

Energy Demand: Sustainability and Efficiency

ED8411 36 weeks

Table of Contents

Acknowledgments.....	1
Course Description.....	3
Task Essentials Table.....	3
Curriculum Framework.....	5
Exploring Sustainability and Efficiency	5
Exploring Energy Demand	13
Exploring Building Science	16
Understanding Facility Design and Engineering Systems	19
Understanding Regulations.....	23
Exploring Efficiency Testing and Ratings	25
Understanding Behavior Modification.....	29
Exploring New and Emerging Technologies	31
SOL Correlation by Task.....	32
Appendix: Credentials, Course Sequences, and Career Cluster Information	37

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Course Description

Suggested Grade Level: 10 or 11

Prerequisite: ES8411

Students in this course will explore the principles of energy demand with an emphasis on sustainability and efficiency. Concepts include energy demand and utilization across sectors such as residential, commercial, industrial, and transportation. Students apply the design process to improve facility efficiency, perform energy audits, and explore new and emerging technologies and will recognize their role as energy stewards of tomorrow.

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	ED8411	Tasks/Competencies
Exploring Sustainability and Efficiency		
39	⊕	Describe the sectors that comprise energy demand.
40	⊕	Investigate energy demand in the residential sector.
41	⊕	Investigate energy demand in the commercial sector.
42	⊕	Investigate energy demand in the industrial sector.
43	⊕	Investigate energy demand in the transportation sector.
44	⊕	Investigate energy demand in other sectors.
45	⊕	Model an energy sector.
46	⊕	Define <i>energy sustainability</i> .
47	⊕	Define <i>energy efficiency</i> .
48	⊕	Discuss sustainability and efficiency as they apply to social, economic, and environmental considerations.

49	⊕	Keep a personal energy log.
Exploring Energy Demand		
50	⊕	Identify the components of energy demand.
51	⊕	Illustrate the electric energy grid.
52	⊕	Describe energy end users.
53	⊕	Describe economic concepts in energy demand.
54	⊕	Investigate energy market structures.
Exploring Building Science		
55	⊕	Define <i>building science</i> .
56	⊕	Describe the Federal Emergency Management Agency's (FEMA's) relationship to building science.
57	⊕	Examine building materials in a building supply store.
58	⊕	Research building science in relation to energy demand.
Understanding Facility Design and Engineering Systems		
59	⊕	Describe systems within facilities.
60	⊕	Demonstrate methods to minimize energy demand in facilities across sectors.
61	⊕	Design an energy-efficient and sustainable home.
62	⊕	Redesign a facility or system(s) within a facility to improve energy efficiency.
Understanding Regulations		
63	⊕	Explain the purpose of energy regulation.
64	⊕	Identify the agencies involved in energy regulation.
65	⊕	Research an example of regulatory compliance.
Exploring Efficiency Testing and Ratings		
66	⊕	Describe efficiency testing and ratings.

67	⊕	Identify the elements of an energy audit.	
68	⊕	Observe an energy audit.	
69	⊕	Revise personal energy log.	
70	⊕	Perform an energy audit.	
Understanding Behavior Modification			
71	⊕	Define behavior as it relates to the demand for energy.	
72	⊕	Describe behavior modification factors in relation to the demand for energy.	
73	⊕	Develop strategies for behavior modification in relation to energy demand.	
Exploring New and Emerging Technologies			
74	⊕	Research new and emerging technologies affecting energy demand.	
75	⊕	Research a new technology affecting a given sector.	
76	⊕	Present research on innovation in energy demand.	

Legend: ⊕ Essential ○ Non-essential ⊖ Omitted

Curriculum Framework

Exploring Sustainability and Efficiency

Task Number 39

Describe the sectors that comprise energy demand.

Definition

Description should include

- residential
- commercial
- industrial
- transportation
- other (e.g., military, community).

Teacher Resources:

- [National Energy Education Department](#)
- [Energy.gov](#)

Process/Skill Questions

- What additional sectors may exist?
- What are examples of users across each of these sectors?
- What percentage of total national energy consumption does each sector represent?
- What non-electrical energy is part of the utility infrastructure?

ITEEA National Standards

1. The Characteristics and Scope of Technology

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

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

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

Task Number 40

Investigate energy demand in the residential sector.

Definition

Investigation should include

- consumers
- types of energy used in this sector for different purposes
- how energy is used and optimized (for sustainability and efficiency)
- opportunities for innovation.

Process/Skill Questions

- How important is saving energy for a typical resident?
- How may energy providers influence demand and efficiency in the residential sector?
- What are the dominant energy sources and providers within this sector?
- How do residents use efficiency and sustainability to control energy costs?

ITEEA National Standards

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

Task Number 41

Investigate energy demand in the commercial sector.

Definition

Investigation should include

- consumers
- types of energy used in this sector for different purposes
- how energy is used and optimized (for sustainability and efficiency)
- opportunities for innovation.

Process/Skill Questions

- How important is saving energy for a typical business?
- How may energy providers influence demand and efficiency in the commercial sector?
- What are the dominant energy sources and providers within this sector?
- How do businesses use efficiency and sustainability to gain a competitive edge in the marketplace?

ITEEA National Standards

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

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

Task Number 42

Investigate energy demand in the industrial sector.

Definition

Investigation should include

- consumers
- types of energy used in this sector
- how energy is used and optimized (for sustainability and efficiency)
- opportunities for innovation.

Process/Skill Questions

- How important is saving energy for a manufacturer?
- How may energy providers influence demand and efficiency in the industrial sector?
- What are the dominant energy sources and providers within this sector?
- How do manufacturers use efficiency and sustainability to gain a competitive edge in the marketplace?

ITEEA National Standards

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

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

Task Number 43

Investigate energy demand in the transportation sector.

Definition

Investigation should include

- consumers
- types of energy used in this sector
- how energy is used and optimized (for sustainability and efficiency)
- opportunities for innovation.

Process/Skill Questions

- How may energy providers influence demand and efficiency in the transportation sector?
- What are the dominant energy sources and providers within this sector?

ITEEA National Standards

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

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

Task Number 44

Investigate energy demand in other sectors.

Definition

Investigation may include

- military/government
- community (microgrids).

Process/Skill Questions

- How and where do microgrids operate?
- What makes government facilities different from those of other sectors?
- What is the definition of *resiliency*, and why is it important?

ITEEA National Standards

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

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

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

Task Number 45

Model an energy sector.

Definition

Modeling may include

- simulation

- computer-aided design (CAD)
- 3D printing
- prototype.

Process/Skill Questions

- How is one sector different from another?
- What do the different sectors have in common?

ITEEA National Standards

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

Task Number 46

Define *energy sustainability*.

Definition

Definition should include components such as

- conservation and efficiency
- renewable energy
- diversity of energy sources
- environmental and economic effects and considerations
- innovation.

Process/Skill Questions

- What is the difference between conservation and efficiency?
- How is a diverse set of energy sources beneficial?
- How are renewable and sustainable energy sources the same, and how are they different?

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

4. The Cultural, Social, Economic, and Political Effects of Technology
 5. The Effects of Technology on the Environment
-

Task Number 47

Define *energy efficiency*.

Definition

Definition should include

- inputs and outputs (the importance of getting more output from less input)
- physical limitations of various technologies and energy sources
- the relationship between efficiency and sustainability.

Process/Skill Questions

- How are efficiency and sustainability related? What is an example of a situation where an increase in efficiency does not lead to greater sustainability?
- What are different types of light bulbs? How and why do their efficiencies differ?

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

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

5. The Effects of Technology on the Environment

Task Number 48

Discuss sustainability and efficiency as they apply to social, economic, and environmental considerations.

Definition

Discussion should include

- social effects
- cultural and personal philosophies
- government policies
- business practices
- the environment and natural resources.

Process/Skill Questions

- What are the advantages/disadvantages of using various energy sources?
- How do business practices affect sustainability and efficiency?
- How do government policies affect energy use?

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

Task Number 49

Keep a personal energy log.

Definition

Keeping a log of energy use may include a spreadsheet, a diary, or a portfolio. The log should include

- date(s) and times
- location
- description
- other details of energy use.

Teacher Resources:

- [National Energy Education Development](#)
- [Energy Resource Guide for Virginia, Virginia Cooperative Extension](#)

Process/Skill Questions

- What can be learned by logging energy use?
- Why is it important to be aware of one's energy use?
- What is the greatest portion of your energy use?

ITEEA National Standards

16. Energy and Power Technologies

Exploring Energy Demand

Task Number 50

Identify the components of energy demand.

Definition

Identification should include

- the electric energy grid
- end users
- economic concepts
- innovation
- consumer expectations.

Process/Skill Questions

- What are the elements of the electric energy grid?
- Who are the most common end users of energy?
- What does *digitization of the grid* mean?

ITEEA National Standards

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

Task Number 51

Illustrate the electric energy grid.

Definition

Illustration may include

- generation
- transmission
- storage
- distribution
- end users
- connections for moving stored energy.

Process/Skill Questions

- What part does transmission play in the electric energy grid?
- What is the purpose of energy storage?
- How is distribution different from transmission?

ITEEA National Standards

16. Energy and Power Technologies

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

5. The Effects of Technology on the Environment

Task Number 52

Describe energy end users.

Definition

Description includes

- residential
- commercial
- industrial
- public sector (e.g., government/military)
- transportation
- community (e.g., microgrids).

Process/Skill Questions

- What sector represents the greatest number of end users in Virginia?
- How does the military end user resemble the residential, commercial, and industrial end users?
- What major innovation could transform the transportation sector?

ITEEA National Standards

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

Task Number 53

Describe economic concepts in energy demand.

Definition

Description includes

- supply and demand
 - availability and capacity
 - intermittency and reliability
 - geographical considerations
 - weather events
 - time of day and seasonal variations
 - curtailment and load-shedding
- cost and affordability
 - rates/pricing (e.g., metering)
 - pricing incentives
 - regulatory considerations.

Process/Skill Questions

- Who sets end-user energy rates?
- How do international markets affect the economics of energy?

ITEEA National Standards

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

Task Number 54

Investigate energy market structures.

Definition

Investigation includes

- energy sources and uses (e.g., gas, electrical)
- wholesale markets within the national grid
- transmission
- distribution
- delivery
- import and export considerations.

Process/Skill Questions

- What are various sources of energy?
- How is the Federal Energy Regulatory Commission (FERC) involved in wholesale energy markets?

ITEEA National Standards

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

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

Exploring Building Science

Task Number 55

Define *building science*.

Definition

Definition should include the study of

- indoor thermal environment
- indoor acoustic environment
- indoor light environment
- indoor air quality
- building resource use, including energy and building material use.

These areas are studied in terms of physical principles, relationship to building occupant health, safety, comfort, and productivity, and how those aspects of a building can be controlled.

Process/Skill Questions

- What are physical phenomena that affect buildings?
- How might an industrial setting need to make adjustments for the acoustic environment?
- What influences indoor air quality?
- How might building materials affect these aspects?
- What is the building *envelope*?

ITEEA National Standards

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

Task Number 56

Describe the Federal Emergency Management Agency's (FEMA's) relationship to building science.

Definition

Description should include developing

- publications
- guidance materials

- tools
- technical bulletins
- recovery advisories

that incorporate the most up-to-date building codes, flood-proofing requirements, seismic design standards, and wind design requirements for new construction and the repair of existing buildings.

Process/Skill Questions

- How does FEMA ensure efficient and sustainable buildings?
- What is the importance of seismic design standards?

ITEEA National Standards

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

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

Task Number 57

Examine building materials in a building supply store.

Definition

Examination should include reporting on the energy efficiency of

- exterior materials (e.g., roofing materials)
- insulation
- lighting and ceiling fans
- plumbing (including water heating options)
- flooring
- smart devices
- windows and doors.

Process/Skill Questions

- When building a house, how can you practice sustainability and efficiency?
- How would you budget for the most sustainable and efficient materials? What trade-offs might be necessary?

ITEEA National Standards

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

Task Number 58

Research building science in relation to energy demand.

Definition

Relation should include

- consumption
- thermal load
- self-generation/net metering
- geographical considerations
- siting considerations
- indoor environmental quality considerations.

Process/Skill Questions

- Why is geography a consideration?
- How does onsite generation (e.g., solar panels) reduce demand?
- What are methods to improve indoor air quality?

ITEEA National Standards

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

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

Understanding Facility Design and Engineering Systems

Task Number 59

Describe systems within facilities.

Definition

Description includes

- siting considerations
- raw materials
- building envelope
 - insulation
 - roof
 - walls
 - windows
- heating, ventilation, and air conditioning (HVAC), including solar-thermal
- electrical (including solar-photovoltaic [PV])
- plumbing
- lighting technology (active and passive [i.e., natural lighting])
- building automation
- communications (e.g., Wi-Fi network)
- security
- safety
 - fire suppression
 - emergency planning
 - personal protective equipment (PPE)
 - first aid.

Process/Skill Questions

- How do building systems affect the demand for energy within the facility?
- What are the most energy-demanding systems within a facility? How do these differ among various types of facilities?
- Why is ventilation critical to a healthy indoor environment?

ITEEA National Standards

2. The Core Concepts of Technology

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

Task Number 60

Demonstrate methods to minimize energy demand in facilities across sectors.

Definition

Demonstration should include outlining the process of minimizing energy demand and identifying considerations during

- planning
- designing
- constructing
- operating/maintaining
- retrofitting (when applicable).

Process/Skill Questions

- What are the major steps involved in planning, designing, constructing, and operating/maintaining a building?
- Who are the team members involved in planning, designing, constructing, and operating a facility?
- Why are facilities sometimes decommissioned? Why are they sometimes retrofitted?

ITEEA National Standards

16. Energy and Power Technologies

Task Number 61

Design an energy-efficient and sustainable home.

Definition

Design should include

- sketches
- explanations of features that make the home energy-efficient.

Process/Skill Questions

- How can a new home be made energy-efficient?
- What effect does sustainability have on home construction?

ITEEA National Standards

11. Apply the Design Process

16. Energy and Power Technologies

20. Construction Technologies

Task Number 62

Redesign a facility or system(s) within a facility to improve energy efficiency.

Definition

Redesign may include

- identifying the problem/challenge
- researching the problem/challenge
- establishing criteria/constraints
- brainstorming solutions
- selecting a solution
- building a model
- creating a prototype
- testing the prototype against criteria
- revising the design
- presenting or sharing the design.

Process/Skill Questions

- What are relevant building certifications?
- Why is the planning and proposal stage so important?
- Who are the important team members to have involved throughout this process?
- What opportunities exist with retrofitting existing facilities?

ITEEA National Standards

11. Apply the Design Process

16. Energy and Power Technologies

2. The Core Concepts of Technology

20. Construction Technologies

Understanding Regulations

Task Number 63

Explain the purpose of energy regulation.

Definition

Explanation should include

- sustainability and efficiency
- establishment of quality standards (e.g., building codes)
- reliability
- access/availability
- safety
- consumer protection.

Process/Skill Questions

- Why is energy regulated?
- How are standards and regulations related and how do they affect one another?
- How does politics influence energy regulation?

ITEEA National Standards

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

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

Task Number 64

Identify the agencies involved in energy regulation.

Definition

Identification may include but not be limited to

- localities
- permitting
- inspections
- state agencies
 - [Virginia Department of Environmental Quality \(DEQ\)](#)
 - [Virginia Department of Transportation \(VDOT\)](#)
 - [Virginia Department of Mines, Minerals, and Energy \(DMME\)](#)
 - [Virginia's State Corporation Commission \(SCC\)](#)
 - [Virginia Department of Labor and Industry \(DOLI\)](#) and [Virginia Occupational Safety and Health \(VOSH\) Safety Compliance Division](#)
 - [Virginia Department of Health \(VDH\)](#)
- federal agencies
 - [Federal Energy Regulatory Commission \(FERC\)](#)
 - [Rural Utilities Service \(RUS\)](#)
 - [Federal Communications Commission \(FCC\)](#)
 - [Federal Aviation Administration \(FAA\)](#)
 - [U.S. Department of Defense \(DOD\)](#)
 - [U.S. Environmental Protection Agency \(EPA\)](#)
 - [U.S. Nuclear Regulatory Commission \(NRC\)](#)
 - [Occupational Safety and Health Administration \(OSHA\)](#)
 - [Bureau of Ocean Energy Management \(BOEM\)](#)
 - [U.S. Fish and Wildlife Service](#)
 - [U.S. Forest Service](#)
 - [U.S. Department of Energy](#)
 - [U.S. Department of Homeland Security](#)
 - [U.S. Army Corps of Engineers](#)
- international organizations
 - [North American Electric Reliability Corporation \(NERC\)](#).

Process/Skill Questions

- How do agency leadership and funding affect regulation enforcement?
- What happens when two regulations contradict one another?

ITEEA National Standards

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

Task Number 65

Research an example of regulatory compliance.

Definition

Research could include

- origin of regulations (e.g., advocacy)
- applicability of regulations to a specific situation or entity
- permitting
- compliance and reporting requirements
- enforcement of regulations.

Process/Skill Questions

- Why do various agencies overlap in their oversight of the energy sector?
- What happens when an entity is not in compliance with a law?
- How might one advocate for change in energy regulation?

ITEEA National Standards

16. Energy and Power Technologies

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

Exploring Efficiency Testing and Ratings

Task Number 66

Describe efficiency testing and ratings.

Definition

Description should include

- purpose of energy efficiency testing
- methods of testing (including equipment and metric used)
- analysis of test results
- recommendations based on test results
- origin of ratings.

Teacher Resource: [EnergyStar.gov](https://www.energystar.gov)

Process/Skill Questions

- What can be done about equipment obsolescence?
- How are materials rated?
- How is the efficiency of appliances rated?

ITEEA National Standards

16. Energy and Power Technologies

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

Task Number 67

Identify the elements of an energy audit.

Definition

Identification may include

- interviews
- facilities survey
- monitoring/testing equipment
- data collection and analysis
- reporting.

Process/Skill Questions

- What is the purpose of an energy audit?
- Who can conduct an energy audit?

ITEEA National Standards

16. Energy and Power Technologies

20. Construction Technologies

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

Task Number 68

Observe an energy audit.

Definition

Observation should include adherence to procedures and may include

- gathering data
- note-taking
- interviewing
- journaling
- completing checklists.

Process/Skill Questions

- What are the steps of an energy audit?
- How can the recommendations from an energy audit be communicated and applied?

ITEEA National Standards

16. Energy and Power Technologies

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

Task Number 69

Revise personal energy log.

Definition

Revision should include updating a log of energy use and may be in spreadsheet, diary, or portfolio format.

Teacher Resources:

- [National Energy Education Development](#)
- [Energy Resource Guide for Virginia, Virginia Cooperative Extension](#)

Process/Skill Questions

- Why is it important to revisit one's personal energy log?
- How does a personal energy log reflect behavior modifications?

ITEEA National Standards

16. Energy and Power Technologies

Task Number 70

Perform an energy audit.

Definition

Performance should include

- adhering to safety practices
- identifying tools for testing
- using testing methods (including equipment and metrics)
- gathering data
- analyzing test results
- making recommendations based on test results.

Process/Skill Questions

- How can your recommendations be communicated?
- How might your recommendations be implemented?
- What are the costs and benefits of your recommendations?

ITEEA National Standards

16. Energy and Power Technologies

20. Construction Technologies

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

Understanding Behavior Modification

Task Number 71

Define behavior as it relates to the demand for energy.

Definition

Definition should include

- availability and diversity of energy sources
- consumption
- lifestyles (modern and historical)
- health considerations
- education and awareness
- cultural and societal expectations
- financial considerations
- ethical and philosophical considerations.

Process/Skill Questions

- What are the challenges to modifying behavior?
- How do geographical location and socioeconomics affect behavior?

ITEEA National Standards

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

Task Number 72

Describe behavior modification factors in relation to the demand for energy.

Definition

Description should include factors involved in behavior modification such as

- understanding current energy use and opportunities for improvement (education and awareness)
- policy requirements and incentive programs
- availability of smart technology
- financial considerations
- social trends.

Teacher Resources:

- [Energy Masters Program, Virginia Cooperative Extension](#)
- [Virginia Energy Sense](#)

Process/Skill Questions

- What are the financial benefits of behavior modification?
- What are the different behavior modifications in relation to energy use across the sectors?
- Why might energy use behaviors be different at work vs. at home?

ITEEA National Standards

16. Energy and Power Technologies

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

Task Number 73

Develop strategies for behavior modification in relation to energy demand.

Definition

Development should include examples of behavior modifications, such as

- scheduling use
- curtailing use
- using technology for optimization
- applying self-generating technologies (e.g., solar panels)
- retrofitting.

Process/Skill Questions

- What behavior modification could assist in conserving energy?
- How might a building be retrofitted to increase energy efficiency?

ITEEA National Standards

16. Energy and Power Technologies

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

Exploring New and Emerging Technologies

Task Number 74

Research new and emerging technologies affecting energy demand.

Definition

Research includes the effect of technology on energy sustainability and efficiency.

Process/Skill Questions

- How has artificial intelligence (AI) affected energy demand?
- How do other technological trends reduce or increase energy demand?

ITEEA National Standards

16. Energy and Power Technologies

Task Number 75

Research a new technology affecting a given sector.

Definition

Research includes the effect of a new technology on energy sustainability and efficiency in a given sector (i.e., residential, commercial, industrial, transportation).

Process/Skill Questions

- What is a unique application of technology in the sector?
- What are recent innovations in energy efficiency in the sector?

ITEEA National Standards

16. Energy and Power Technologies

Task Number 76

Present research on innovation in energy demand.

Definition

Presentation may take the form of a portfolio, use multimedia, or may include a prototype.

Process/Skill Questions

- What ideas from other student presentations influenced you or changed your perception?
- How have your perceptions changed based on the outcome of your research?

ITEEA National Standards

16. Energy and Power Technologies

SOL Correlation by Task

39	Describe the sectors that comprise energy demand.	English: 10.5, 11.5 History and Social Science: GOVT.14, GOVT.15
40	Investigate energy demand in the residential sector.	English: 10.5, 11.5 History and Social Science: GOVT.14, GOVT.15
41	Investigate energy demand in the commercial sector.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.14, GOVT.15
42	Investigate energy demand in the industrial sector.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.14, GOVT.15
43	Investigate energy demand in the transportation sector.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.14, GOVT.15
44	Investigate energy demand in other sectors.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.14, GOVT.15
45	Model an energy sector.	
46	Define <i>energy sustainability</i> .	English: 10.3, 10.5, 11.3, 11.5 History and Social Science: GOVT.9, GOVT.12, VUS.14, WG.17, WHIL.14 Science: ES.6
47	Define <i>energy efficiency</i> .	English: 10.3, 10.5, 10.8, 11.8 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14
48	Discuss sustainability and efficiency as they apply to social, economic, and environmental considerations.	English: 10.1, 11.1 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14 Science: ES.6
49	Keep a personal energy log.	English: 10.6, 11.6

		History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
50	Identify the components of energy demand.	English: 10.5, 11.5 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
51	Illustrate the electric energy grid.	History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
52	Describe energy end users.	English: 10.5, 11.5 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
53	Describe economic concepts in energy demand.	English: 10.5, 11.5 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
54	Investigate energy market structures.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
55	Define <i>building science</i> .	English: 10.3, 10.5, 11.3, 11.5
56	Describe the Federal Emergency Management Agency's (FEMA's) relationship to building science.	English: 10.5, 11.5 History and Social Science: GOVT.7, GOVT.14, GOVT.15
57	Examine building materials in a building supply store.	English: 10.8, 11.8
58	Research building science in relation to energy demand.	English: 10.8, 11.8
59	Describe systems within facilities.	English: 10.5, 11.5
60	Demonstrate methods to minimize energy demand in facilities across sectors.	English: 10.1, 10.6, 11.1, 11.6 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
61	Design an energy-efficient and sustainable home.	History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14

62	Redesign a facility or system(s) within a facility to improve energy efficiency.	History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14
63	Explain the purpose of energy regulation.	English: 10.5, 11.5 History and Social Science: GOVT.7, GOVT.8, GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14
64	Identify the agencies involved in energy regulation.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: GOVT.7, GOVT.8, GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14
65	Research an example of regulatory compliance.	English: 10.8, 11.8 History and Social Science: GOVT.7, GOVT.8, GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14
66	Describe efficiency testing and ratings.	English: 10.5, 11.5 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14 Mathematics: AFDA.8, PS.1*, PS.2*, PS.3*, PS.4*, PS.10*
67	Identify the elements of an energy audit.	English: 10.5, 11.5 Mathematics: AFDA.8, PS.1*, PS.2*, PS.3*, PS.4*, PS.8*, PS.9*, PS.10*
68	Observe an energy audit.	Mathematics: AFDA.8, PS.1*, PS.2*, PS.3*, PS.4*, PS.8*, PS.9*, PS.10*
69	Revise personal energy log.	English: 10.6, 10.7, 11.6, 11.7
70	Perform an energy audit.	English: 10.5, 11.5 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14 Mathematics: AFDA.8, PS.1*, PS.2*, PS.3*, PS.4*, PS.8*, PS.9*, PS.10*
71	Define behavior as it relates to the demand for energy.	English: 10.3, 11.3 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHIL.14

72	Describe behavior modification factors in relation to the demand for energy.	English: 10.5, 11.5 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
73	Develop strategies for behavior modification in relation to energy demand.	English: 10.1, 11.1 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14 Mathematics: DM.4, DM.3*
74	Research new and emerging technologies affecting energy demand.	English: 10.8, 11.8 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
75	Research a new technology affecting a given sector.	English: 10.8, 11.8 History and Social Science: GOVT.9, GOVT.12, GOVT.14, GOVT.15, VUS.14, WG.17, WHII.14
76	Present research on innovation in energy demand.	English: 10.1, 10.6, 10.7, 11.1, 11.6, 11.7

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Building Science Principles Examination
- 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.*

- Energy Supply: Sustainability and Efficiency (ES8411/36 weeks)

Career Cluster: Energy	
Pathway	Occupations
Energy Efficiency	Electrical Engineer Electrician Environmental Engineer Environmental Engineering Technician Environmental Science and Protection Technician Environmental Scientist 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

Career Cluster: Energy	
Pathway	Occupations
	Wellhead Pumper
Power Generation	Control and Valve Installer, Repairer 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 Programmer Computer Software Engineer Electrical Drafter Electrical Engineer Electrical Engineering Technician Electro-Mechanical Technician Electronic Drafter Electronics Engineering Technician 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
Science and Mathematics	Atmospheric Scientist Chemist Ecologist Environmental Scientist Geodetic Surveyor Geoscientist