

**POWER, ENERGY, AND TRANSPORTATION TECHNOLOGY I**  
**(Revised) AUGUST 2007**  
**COURSE NUMBER 771**

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**Name of Course:** Power, Energy, and Transportation Technology I

**Level of Course:** Academic Level I

**Prerequisites:** None

**Grades Levels Offered to:** 9 through 12

**Course Number:** 771

**Number of Credits:** 5

**Revised Date and Teachers Names:** Mr. Brian J. Drelick (August 2007)

**Purpose:**

This Power, Energy, and Transportation Technology course will provide our students with the hands on practical knowledge of how these critical systems within our society are constructed and operate. Studying modes of transportation and then applying these concepts in order to solve real life problems will provide students with a better understanding of how real world situations are addressed. Furthermore, with different forms of energy and power emerging here in the 21<sup>st</sup> Century, our students will be introduced to both the advantages and disadvantages of these new systems and how they differ from the traditional forms while concurrently completing activities which pertain to them.

This course concentrates on a wide range of technological areas related to power, energy, and transportation. Emphasis is on hands on, problem solving activities in which students work together in lab activities designed to reinforce the content presented. Activities present information on alternate energy and power systems including solar, hydroelectric, wind, mechanical, electrical, and fluid power. A strong emphasis is placed on a variety of modes of land and marine transportation. The internal combustion engine is also introduced as a specific component of human transportation systems. High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

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**General Objectives:**

At the conclusion of this course, the students will be able to:

1. Define technology.
2. Describe technology as a system.
3. List, describe, and implement the steps in the design process.
4. Identify how different systems components within transportation, energy, and power systems operate.
5. Utilize a variety of different forms of presentation techniques.

6. Define energy and different sources of renewable and non-renewable energy.
7. List and describe the six important forms of energy.
8. Describe the importance of energy as an input to all technology systems.
9. Explain how energy technology can make our lives better, and how energy technology can cause damage.
10. Define transportation and transportation technology.
11. List and describe the parts of a transportation system.
12. Describe transportation as a technological system within our society.
13. Define power.
14. Identify with the three basic power systems.
15. Understand the different uses of energy in transportation.
16. Identify the different modes of land transportation.
17. Discuss the modes and different routes of water transportation.
18. Identify and experiment with different modes of vehicle propulsion.
19. Describe the operation of a basic four-stroke engine.
20. Explain the importance of guidance systems in transportation technology.
21. Explain the need for control systems on transportation systems.
22. Describe structural systems for various types of vehicles.
23. List the goals for future transportation systems.
24. Discuss the negative effects of technology's impact on various power, energy, and transportation systems.

Measurement of success in meeting these general objectives will be carried out through the following methods of assessment:

Classwork/Homework	Objectives 4, 7, 10, 13, 14
Quizzes	Objectives 1, 2, 11, 19,
Tests	Objectives 6, 8, 9, 12,
Projects/Labs	Objectives 3, 15, 16, 17, 18, 20, 21, 22,
Class Participation	Objectives 5, 23, 24

## **Method of Instruction - Standards Targeted Throughout the Curriculum**

### **New Jersey Core Content Standards - Career, Science, and Technology**

**Career Education and Consumer, Family and Life Skills STANDARD 9.2** (Consumer, Family, and Life Skills) All students will demonstrate critical life skills in order to be functional members of society.

#### **A. Critical Thinking**

1. Apply communications and data analysis to the problem-solving and decision making processes in a variety of life situations.
2. Describe and apply constructive responses to criticism.
3. Apply the use of symbols, pictures, graphs, objects, and other visual information to a selected project in academic and/or occupational settings.
4. Recognize bias, vested interest, stereotyping, and the manipulation and misuse of information while formulating solutions to problems that interfere with attaining goals.
5. Apply knowledge and skills needed to use various means of transportation within a community.

## **B. Self-Management**

1. Revise and update the personal growth plan to address multiple life roles.
2. Apply project planning and management skills in academic and/or occupational settings.
3. Compare and contrast methods for maximizing personal productivity.

## **C. Interpersonal Communication**

1. Model interpersonal and effective conflict resolution skills.
2. Communicate effectively in a variety of settings with a diverse group of people.

**Science STANDARD 5.4** (Nature and Process of Technology) All students will understand the interrelationships between science and technology and develop a conceptual understanding of the nature and process of technology.

## **A. Science and Technology**

1. Know that scientific inquiry is driven by the desire to understand the natural world and seeks to answer questions that may or may not directly influence humans, while technology is driven by the need to meet human needs and solve human problems.

## **B. Nature of Technology**

2. Assess the impacts of introducing a new technology in terms of alternative solutions, costs, tradeoffs, risks, benefits and environmental impact.

## **C. Technological Design**

3. Plan, develop, and implement a proposal to solve an authentic, technological problem.

**Technological Literacy STANDARD 8.1** (Computer and information literacy ) All students will use computer applications to gather and organize information and to solve problems.

## **A. Basic Computer Skills and Tools**

1. Create a multi-page document with citations using word processing software in conjunction with other tools that demonstrates the ability to format, edit, and print.
2. Create documents including a resume and a business letter using professional format.
3. Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.
4. Given a database, define fields, input data from multiple records, produce a report using sort and query, and interpret the data.
5. Produce a multimedia project using text, graphics, moving images, and sound.
6. Produce and edit page layouts in different formats using desktop publishing and graphics software.
7. Develop a document or file for inclusion into a website or web page.
8. Discuss and/or demonstrate the capability of emerging technologies and software in the creation of documents or files.
9. Merge information from one document to another.

## **B. Application of Productivity Tools**

### **Social Aspects**

1. Describe the potential and implications of contemporary and emerging computer applications for personal, social, lifelong learning, and workplace needs.
2. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Make informed choices among technology systems, resources, and services in a variety of contexts.
4. Use appropriate language when communicating with diverse audiences using computer and information literacy.

### **Information Access and Research**

1. Select and use specialized databases for advanced research to solve real world problems.

2. Identify new technologies and other organizational tools to use in personal, home, and/or work environments for information retrieval, entry, and presentation.
3. Evaluate information sources for accuracy, relevance, and appropriateness.
4. Compose, send, and organize e-mail messages with and without attachments.

**Problem Solving and Decision Making**

1. Create and manipulate information, independently and/or collaboratively, to solve problems and design and develop products.
2. Identify, diagnose, and suggest solutions for non-functioning technology systems.
3. Identify a problem in a content area and formulate a strategy to solve the problem using brainstorming, flowcharting, and appropriate resources.
4. Integrate new information into an existing knowledge base and communicate the results in a project or presentation.

**Technological Literacy STANDARD 8.2** (Technology Education) All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.

**A. Nature and Impact of Technology**

1. Use appropriate data to discuss the full costs, benefits and trade-offs, and risks related to the use of technologies.
2. Explain how technological development is affected by competition through a variety of management activities associated with planning, organizing, and controlling the enterprise.
3. Provide various examples of how technological developments have shaped human history.

**B. Design Process and Impact Assessment**

1. Analyze a given technological product, system, or environment to understand how the engineering design process and design specification limitations influenced the final solution.
2. Evaluate the function, value, and appearance of technological products, systems, and environments from the perspective of the user and the producer.
3. Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities.
4. Use a computer assisted design (CAD) system in the development of an appropriate design solution.
5. Diagnose a malfunctioning product and system using appropriate critical thinking methods.
6. Create a technological product, system, or environment using given design specifications and constraints by applying design and engineering principles.

**C. Systems in the Designed World**

1. Explain the life cycle of a product from initial design to reuse, recycling, remanufacture, or final disposal, and its relationship to people, society, and the environment, including conservation and sustainability principles.
2. Analyze the factors that influence design of products, systems, and environments.
3. Compare and contrast the effectiveness of various products, systems, and environments associated with technological activities in energy, transportation, manufacturing, and information and communication.

**Standards of Technological Literacy from the Technology (STL) for All Americans Project and the International Technology Education Association (ITEA)**

- In order to comprehend the scope of technology, students should learn that technology is closely linked to creativity, which has resulted in innovation. (STL #1, H)
- In order to recognize the core concepts of technology, students should learn that systems thinking involves considering how every part relates to others. (STL #2, N)
- In order to comprehend the attributes of design, students should learn that there is no perfect design. (STL #8, F)
- In order to comprehend the attributes of design, students should learn that the requirements for a design are made up of criteria and constraints. (STL #8, G)
- As part of learning how to apply design processes, students should be able to make two-dimensional and three-dimensional representations of the designed solution. (STL #11, J)
- In order to select, use, and understand information and communication technologies, students should learn that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas. (STL #17, K)

Source: International Technology Education Association (2000). *Standards for Technological Literacy*. Reston, VA: ITEA. ISBN 1-887101-02-0

### **Benchmarks of Project 2061**

- Almost all control systems have inputs, outputs, and feedback. The essence of control is comparing information about what is happening to what people want to happen and then making appropriate adjustments. This procedure requires sensing information, processing it, and making changes. In almost all modern machines, microprocessors serve as centers of performance control. (Project 2061, #1)
- What use can be made of a large collection of information depends upon how it is organized. One of the values of computers is that they are able, on command, to reorganize information in a variety of ways, thereby enabling people to make more and better uses of the collection. (Project, 2061, #3)

### **Specific Behavioral Objectives and Timelines:**

Unit 1: Course Introduction and Safety Guidelines

Time: 3 days

Goal:

- To introduce the students to the course expectations, discipline policy, and safety guidelines.

Objectives:

- Outline the course expectations and timeline for instruction.
- Discuss the specific discipline policy that relates to behavior in this class.
- Outline the specific safety guidelines of the classroom.

Audio-Visual Needs:

- Overhead projector
- Movie “UVEX PPE Eyewear Training Video/Technology Department Eye Safety”

Computer Needs/Use: None

Assignments:

- Movie related worksheet

Lab Activities: None

Assessment Method:

- Safety Quiz

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2

## Unit 2: Introduction to Technology

Time: 2 Weeks

Goal:

- Introduce the students to the systems of technology education and technological literacy.

Objectives:

- Define technology.
- Describe the difference between science and technology.
- Describe technology as a system, and list and explain the components of these systems.
- Discuss the positive and negative impacts of different technological systems.
- Introduce the design loop and its impact on technological problem solving.
- Introduce the presentation technique of formal documentation.

Audio-Visual Needs:

- Overhead projector
- Previous examples of student work
- SmartBoard technology
- Movie “What’s Up in Technology”
- Text: Hutchinson, J. and Karsnitz, J. (1994). *Design and Problem Solving in Technology*. Albany: Delmar Publishers, Inc.

Computer Needs/Use:

- Internet research

Assignments:

- Homework: *The Design Loop*
- Classwork: *Creating a Design Brief/Technological Outputs*
- Classwork: *Coloring and Shading*
- Homework: *Introduction to Technology Review*

Lab Activities:

- Design Principles Re-Design

Assessment Method:

- Authentic: *Teacher Observation*
- Traditional: *Introduction to Technology Test*

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- STL #1, H
- STL #2, N
- STL #8, F

## Unit 3: Introduction to Power, Energy, and Transportation

Time: 1 Week

Goal:

- Introduce the students to the importance of power, energy, and transportation in today’s society and technology’s impact on transportation systems.

Objectives:

- Define power, energy, and transportation.
- Discuss the importance of the study of power, energy, and transportation.

- Define power, energy, and transportation as its own technological system and an integrated technological system within our society.
- Introduce the history of transportation in the United States and around the world.
- Understand the different uses of energy in transportation.
- Identify with the three basic power systems.
- Discuss the future of transportation and potential careers in transportation.
- Introduce the real life applications of gears and the how to generate mechanical advantage using gears.

Audio-Visual Needs:

- Overhead projector
- Photos
- SmartBoard technology

Computer Needs/Use:

- Instructor: PowerPoint Presentation
- Students: Internet research

Assignments:

- Homework: *Alternate energy as an environmental factor*
- Classwork: *If I were a California lawmaker, this is what I would do...*
- Classwork: *Test review*
- Homework: *Pioneers of transportation*

Lab Activities:

- Work and power conversion (Understand the relationship between energy and power through developing basic gear systems using LEGOS to generate maximum and minimum mechanical advantage.)

Assessment Method:

- Authentic: Teacher observations
- Traditional: Homework, classwork, class participation, unit test

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- Project 2061, #3

Unit #4: Introductory Project - Power

Time: 7 Weeks

Goal:

- To introduce concepts, emphasize documentation, and to implement Microsoft PowerPoint and Publisher as effective teaching and presentation tools

Objectives:

- Identify how different systems and components within transportation, energy, and power systems operate.
- Utilize a variety of different presentation techniques.
- Present how technology has positively and negatively impacted different transportation techniques.

Audio-Visual Needs:

- Various websites
- Overhead projector
- SmartBoard technology

Computer Needs/Use:

- Internet research

- Microsoft PowerPoint
- Microsoft Publisher
- Presentation resource

Assignments:

- Series of interim due dates

Lab Activities:

- Situation: *Design and develop a power system that addresses how the elements of work, power, force, and distance work together to create the most efficient power system.*

Assessment:

- Authentic: Student presentation both oral, written, and designed.

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- STL #1, H
- STL #8, F
- STL #8, G
- STL #11, J
- Project 2061, #3

Unit #5: Introduction to Land Transportation

Time: 1 Week

Goal:

- Introduce the students to the major concepts and factors involved with modern transportation.

Objectives:

- Introduction to the major concepts including friction and inertia.
- Identify the different modes of land transportation.
- Identify the different modes of vehicle propulsion.
- Discuss the guidance, control, and structural systems of land transportation vehicles.
- Introduce the history of heat and steam engines.
- Discuss potential careers and the future of land transportation.

Audio-Visual Needs:

- Overhead projector
- Demonstration tools
- Safe Driving Demo
- Safety Videos and Clips with Air Bag/Vehicle Safety
- SmartBoard technology via the Internet

Computer Needs/Use:

- Student Internet research

Assignments:

- Classwork reviewing information
- Homework: "Identifying and understanding different sub systems of land transportation vehicles in regards to guidance, control, propulsion, structure, support, and suspension."

Lab Activities:

- None

Assessment Method:

- Authentic: Teacher observation
- Traditional: Class participation, Classwork/homework, quiz

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- STL #2, N

#### Unit #6: Alternate Energy

Time: 2 Weeks

##### Goal:

- To introduce the students to the prominent forms of alternate energy, their uses, and technology's impact on their impact, their function, and the environment.

##### Objectives:

- Define renewable energy sources.
- Identify the basic sources of renewable energy.
- Describe the importance of energy as an input to all technology systems.
- Explain how energy technology can make our lives better, and how energy technology can cause damage.

##### Audio-Visual Needs:

- SmartBoard technology
- Overhead projector
- Energy demonstrators and models
- "Get Smart about Energy" CD-Rom from United States Department of Energy
- Hybrid Car Demonstration
- GEMCAR Demonstration
- Segway CD-Rom

##### Computer Needs/Use:

- Student Internet research
- Energy CD-ROM

##### Assignments:

- Classwork/Homework pertaining to material
- Essay "*How energy affects my life?*"

##### Lab Activities:

- Conducting normal life in the midst of a California Rolling Black Out and generating possible alternatives

##### Assessment:

- Authentic: Teacher observation, student presentations
- Traditional: Quiz/Test, class participation

##### Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2

#### Unit #7: Design Project: Land Transportation

Time: 10 Weeks

##### Goal:

- The students will apply their acquired knowledge in order to complete a comprehensive design and problem solving activity.

##### Objectives:

- Implement the steps in the design process.
- Utilize a variety of forms of presentation techniques.
- Apply acquired knowledge into the development of a working prototype.
- Implement the teamwork performance model to maximize group efficiency.

- Introduce a variety of different materials for usage and processing.

Audio-Visual Needs:

- SmartBoard technology
- Examples of student work
- Internet

Computer Needs/Use:

- Student Internet research
- Documentation development
- Word/Publisher
- Digital Camera
- Student presentation using SmartBoard

Assignments:

- Classwork/homework to reinforce concepts
- Interim due dates
- Oral presentations

Lab Activities:

- Situation: *Design and develop a land transportation vehicle that can transport cargo over a specified distance in the shortest period of time.*

Assessment Method:

- Authentic: Comprehensive documentation, teacher observation, teamwork performance, student self and group assessment, daily logs
- Traditional: Class participation

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- STL #1, H
- STL #8, F
- STL #8, G
- STL #11, J
- Project 2061, #3

Unit #8: Small Engine Inspection

Time: 6 Weeks

Goal:

- Introduce the students to one of the major forms of vehicle propulsion, the internal combustion engine.

Objectives:

- Identify the five different systems operating within a four-stroke internal combustion engine.
- Thoroughly inspect and evaluate the form and function of a Briggs and Stratton four stroke engine
- Introduce the form and function of specific small engine parts.
- Properly use the correct tools and processes in order to effectively disassemble, reassemble and run a four-stroke internal combustion engine.

Audio-Visual Needs:

- Overhead projector
- Briggs and Stratton CD-Rom
- Classroom posters
- Parts and tool identification activities

- SmartBoard technology

Computer Needs/Use:

- Briggs and Stratton CD-Rom

Assignments:

- None

Lab Activities:

- Complete engine disassembly and reassembly
- Carburetion, ignition, lubrication, cooling, and structural inspection sheets checked by instructor on periodic dates

Assessment Method:

- Authentic: Student demonstration of ability to correctly manipulate engine, teacher observation, daily log
- Traditional: Series of quizzes on tools, carburetion, ignition, lubrication, and overall construction of the internal combustion engine, unit test

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- STL #2, N

Unit #9: Introduction to Marine Transportation

Time: 2 Weeks

Goal:

- To introduce the students to major concepts, modes, and functions of marine transportation.

Objectives:

- Describe the modes of marine transportation
- Discuss the different routes of marine transportation
- Identify the function and history of several marine vehicles.
- Define and explain buoyancy.
- Understand and apply how and why an object will float.
- Discuss the future of marine transportation and potential careers in this area.

Audio-Visual Needs:

- Internet research and resources via SmartBoard technology
- Models
- Movies
- Marine transportation route maps

Computer Needs/Use:

- Internet research and computer applications

Assignments:

- Classwork/homework assignments

Lab Activities:

- Experiments related to buoyancy and different control/propulsion systems

Assessment:

- Authentic: Teacher observation
- Traditional: Classwork/homework, quiz, test

Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2

## Unit #10: Marine Transportation Activity

Time: 8 Weeks

### Goal:

- The students will apply their acquired knowledge to design and develop a comprehensive marine transportation vehicle.

### Objective:

- List, describe, and implement the steps of the design process in order to develop a comprehensive documentation portfolio.
- Utilize a variety of different forms of presentation techniques.
- Apply the importance of guidance, control, propulsion, and structural systems to the effectiveness of the marine transportation vehicle.
- Apply various concepts within energy and power to the structural design and development of this prototype.

### Audio-Visual Needs:

- Internet resources via SmartBoard technology
- Models and previous examples
- Overhead projectors
- Annotated and developmental orthographic and isometric drawings

### Computer Needs/Use:

- Word/Publisher for documentation development
- Digital camera
- Extensive Internet usage
- E-mail correspondence

### Assignments:

- Classwork/homework
- Interim due dates
- Class presentations
- Complete documentation development

### Lab Activities:

- Design and develop a marine transportation vehicle and the completion of a comprehensive documentation portfolio.

### Assessment:

- Authentic: Teacher observation, documentation portfolio, teamwork performance, daily journals, cooperation, time management
- Traditional: Class participation, Classwork

### Standards targeted via this unit:

- NJCCCS 9.2, 5.4, 8.1, 8.2
- STL #1, H
- STL #8, F
- STL #8, G
- STL #11, J
- STL #17, K
- Project 2061, #3

### Materials/Resources:

Text: None

### Labs:

- Introduction to Power, Energy, and Transportation Activity
- Introduction to the Internal Combustion Engine

- Introduction to Land Transportation Activity
- Introduction to Alternative Energy Activity
- Introduction to Marine Transportation Activity

People:

- Visual Hybrid Car Demonstration

Audio-Visual:

- SmartBoard technology
- Presentation techniques
- Series of movies
- Multiple models
- Previous student work
- Pertinent publications
- Information from United States transportation and energy agencies.

### **Assessment:**

The assessment of student progress in the objectives cited on the previous pages will be primarily by, but not limited to, the following criteria.

Classwork/Homework	10%
Quizzes	10%
Tests	15%
Projects/Labs	35%
Class Participation	30%

### **Midterm and Final Exams last updated 5/2008**

### **Periodic evaluation of objectives and this curriculum guide:**

With the evaluation of a new text every five years, administration requests a curriculum re-write in: **2012**

### **Special Course Policies:**

Success in this course will be based on a variety of factors, however the instructor will most directly assess the student's performance in comprehensive design and problem solving activities, teamwork performance, and class participation as the means of determining a grade. A typical week in class will consist of formal instruction on a variety of material, students working in groups to complete work pertaining to the lecture, research and development, teamwork to generate possible solutions to and solve problems, and in some cases the development of different products and prototypes. Quizzes and tests will be given to re-emphasize and assess the student's understanding of the presented information.

### **Supplementary Readings and Instructors Bibliography:**

Johnson, Stephen R. Exploring Transportation. (Goodheart-Wilcox Company, Tinley Park, Illinois). 2000. ISBN 1-56637-675-0.

Smith, Howard. Understanding Technology. (Goodheart-Wilcox Company, Tinley Park, Illinois). 1998. ISBN 1-56637-374-3.

Wright, Thomas. Technology Systems. (Goodheart-Wilcox Company, Tinley Park, Illinois). 1966. ISBN1-56637-263-1.

### **Homework, Extra Credit Policy:**

Due to the periodic nature of homework in this course, homework will be not be accepted late unless a legitimate excuse exists. Extra credit will be available during the design and problem solving activities in the form of additional research/development and competitive events.

### **Web pages that support learning:**

[www.energy.gov](http://www.energy.gov)  
[www.nasa.gov](http://www.nasa.gov)  
[www.segway.com](http://www.segway.com)  
[www.gemcar.com](http://www.gemcar.com)  
[www.eere.energy.gov](http://www.eere.energy.gov)  
[www.teanj.com](http://www.teanj.com)  
[www.iteawww.com](http://www.iteawww.com)

### **Lab/Classroom set up and special needs:**

This course will be taught implementing a variety of different and state of the art instructional technologies such as:

- Multiple computers
- Multiple workbenches
- SmartBoard technology
- Projection screen and device
- Electrical outlets
- Testing area
- Teamwork areas
- Scanner and digital cameras