Power Generation Design and Function

PG8411 36 weeks

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Office of Career, Technical, and Adult Education

Course Description

Suggested Grade Level: 10 or 11
Prerequisite: FD8411

In this advanced course, students use hands-on applications like designing circuits, generation systems, and modeling system parts to deepen their knowledge of concepts and policies related to power generation. They explore symptoms of trouble and how these are handled. Students use and interpret engineering and technical drawings and schematics. They explore emerging trends and consider how power generation affects society and the environment.

Task Essentials Table

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

Task Number	PG8411	Tasks/Competencies	
Reading and Interpreting Technical and Engineering Drawings			
39	⊕	Explain types of schematics and diagrams.	
40	⊕	Interpret computer-aided design (CAD) drawings and blueprints.	
41	⊕	Interpret site plans.	
42	⊕	Perform linear measurements.	
43	⊕	Describe characteristics of series, parallel, and combination circuits.	
Performing Tests, Calibrations, and Measurements			
44	⊕	Apply safety guidelines in appropriate circumstances.	
45	⊕	Demonstrate the use of tools and applications in electricity and gas.	
46	⊕	Demonstrate the use of instruments to measure units.	
47	⊕	Interpret units of measure.	

48	⊕	Produce a model of part of a generation system.	
Maintaining and Operating Power Generation Systems			
49	⊕	Describe the types of maintenance schedules.	
50	⊕	Design a preventative maintenance schedule.	
51	⊕	Design a predictive maintenance schedule.	
52	⊕	Explain Supervisory Control and Data Automation (SCADA) systems.	
53	⊕	Describe responsibilities of power plant operators.	
Operations of Power Generation Systems			
54	⊕	Identify generation systems.	
55	⊕	Distinguish among system types.	
56	⊕	Identify indicators (symptoms) of potential issues in a generation system.	
57	⊕	Diagnose indicators of potential issues (symptoms).	
58	⊕	Design a model of an energy generation system or parts that interact in a system.	
Upgrading Generation Operational Systems			
59	⊕	Define *digital instrumentation and control systems*.	
60	⊕	Research digital instrumentation and control systems.	
Exploring Trends and Technology Development			
61	⊕	Explore factors that lead to technological development in power generation.	
62	⊕	Explore advantages and disadvantages of hydroelectric power.	
63	⊕	Explore obstacles with onshore/offshore wind power and technological solutions.	
64	⊕	Identify benefits and disadvantages of nuclear technologies.	

65	⊕	Explain advantages and disadvantages of solar generation plants or farms.	

Legend: ⊕Essential ○Non-essential ⊖Omitted

Reading and Interpreting Technical and Engineering Drawings

Task Number 001

Explain types of schematics and diagrams.

Definition

Explanation should include both external and internal types such as

- pipelines
- piping
- transmission
- distribution
- electrical circuits
- controls
- components
- systems
- understanding process and instrumentation drawing (P-&-ID).

Explanation should also include identifying symbols for components, such as transformers, valves, motors, breakers, pumping stations, etc.

Process/Skill Questions

- What does the term *schematic* mean?
- What are some examples of schematics?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

Task Number 002

Interpret computer-aided design (CAD) drawings and blueprints.

Definition

Interpretation should include

- interpreting scale (e.g., dimensions)
- converting between U.S. customary units and metric measurements
- identifying standard symbols
- utilizing three dimensional (3D) models
- reading mechanical, electrical, and plumbing CAD drawings and blueprints.

Process/Skill Questions

- What does scale refer to? Why is it important?
- What are some symbols used in CAD?

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10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

2. The Core Concepts of Technology

Task Number 003

Interpret site plans.

Definition

Interpretation should include

- schedules
- components of drawings
- scale
- topography
- site layout
- security
- helioscopes, geolocation, and environmental information.

Process/Skill Questions

- What is *topography*?
- What type of site plans would use helioscopes?

ITEEA National Standards

16. Energy and Power Technologies

20. Construction Technologies

Task Number 004

Perform linear measurements.

Definition

Performance should include

- using measurement tools
- measuring site plans
- laying out circuits or pipeline system segments.

Process/Skill Questions

- What types of measurement scales are used with site plans?

ITEEA National Standards

16. Energy and Power Technologies

2. The Core Concepts of Technology

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 005

Describe characteristics of series, parallel, and combination circuits.

Definition

Description should include

- circuit components (e.g., power supply, load, regulators, switches, transformers, fuses, wires)
- basic electrical schematics drawing
- voltage, amperage, and resistance calculations
- applications of each type of circuit.

Process/Skill Questions

- What type of circuit consists of power supply, switch, load, and wires?
- What is a combination circuit?
- Why are basic electrical schematics used? What information can be obtained?

Performing Tests, Calibrations, and Measurements

Task Number 006

Apply safety guidelines in appropriate circumstances.

Definition

Application should include

- Occupational Safety and Health Administration (OSHA) guidelines for construction (29 CFR 1926) and general industry (29 CFR 1910)
    - personal protective equipment (PPE)
    - lockout/tagout procedures
    - confined space
    - hearing protection
    - respiratory protection
    - work permits
    - hazardous waste and materials
- manufacturer guidelines for maintenance and use of tools and equipment
- maintaining lab safety
- conduct testing, calibration, and measurement requirements
- National Electrical Code (NEC) National Fire Protection Association (NFPA 70)
- American Society of Mechanical Engineers (ASME) codes
- National Board of Boiler and Pressure Vessel Inspectors (NBBI) codes
- US Chemical Safety and Hazard Investigation Board (CSB) videos
- US Department of Transportation natural gas pipeline Fatigue Management Mitigation Program
- Federal Pipeline Safety Regulations.

Process/Skill Questions

- What are some OSHA guidelines for safety?
- What safety guidance does ASME provide?
- What are the guidelines for mitigating employee fatigue in the DOT Fatigue Management Program?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

2. The Core Concepts of Technology

Task Number 007

Demonstrate the use of tools and applications in electricity and gas.

Definition

Demonstration may include

- basic insulated hand tools used for electricity (e.g., screwdriver, stripping tools, wire cutters, crimpers, wrenches)
- basic hand tools used for gas (e.g., wrenches, pipe cutters, pipe threader, shovels, brass wrenches, brass channel locks, brass pipe wrenches, brass hammers)
- applications (e.g., gauging, measuring, connecting, terminating, grounding)
- light rigging equipment, chain falls, straps.

Process/Skill Questions

- Why are electrical hand tools insulated?
- What is the reason for gas working tools to be made of brass?
- Why are the right rigging tools important before starting to lift equipment?

ITEEA National Standards

16. Energy and Power Technologies

2. The Core Concepts of Technology

Task Number 008

Demonstrate the use of instruments to measure units.

Definition

Demonstration should include collecting data (e.g., wattage, voltage, amperage, torque, temperature, resistance, pressure) and may include the following instruments:

- Multimeter (e.g., digital, analog)
- Ammeter
- Voltmeter
- Torque wrench
- Pressure gauge
- Control valve
- Spring scale
- Thermometer (e.g., red alcohol, mercury, laser, probe)
- Micrometers
- Dial indicators
- Calipers

Process/Skill Questions

- When would a torque wrench be needed? What is the proper range if using a torque wrench?
- What units of measure do control valves use?
- Why are there calibration periodicities for some of these measuring devices?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

Task Number 009

Interpret units of measure.

Definition

Interpretation should include the use of unit conversion charts and formulas (e.g., Watt's law, Ohm's law, ideal gas law) to convert

- metric to U.S. customary standard units, and vice versa
- scientific notation (e.g., kilo-, mega-, giga-, micro-)
- parts per million (ppm), lower explosive limit (LEL), and percent gas concentration
- British thermal units (BTUs) to therms.

Process/Skill Questions

- Why are scientific notation prefixes used in energy situations?
- What is a *therm*?
- Why is natural gas measured in dekatherms (dth)?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

Task Number 010

Produce a model of part of a generation system.

Definition

Production may include drawings, using tools and materials, and explaining systems such as

- nuclear reactors
- solar inverters
- pumping systems
- gas valve systems
- turbines
- cooling systems
- waste disposal systems
- safety systems.

Process/Skill Questions

- How can modeling part of a system assist in learning about power generation?
- What kinds of turbines might be produced?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

11. Apply the Design Process

16. Energy and Power Technologies

9. Engineering Design

Maintaining and Operating Power Generation Systems

Task Number 011

Describe the types of maintenance schedules.

Definition

Description should include the following types:

- Preventative maintenance
- Predictive maintenance
- Condition-based maintenance
- Reliability maintenance
- Corrective maintenance.

Process/Skill Questions

- How can maintenance schedules reduce workload?
- What is generally included in a predictive maintenance schedule?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 012

Design a preventative maintenance schedule.

Definition

Design should include

- site inspections
- routine inspections (e.g., filter, battery, belt)
- cost analysis in event of failure
- schedule using software
- return on investment (ROI)
- equipment history
- equipment run time (usage-based)
- safety record

- parts lead times
- man-hours
- non-destructive testing (NDT).

Process/Skill Questions

- How is cost analysis conducted?
- Why are man-hours used in calculating ROI?
- Why is maintaining a proper machinery history important?
- What should be included in a maintenance budget?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 013

Design a predictive maintenance schedule.

Definition

Design should include

- cost analysis, in event of failure
- schedule, using software
- return on investment (ROI)
- equipment history
- equipment run time (reliability)
- safety record
- parts lead times
- man-hours.

Process/Skill Questions

- What are benefits of predictive maintenance?
- Are there disadvantages to predictive maintenance, and if so, what are they?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 014

Explain Supervisory Control and Data Automation (SCADA) systems.

Definition

Explanation should include

- database
- central server
- mobile devices
- web based interface
- cloud computing
- programmable logic controllers (PLC)
- human machine interfaces (HMI)
- inputs
- remote terminal unit (RTU)
- sensors.

Process/Skill Questions

- What are control symbols (or, and, summations, etc.)?
- What is the difference between linear control systems and non-linear control systems?

ITEEA National Standards

16. Energy and Power Technologies

Task Number 015

Describe responsibilities of power plant operators.

Definition

Description should include

- controlling the functioning of power-generating equipment to ensure all procedures run smoothly
- interpreting the readings on meters and gauges to ensure voltage and electricity flow within the specified parameters
- inspecting indicators and equipment for evidence of defects
- supervising staff members
- coordinating maintenance
- operating machines used to create electricity.

Process/Skill Questions

- When does a power plant operator work alone?
- What other jobs are included in power plant operations?

ITEEA National Standards

16. Energy and Power Technologies

Operations of Power Generation Systems

Task Number 016

Identify generation systems.

Definition

Identification may include drawings, schematics, flow charts, diagrams, and description of process of generating electricity with

- fossil fuel
- natural gas
- nuclear fuel (uranium)
- biomass
- hydro stations
- pumped storage
- solar

- wind.

Process/Skill Questions

- What type of fuel is predominately used in electric generating plants in Virginia?
- What type of terrain lends itself to hydro stations?
- What are the gas specifications for this type of fuel?
- What is found on a wind map?

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16. Energy and Power Technologies

Task Number 017

Distinguish among system types.

Definition

Distinction could include

- turbine (i.e., gas, wind, steam)
- air system
- fuel system
- water system
- solar inverters
- solar panels
- hydraulic system.

Process/Skill Questions

- What is the purpose of an inverter?
- How are solar panels made?
- Why are many large operating valves actuated by air or hydraulics?

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16. Energy and Power Technologies

Task Number 018

Identify indicators (symptoms) of potential issues in a generation system.

Definition

Identification should include

- vibration
- pressure change
- leakage
- burning smells
- noises
- temperature change
- chemistry
- corrosion samples
- failure mode analysis (FMA) results
- diagnostic analysis results.

Process/Skill Questions

- Who should report symptoms in a generating system?
- What should be checked if a burning smell is noticed?
- Why is piping corrosion a major concern?
- What is the role of an analytical engineer?

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10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

Task Number 019

Diagnose indicators of potential issues (symptoms).

Definition

Diagnosis should include investigation of what is different from normal parameters, including

- anything that has changed
- any influencers
- history of the system
- trends
- analytics
- statistical process control charts (SPC)
- alarms
- warning lights
- root cause analysis (RCA)
- vibration analysis.

Process/Skill Questions

- How is a problem diagnosed in a generation system?
- What is RCA?
- What does company protocol mean when diagnosing potential areas of concern?
- What are examples of using SPCs?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

Task Number 020

Design a model of an energy generation system or parts that interact in a system.

Definition

Design may include

- diagram
- optimization
- systems configuration
- simulation of systems operation
- mathematical forecast model
- 3D model
- CAD design
- illustration.

Process/Skill Questions

- When designing, what are criteria and constraints?
- What scale should a model be?
- How do power plants use power generation forecast models?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

11. Apply the Design Process

16. Energy and Power Technologies

9. Engineering Design

Upgrading Generation Operational Systems

Task Number 021

Define *digital instrumentation and control systems*.

Definition

Definition should include

- plant protection and mitigation systems
- safety systems
- transition from analog to digital control systems
- benefits of a digital control system
- cybersecurity upgrades
- North American Electric Reliability Corporation (NERC) upgrades
- operational excellence
- reliability analysis
- analytics
- process monitoring and controls.

Process/Skill Questions

- What are some functions of digital instrumentation and control systems?
- What is NERC?
- What happens when a power plant violates a NERC regulatory standard?

ITEEA National Standards

16. Energy and Power Technologies

Task Number 022

Research digital instrumentation and control systems.

Definition

Research may include aspects defined

- presentations
- papers
- reports.

Process/Skill Questions

- What are some aspects of DICS that lend themselves to research?
- When are analytics used?
- What are advantages of upgrading power generation systems?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

16. Energy and Power Technologies

Exploring Trends and Technology Development

Task Number 023

Explore factors that lead to technological development in power generation.

Definition

Exploration may include

- environmental impact assessment
    - stakeholder engagement
        - habitat
        - wildlife
        - noise/vibration
- investors
- ROI
- power plant life expectancy.

Process/Skill Questions

- What are environmental effects of hydropower? What are technological solutions?
- What are challenges involved in solar panel siting?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

6. The Role of Society in the Development and Use of Technology

Task Number 024

Explore advantages and disadvantages of hydroelectric power.

Definition

Exploration may include

- issues and risks associated with hydroelectric power
- water quality
    - oxygen levels
    - water flow
    - aerating turbine solutions
- fish population and migration
    - fish population allowed to migrate according to natural behavior
    - drop differences and bottom areas
    - water velocity
- technologies
    - helicoid penstocks
    - hydrosphere
    - air-water-gravity generator
    - hydrokinetic systems
    - vortex
    - sewer/wastewater pipe power
    - fish ladders.

Process/Skill Questions

- What are advantages of hydroelectric power?
- What are some effects on fish populations?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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6. The Role of Society in the Development and Use of Technology

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Task Number 025

Explore obstacles with onshore/offshore wind power and technological solutions.

Definition

Exploration may include

- migratory flight pattern disruption and wildlife endangerment
- underwater noise affects and technological solutions
- noise pollution
- aesthetic effects
- technologies
    - magnetic
    - omni-directional, vertical axis
    - airborne turbines
    - jet engine concept
    - bladeless
        - fuller turbine
        - windstalks
    - sails
    - alternative blade and structural design
        - to combat wear and tear
        - floating.

Process/Skill Questions

- What are possible environmental effects of wind power generation?
- What does the expression “gas turbines follow the wind” mean?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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5. The Effects of Technology on the Environment

6. The Role of Society in the Development and Use of Technology

Task Number 026

Identify benefits and disadvantages of nuclear technologies.

Definition

Identification may include

- small modular reactors
- radioactive waste disposal
- Generation IV systems
    - sodium-cooled reactors
    - molten-salt reactors
    - helium-cooled reactors
    - advanced fission reactor
- economic influences
- climate influences
- ecological influences.

Process/Skill Questions

- What are some benefits of nuclear technologies?
- What storage methods are used for spent fuel in nuclear power plants?
- What are the major contents of radioactive waste?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

6. The Role of Society in the Development and Use of Technology

Task Number 027

Explain advantages and disadvantages of solar generation plants or farms.

Definition

Explanation should include

- land use
- environment
- habitat
- reclamation
- stabilization of the grid
- clean energy
- terrain and location.

Process/Skill Questions

- What is a disadvantage of a solar farm?
- Where are solar farms best located?
- What are the environmental concerns with building a solar farm?

ITEEA National Standards

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

6. The Role of Society in the Development and Use of Technology

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SOL Correlation by Task

39	Explain types of schematics and diagrams.	English: 10.5, 11.5 History and Social Science: VUS.14, WHII.14 Science: PH.11

40	Interpret computer-aided design (CAD) drawings and blueprints.	English: 10.5, 11.5 Mathematics: A.1, A.4, AII.3
41	Interpret site plans.	English: 10.5, 11.5
42	Perform linear measurements.	
43	Describe characteristics of series, parallel, and combination circuits.	English: 10.5, 11.5 Mathematics: A.1, A.4, AII.3 Science: PH.11
44	Apply safety guidelines in appropriate circumstances.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.7, GOVT.8, GOVT.9, GOVT.14, GOVT.15
45	Demonstrate the use of tools and applications in electricity and gas.	
46	Demonstrate the use of instruments to measure units.	English: 10.5, 11.5
47	Interpret units of measure.	English: 10.5, 11.5 Mathematics: A.1, A.4, AII.3, COM.15 Science: PH.11
48	Produce a model of part of a generation system.	English: 10.5, 11.5
49	Describe the types of maintenance schedules.	English: 10.5, 11.5
50	Design a preventative maintenance schedule.	English: 10.1, 10.5, 10.6, 11.1, 11.5, 11.6
51	Design a predictive maintenance schedule.	English: 10.1, 10.5, 11.1, 11.5
52	Explain Supervisory Control and Data Automation (SCADA) systems.	English: 10.5, 11.5
53	Describe responsibilities of power plant operators.	English: 10.5, 11.5
54	Identify generation systems.	English: 10.5, 11.5 Science: ES.6
55	Distinguish among system types.	English: 10.5, 11.5
56	Identify indicators (symptoms) of potential issues in a generation system.	English: 10.5, 11.5
57	Diagnose indicators of potential issues (symptoms).	English: 10.5, 11.5
58	Design a model of an energy generation system or parts that interact in a system.	English: 10.1, 11.1 Mathematics: AFDA.3, AFDA.4, AII.9, AII.10, COM.1

59	Define *digital instrumentation and control systems*.	English: 10.3, 10.5, 11.3, 11.5 Mathematics: PS.1*, PS.2*, PS.4*
60	Research digital instrumentation and control systems.	English: 10.5, 10.8, 11.5, 11.8
61	Explore factors that lead to technological development in power generation.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.12, VUS.14, WG.17, WHII.14
62	Explore advantages and disadvantages of hydroelectric power.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: VUS.14, WHII.14
63	Explore obstacles with onshore/offshore wind power and technological solutions.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: VUS.14, WHII.14
64	Identify benefits and disadvantages of nuclear technologies.	English: 10.5, 11.5 History and Social Science: VUS.14, WHII.14
65	Explain advantages and disadvantages of solar generation plants or farms.	English: 10.5, 11.5 History and Social Science: VUS.14, WHII.14

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- Energy Industry Fundamentals Certificate Assessment
- National Career Readiness Certificate Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Fundamentals of Power Generation (FP8411/36 weeks)

Career Cluster Name: Energy	
Pathway	**Occupations**
Energy Efficiency	**Electrical Engineer** **Electrician** **Environmental Engineer** **Environmental Engineering Technician** **Environmental Science and Protection Technician** **Environmental Scientist** **Geoscientist** **HVAC and Refrigeration Mechanic or Installer**
Fuels Production	**Chemical Engineer** **Chemist** **Continuous Mining Machine Operator** **First-Line Supervisor of Transportation and Material-Moving Machine and Vehicle Operator** **Geological Technician** **Petroleum Engineer** **Petroleum Technician** **Service Unit Operator, Oil, Gas, and Mining** **Wellhead Pumper**
Power Generation	**Control and Valve Installer, Repairer**

Career Cluster Name: Energy	
Pathway	**Occupations**
	Electrical Engineering Technician **Electronics Engineer** **Electronics Engineering Technician** **Engineering Manager** **Health and Safety Engineer** **Mechanical Engineer** **Nuclear Engineer** **Nuclear Power Reactor Operator** **Nuclear Technician** **Solar Photovoltaic Installer**
Transmission and Distribution	**Electrical and Electronics Repairer, Powerhouse, Substation and Relay** **Electrical Power Line Installer/Repairer** **Electro-Mechanical Technician** **Gas Compressor and Gas Pumping Station Operator** **Pipefitter, Steamfitter** **Plumber** **Power Distributor, Dispatcher** **Wind Turbine Service Technician**

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
Engineering and Technology	**Chemical Engineer** **Civil Engineer** **Civil Engineering Technician** **Computer Hardware Engineer** **Computer Programmer** **Computer Software Engineer** **Electrical Drafter** **Electrical Engineer** **Electrical Engineering Technician** **Electro-Mechanical Technician** **Electronic Drafter** **Electronics Engineering Technician** **Environmental Engineer** **Mechanical Drafter** **Mechanical Engineer** **Mechanical Engineering Technician** **Network and Computer Systems Administrator** **Network Systems and Data Communication Analyst** **Nuclear Engineer** **Petroleum Engineer** **Pipeline Drafter** **Power Systems Engineer** **Quality Engineer** **Quality Technician** **Statistician** **Systems Analyst**

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
	Transportation Manager
Science and Mathematics	**Chemist** **Ecologist** **Environmental Scientist** **Geodetic Surveyor** **Geoscientist** **Occupational Health and Safety Specialist** **Research Chemist**

Career Cluster: Transportation, Distribution and Logistics	
Pathway	**Occupations**
Health, Safety and Environmental Management	**Health, Safety, and Environment Manager**
Logistics Planning and Management Services	**Logistics Analyst** **Logistics Engineer** **Logistics Manager**
Transportation Systems/Infrastructure Planning, Management and Regulation	**Civil Engineer** **Civil Engineering Technician** **Transportation Manager**