devices (e.g., photovoltaic [PV], solar thermal, concentrating solar power [CSP]) and how they produce energy. 9.4.1
	2 Conduct a site evaluation to identify an appropriate solar panel installation. 9.4.2
	3 Select the appropriate solar energy application for commercial and residential use. 9.4.3
	4 Identify the basic design and components of a solar installation. 9.4.4
	5 Identify and describe technical standards and governance for a residential, community, utility solar energy installation. 9.4.5
	6 Review and interpret an electric schematic and site plan for a solar energy installation. 9.4.6

	7 **Install, test, and maintain a solar energy installation.** 9.4.7
	8 **Identify and describe project decommissioning recycling and disposal methods for a solar energy installation.** 9.4.8
Wind Energy: Plan and maintain a wind energy installation that captures, stores, and distributes electrical energy. 9.5	1 **Describe the internal and external components of wind energy technologies and installations.** 9.5.1
	2 **Conduct a site evaluation to identify an appropriate wind turbine installation.** 9.5.2
	3 **Identify and describe technical standards and governance for wind energy technologies and installations.** 9.5.3
	4 **Identify, describe, and differentiate wind technologies used for wind energy production.** 9.5.4
	5 **Select and design an appropriate wind energy installation for commercial and residential applications.** 9.5.5
	6 **Review and interpret an electric schematic and site plan for a wind energy installation.** 9.5.6
	7 **Install, test, and maintain components of a wind energy installation.** 9.5.7
	8 **Identify and describe project decommissioning recycling and disposal methods for a wind energy installation.** 9.5.8
	9 **Understand and describe aerodynamics and how it affects the operation of a wind turbine (e.g. Bernoulli's Principle).** 9.5.9
	10 **Differentiate between synchronous asynchronous, fixed speed, and variable speed generators.** 9.5.10
	11 **Identify, describe, and differentiate various wind turbine configurations (e.g., vertical axis wind turbine, horizontal axis wind turbine, number of blades).** 9.5.11
	12 **Calculate wind shear based on environmental conditions, and tower height.** 9.5.12