

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

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- 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**
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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**
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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**
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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
