General Brown Junior Senior High School

7th Grade Technology Education/STEM

Content Standards

Analyze how an interdisciplinary (STEM) approach to problem solving will yield more successful results.

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and make sense of regularity in repeated reasoning.

Standards for Writing in Science and Technical Subjects:

- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently
- Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Enduring Understandings	Essential Questions
• Using a multi-disciplinary (STEM) approach to problem solving will yield greater results in all fields of study • Science Technology Engineering and Math all go together. • Every lesson is a STEM lesson. • STEM is how things get done in the real world. • STEM is fun!	• How can I solve this problem? • What is the engineering design process? • What are some practical applications of math and science? • How are technical ideas communicated and applied to real world problems? • What does precision mean in engineering and design?

Related Misconception

Science, Technology, Engineering and Math are different subjects that do not relate to one another.

Knowledge/Concepts Students will know…	Skills/Competencies Students will be able to…
• How to use the engineering design process to solve problems. • Math and science need to be applied to solve real world problems. All STEM content areas are dependent upon one another. • Teamwork is essential for solving STEM problems	• Use the engineering design process to solve real-world problems. • Apply math and science in the solution of authentic, real-world problems. • Communicate technical ideas and engineering design solutions verbally, in writing, and through models and prototypes. Measure and model within appropriate parameters and precision.

Assessments Strategies & Tools

Formative Assessment	Summative Assessment
• Peer conferencing • Teacher conferencing • Engineering Journals • Questioning • Exit/Admit Tickets • "Beachball" discussions	• Quizzes • Project and Activity Rubrics • Engineering Journals • E-portfolio • "Shark Tank"

COURSE DESCRIPTION

The 7th grade Technology Education/STEM curriculum ***active, authentic learning situations that allow students to explore technology, engineering, and related careers. Working both individually and in cooperative groups, students explore different technologies, employ the engineering problem-solving process, develop creative and critical thinking skills, and work toward developing a growth mindset.***

The curriculum is designed to give students the opportunity to develop skills and understanding of course concepts through ***activity-, project-, and problem-based (APPB) learning.*** Used in combination with a teaming approach, APPB-learning challenges students to develop their interpersonal skills, creative abilities and understanding of the design process. It also allows students to develop strategies to enable and direct their own learning. Further, the use of authentic, real-world content and activities designed to ***integrate and reinforce studies in all the core academics.***

General Course Goals and Objectives

Upon successful completion of this course students will be able to:

- Apply the engineering design process
- Create technical sketches and drawings
- Document the process and solution of an engineering design problem
- Demonstrate proper measurement and tool use
- Apply mathematics and science principles in the solution of and engineering design problem
- Create 3D solid models
- Solve an authentic engineering problem based on a client's needs/wants

Course Structure

The course will be structured around the following 6 design principles:

- Design Principle #1 **Scaffolded Learning**
  - The engineering learning objectives in each unit are specific and useful in subsequent units.
- Design Principle #2 **Engineering Design Process is Central**
  - The curriculum employs a standardized engineering design process as an instructional framework.
- Design Principle #3 **Authentic Engineering Practices**
  - Students are engaged in meaningful (if simplified) version of the practices of engineers.
- Design Principle #4 **Math and Science are the Tools of the Engineering Design Process**
  - Student work is contextualized within STEM design challenges that can only be completed through the purposeful application of engineering principles and relevant science and mathematics concepts that are clearly necessary for the successful completion of the projects.
- Design Principle #5 **The Message Matters**
  - The STEM design challenges make clear engineering's potential to impact in a positive manner human health and the environment.
- Design Principle #5 **There are NO Right Answers**
  - All STEM design challenges have multiple successful solutions.

General Standards Alignment

- NYS Standard 1 – Analysis, Inquiry and Design
- Framework for 21st Century Leaning
- Common Core Standards for ELA (Writing, Science, and Technical Subjects)
- Next Generation Science Standards for High School Engineering
- Common Career Technical Core

Assessment & Evaluation

As students face challenges, "failure" is not only an ongoing event; it is a necessity to authentic learning! *When you start from scratch, never having experienced working with the tools, materials, and concepts you will be presented with, you LEARN BY DOING. There is no" right way" - there is only your way to a solution. Should that solution not be successful then then you are challenged to: pinpoint and describe the problem? Can you devise an alternative solution? Can you turn "failure" into success?* ***This is the foundation upon which I design and conduct this class.***

As such, assessment will be both formative and summative. Formative assessment will be ongoing and involve observation, questioning, conferencing, journaling, exit and admit slips, etc. Summative assessment instruments will be in the form of rubrics. **Please keep in mind:** ***Process is equal to, if not more important that product in a technology education/STEM environment. A well-researched, well explained "failure" can ultimately be of more learning value than a poorly understood, poorly explained "success."***

UNIT: THE ENGINEERING DESIGN PROCESS

Concept: Invention vs. Innovation

Concepts Addressed in Lesson:

- People of all times and places have increased their capability by innovating and inventing.
- How does invention differ from innovation?
- All technologies have flaws; there is no perfect design.
- Inventions & innovations are the result of demands, values, & interests of individuals, industries, and societies.
- Empathy versus sympathy
- An empathy first approach to design allows you to think outside the box and see the big picture.
- Developing empathy requires research, focusing on the user's feelings, attitudes, and motivations.

Performance Objectives Addressed: It is expected that students will:

- Differentiate between invention and innovation
- Apply empathy in the engineering design process
- Demonstrate an empathy-based approach to the solution of authentic design problems
- Collect information and data leading to a user-friendly solution to an authentic design problem

Concept: Introduction to the Engineering Design Process

Concepts Addressed in Lesson:

- The engineering design process is a systematic problem-solving strategy, with criteria and constraints, used o develop many possible solutions to a problem.
- Engineers solve problems to satisfy human needs and wants.
- The engineering design process is iterative and is informed by a variety of factors.
- There are many design processes that guide professionals in developing solutions to problems.
- The design process most used by engineers includes defining a problem, brainstorming, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating results.
- Design teams use brainstorming techniques to generate large numbers of ideas in short time periods.
- Engineers conduct research to develop their knowledge base, stimulate creative ideas, & make informed decisions.
- A designer uses an engineer's notebook to chronologically document all aspects of a design project.

Performance Objectives Addressed: It is expected that students will:

- Apply engineering notebook standards to document their work.
- Identify and apply group brainstorming techniques and the rules associated with brainstorming.
- Use online and published works to research aspects of design problems.
- Identify the design process steps used in given scenarios.

UNIT PROJECTS

Project supporting this unit will include, but are not limited to:

- 21st Century School Locker
- Assistive Device for an Artist
- Backpack for the 21st Century Student
- Playground Equipment
- Product Evolution
- Redesigning Shelter
- Desktop Toy Challenge
- Toothbrush
- One-Handed Shovel
- "Cool Puppy"
- "5 Chairs"
- "SCAMPER"

UNIT: DESIGN & MODELING

Concept: Technical Sketching and Modeling

Concepts Addressed in Lesson:

- Drawing is an international language.
- Engineers create sketches to quickly record, communicate, and investigate ideas.
- Designers use isometric and multi-view sketching to maintain an object's visual proportions.
- A multi-view projection is the most common method of communicating the shape and size of an object that is intended for manufacture.
- Engineers use CAD models, assemblies, and animations to check for design problems, verify the functional qualities of a design, and communicate information to other professionals and clients.

Performance Objectives Addressed: It is expected that students will:

- Identify, sketch, and explain the function of points, construction lines, object lines, and hidden lines in a mechanical/technical drawing.
- Explain the concepts of technical sketching and drawing.
- Sketch an isometric view of simple geometric solids.
- Sketch multi-view drawings of simple geometric solids.
- Determine the front view for a given object.
- Develop a 3D model from a technical sketch.
- Create a 3D assembly of a technological system.
- Create an exploded view assembly of a technological system.
- Generate the multi-view drawings from a 3D model.

Concept: Measurement and Statistics

Concepts Addressed in Lesson:

- Measurement systems were developed out of a need for standardization.
- Engineers apply dimension and tolerances to drawings to communicate manufacturing information.
- Manufactured parts are often created in different locals, even countries.
- There are various tools of measurement that offer varying degrees of precision.

Performance Objectives Addressed: It is expected that students will:

- Research and design a presentation on the origins of measurement systems.
- Measure and record linear distances using a scale to a precision of 1/16" and 1mm.
- Add and subtract U.S. standard and metric linear measurements.
- Convert measurements from U.S. standard to metric and vice versa.
- Apply dimensions to a Multiview mechanical drawing.

Concept: Core Concepts of Technology and Engineering

Concepts addressed in the lesson

- Core concepts; including systems, resources, requirements, optimization and trade-offs, processes, and controls; serve as cornerstones for the study of technology.
- To design, invent or innovate, a person must understand, analyze, and optimize the technologies that exist in the modern world.
- Engineers must consider the core concepts of technology and other resources such as scientific knowledge during the process of designing. They must also adhere to the criteria and constraints of a design.
- When humans develop and use technology systems and products there is a direct influence, both positive and negative, on our economy, our culture, our environment, and our society.

Performance Objectives Addressed: It is expected that students will:

- Develop a model of a technological system or process and its controls.
- Analyze and evaluate existing products and systems and discuss their impacts, both positive and negative, on their everyday lives.
- Apply the engineering design process in the solution of an engineering design problem.
- Fabricate a working prototype for the solution of an engineering design problem.
- Analyze and evaluate the solution of an engineering design problem to determine its impact.

Concept: Design Briefs

Concepts addressed in the lesson

- Design solutions can be created as an individual or in teams.
- Engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.
- Engineers often qualify the solution to a design problem using a decision-making matrix
- Teamwork requires constant communication to achieve the goal at hand.
- Engineers conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.
- Engineers use a design process to create solutions to existing problems.

Performance Objectives Addressed: It is expected that students will:

- Brainstorm and sketch possible solutions to an authentic engineering design problem.
- Create a decision-making matrix.
- Select an approach/solution that meets or satisfies the constraints given in a design brief.
- Explain what constraints are and why they are included in a design brief.
- Develop a design brief for an authentic engineering design problem.

UNIT PROJECTS

Project supporting this unit will include, but are not limited to:

- Puzzle Cube
- Playground Equipment
- Medical Supply Drop Device
- Candy Dispenser
- Foot Orthosis Device
- "Newton" Scooter
- Marshmallow Catapult
- Spill-proof Candle Holder
- "Mayday!"
- "Sail away!"
- Interview a practicing engineer

UNIT: FORCES & STRUCTURES

Concept: What is a Structure?

Concepts addressed in the lesson

- Engineers and architects are professionals who design structures.
- Architect and engineers design different types of structures.
- A structure is an arrangement and organization of inter-related elements or entities in a system.
- Structures may be natural or human-made/built.
- Natural structures include trees, caves, shells, skeletons, nests, etc.
- Human-made/built structures include buildings, bridges, towers, seawalls, levees, etc.
- A built structure is inly as strong as the soil it sits upon.
- All built structure must have a strong foundation system

Performance Objectives Addressed: It is expected that students will:

- Understand what a structure is and what purposes they serve.
- Identify and classify types of structures.
- Define the concept of a foundation and describe its purpose and importance to all built structures.

Concept: The Shape of Things

Concepts addressed in the lesson

- All built structures are designed using inter-related shapes and solids.
- Shapes and solids can be organic or geometric.
- Certain shapes and solids are inherently stronger than others.

Performance Objectives Addressed: It is expected that students will:

- Identify and classify shapes and solids as either geometric or organic
- Analyze geometric shapes and solids to determine their inherent structural integrity.
- Analyze and evaluate how shapes and solids are combined to create the shape of a structure and improve its strength.

Concept: Forces Acting Upon Structures

Concepts addressed in the lesson

- All structures must be capable of carrying loads and oppose the forces that act upon them.
- Loads are classified as either "live" loads or "dead" loads.
- The loads of a structure must be manipulated to withstand the forces that act upon a structure.
- Compression, tension, and torsion are the major forces that act upon a structure.
- Built structures require a foundation system.
- Civil and structural engineers use structural analysis to assess the forces that could act on a structure and choose materials and reinforcement that will effectively withstand those forces.

Performance Objectives Addressed: It is expected that students will:

- Identify and classify the types of loads that act upon a structure.
- Model the forces of compression, tension, and torsion and explain how the effect that each force has on the built environment.
- Identify structural shapes and solids within an existing structure and discuss how those elements are working as a system to transfer the loads and forces that act upon them.

Concept: Strength of Materials

Concepts addressed in the lesson

- There are common materials used to engineer and design structures: wood, steel, concrete.
- Different building materials allow for different structural and aesthetic designs.
- Different materials have different characteristics regarding the way they resist forces and accommodate loads.
- The way materials are shaped and combined has significant impact on their strength.
- Trusses are a major design element on the design of structures.

Performance Objectives Addressed: It is expected that students will:

- List several materials used in the design and construction of structures.
- Describe several factors that engineers and architects must consider when selecting materials for the design of a structure.
- Test and evaluate the strength of typical building materials.
- Explain the advantages and disadvantages of common materials used in engineering and building structures.
- Identify the load/forces transfer in a common truss.
- Design and test a model balsa wood truss.

Concept: Bridges

Concepts addressed in the lesson

- Bridges have a significant impact on society in terms of transportation and the economy.
- There are different types of bridges for different needs and applications.
- Structural efficiency is the relationship between the strength of a structure in relation its dead loaded weight.
- Bridges (and all structures) must be designed for structural efficiency.
- The factors that affect the type and design of a bridge include:
    - Geography/location
    - Span
    - Expected type and amount of traffic
    - Cost

Performance Objectives Addressed: It is expected that students will:

- Identify the best bridge type for a specified circumstance.
- Virtually design a cantilever bridge to meet specifications.
- Virtually design a suspension bridge to meet specifications.
- Design and fabricate a balsa wood bridge and test its structural efficiency

UNIT PROJECTS

Project supporting this unit will include, but are not limited to:

- Model Truss Design and Test
- Building Materials Testing
- West Point Bridge Designer Virtual Bridge Design
- Balsa Wood Bridge Competition

UNIT: MECHANISMS

Concept: Work and Power

Concepts addressed in the lesson

- Energy is the ability to do work.
- Energy cannot be created or destroyed.
- Potential energy is energy at rest.
- Kinetic energy is the energy of motion.
- Work is the movement or displacement of an object.
- Work is measurable and quantifiable.
- Power is the rate at which work is done. Power is the work/time ratio.
- Work is only done when the force and the motion are in the same direction.

Performance Objectives Addressed: It is expected that students will:

- Define and differentiate the concepts of work and power.
- Model the concepts of potential and kinetic energy.

Concept: Simple Machines – Mechanical Advantage

Concepts addressed in the lesson

- Machines make work easier: Mechanical Advantage
- Simple machines are devices with few or no moving parts that make work easier.
- There are six types of simple machines:
    - Wedge: forces objects or substances apart
    - Wheel & Axle: reduces the friction involved in moving an object, making the object easier to transport
    - Lever simple machine consists of a load, a fulcrum and effort (or force). The load is the object that is moved or lifted. The fulcrum is the pivot point, and the effort is the force required to lift or move the load. By exerting a force on one end of the lever (the applied force), a force at the other end of the lever is created. The applied force is either increased or decreased, depending on the distance from the fulcrum (the point or support on which a lever pivots) to the load, and from the fulcrum to the effort.
    - Incline Plane: makes it easier to lift something by using diagonals (think ramp). The force to lift the object is reduced but the time to move it is increased,
    - Screw: essentially an inclined plane wrapped around a shaft. Screws have two primary functions: they hold things together, or they lift objects.
    - Pulley: used to change the direction of force.

Performance Objectives Addressed: It is expected that students will:

- Define simple machines.
- Identify the six simple machines.
- Select the proper simple machine for a specified task.
- Differentiate between a simple machine and a complex machine.
- Develop a simple machines scavenger hunt for elementary school students.

Concept: Forces & Motion

Concepts addressed in the lesson

- A force is anything that causes acceleration.
- Mass is the amount of matter (stuff) an object has.
- Force and mass are related; the more mass an object has the more force it takes to move it.
- Inertia is an objects resistance to change: the more mass the more inertia.
- Newton's 3 Laws of Motion
- Forces may be balances or unbalanced.

Performance Objectives Addressed: It is expected that students will:

- Explain what a force is.
- Discuss the relationship of mass and force.
- Develop models to demonstrate Newton's 3 Laws of Motion.
- Identify forces that affect your everyday life.

Concept: Hydraulic Power

Concepts addressed in the lesson

- Hydraulic systems use incompressible fluids (e.g. water, oil) to transmit forces from one location to another.
- Most hydraulic systems use cylinders to control the flow (input and output) of the fluid in a system.
- Pascal's Law is the basis of hydraulic systems.
- Pascal's Law says that when there is an increase in pressure at one point (input), there is an equal increase of pressure at another point (output).
- In a straight-line hydraulic system, the pressure exerted on the starting cylinder will be the same as the pressure exerted in the receiving cylinder.

***Performance Objectives Addressed**:* It is expected that students will

- Explain the concept of Pascal's Law.
- Model a simple hydraulic power system:
    - Identify the input and output of the system.
    - Demonstrate how the system is controlled.
- Identify mechanical equipment that employs hydraulic power to function.

Concept: Cams & Gears – Rotary Motion

Concepts addressed in the lesson

- Gears can be used in pairs as well as in multiples.
- Gears are used to transmit rotational motion to a different axis.
- When two gears mesh, if one gear is bigger than the other, a mechanical advantage is produced, with the rotational speeds and torques.
- Gears may used in pairs or in a "gear train"
    - Even numbers of gears create opposing motion.
    - Odd numbers of rears create unidirectional motion
- Cams are rotating or sliding pieces in a mechanical linkage that transform rotary motion into linear motion.
- Cams require a "follower" to create linear motion.
- The cam follower is what creates the displacement in the motion cycle.
- The shape of a cam can be manipulated to create a wide range of motion.

***Performance Objectives Addressed**:* It is expected that students will

- Differentiate between a gear and a cam.
- Discuss the uses/applications of cams and gears
- Model a gear train to produce a specified outcome.
- Model a cam to produce a specified outcome.
- Determine the displacement of a cam.
- 3D model a cam and a gear.

UNIT PROJECTS

Project supporting this unit will include, but are not limited to:

- Spinning Top
- Crash Test Dummies
- Rube Goldberg Machine
- Water clock
- Transfer Challenge
- Reverse Engineering Activity
- "Creative Crane"
- Siege Machines
- Automaton
- Hydraulically Controlled Robotic Arm

UNIT: RENEWABLE ENERGY

Concept: What is Renewable Energy

Concepts addressed in the lesson

- Renewable is a term applied to natural resources and refers to those resources that can be renewed or replenished in a short period of time.
- Renewable energy is also called "clean" or "green" energy because it does not pollute the air or harm the environment.
- As the demand for energy increases renewable energy will play an important role in supplying the worlds clean energy needs.
- The five renewable resources used most often are: solar, wind, hydro (water), geothermal, and biomass.

Performance Objectives Addressed: It is expected that students will

- Explain what a renewable energy source is and identify renewable sources of energy.
- Differentiate how different renewable energy sources work.
- Explain what "clean" energy is.

Concept: Solar Energy

Concepts addressed in the lesson

- The primary source of all energy on planet Earth is from the sun.
- Solar power is power generated directly from sunlight. Solar energy is turning sunshine (photons) directly into electricity (voltage) through a scientific phenomenon known as the photovoltaic effect. The word "photovoltaic" comes from the word "photons", which are particles that make up sunlight, as well as the word "volts", which is a measurement of electricity.
- Today solar cells are commonly used in small handheld devices like calculators and wrist watches. They are becoming more popular for buildings and homes as they become more efficient. One nice thing about solar cells is that they can be placed on the roof of a building or home, not taking up any extra space.
- Solar cells convert the energy of photons from the sun into electricity. When the photon hits the top of the cell, electrons will be attracted to the surface of the cell. This causes a voltage to form between the top and the bottom layers of the cell. When an electric circuit is formed across the top and the bottom of the cell, current will flow, powering electrical equipment.
- It takes a lot of solar cells to power a building or a home. In this case, solar cells are connected into a large array of cells that can produce more total energy.

Performance Objectives Addressed: It is expected that students will

- Explain how sunlight is converted into electricity.
- Discuss solar power as a viable alternative to fossil fuels.
- Identify the concerns or drawbacks associated with solar power.
- Analyze the "reasonableness" of implementing solar power in their community.

Concept: Hydropower

Concepts addressed in the lesson

- Hydropower is power generated from moving water.
- Falling or flowing water inherently has a lot of energy.
- Using rivers and waterfalls to power mechanical devices is an ancient concept.
- The energy from the water is harness by forcing it through a condensed are which then turns the blades of a turbine which in turns spins an electric generator.
- Like any power source hydropower has its advantages and disadvantages.
    - Loss of land and damage to ecosystem when dams are built and lakes are created.
    - Methane emissions generated by the turbines.
- The communities you live in were developed because of the Black River.

Performance Objectives Addressed: It is expected that students will

- Explain how flowing water is converted into electricity.
- Discuss hydropower as a viable alternative to fossil fuels.
- Identify the concerns or drawbacks associated with hydropower.
- Analyze how hydropower has impacted the communities you live in.

Concept: Wind Power

Concepts addressed in the lesson

- Wind power is energy generated directly from the wind.
- Wind turbines are required to capture the energy produced by wind.
- A collection of wind turbines is called a wind farm.
- Wind turbines are large structures and typically have 3 blades.
- Wind turbines work the opposite of fans. Rather than use electricity to turn the blades to create wind, they use the wind to turn the blades to run a turbine to create electricity.
- Engineers do analysis and calculations to determine the best areas to place wind turbines. The wind will not blow all the time, so the important thing is how much the wind blows on average.
- Wind power has disadvantages that, as a result, make wind power and wind farms often a source of controversy.

***Performance Objectives Addressed**:* It is expected that students will

- Explain how wind is converted into electricity.
- Discuss wind power as a viable alternative to fossil fuels.
- Identify the concerns or drawbacks associated with wind power.
- Analyze how wind power and wind farms has impacted the area of New York State that you live in.

Concept: Biomass: Biofuels & Biodiesel

Concepts addressed in the lesson

- Biomass is any material made by plants and animals that can be converted into energy.
- Biomass has energy stored in it from the sun. Plants get energy from the sun through a process called photosynthesis. Animals get their energy indirectly from the sun by eating plants.
- Biomass energy is considered a renewable energy source because we can always grow more plants and trees. It is not an infinite resource, however, as there is only so much land and water to grow plants.
- Biomass comes in many forms: wood, crops such as corn, manure, even garbage.
- One way to release the energy from biomass is to burn it.
- When biomass rots it produces methane gas, which can be used to make natural gas (a common form of energy). As such, when garbage rots in a landfill, the methane gas produces and be captured and used as energy.
- Farms can use the manure from their animals to capture methane gas and create energy.
- Biofuels, like corn and sugar cane can be converted into ethanol. Ethanol is used to power cars. The first cars (Model T were powered with ethanol.
- Vegetable oils and animal fats are used to create biodiesel. Biodiesel can be used as heating oil as well as to power diesel vehicles.
- Biomass has disadvantages such as:
    - Air pollution from burning
    - Releasing greenhouse gasses such as carbon dioxide into the atmosphere
    - Burning trash and waste can release harmful chemicals and gasses into the environment
    - The land cleared for growing corn and sugar cane can reduce habitats and destroy ecosystems
    - The land used for growing biomass could be used to grow other crops for food
- Despite so many negatives associates with biomass, many believe it is a better and cleaner alternative to fossil fuels.

***Performance Objectives Addressed**:* It is expected that students will

- Explain what biomass is.
- Differentiate between biofuels and biodiesel
- Identify the concerns or drawbacks associated with biomass.
- Debate the use of biomass versus fossil fuels.

Concept: Geothermal Energy

Concepts addressed in the lesson

- The inside, or core, of the Earth is very hot. This heat sometimes breaks through to the surface of the Earth through volcanoes or geysers.
- When we use heat from the Earth to generate energy it's called geothermal energy.
- Geothermal plants are clean and have little negative impact in the environment.
- Iceland and the Philippines use extensive amounts of geothermal energy.
- Geothermal energy is captured in 3 ways:
  - Geothermal heat pumps
  - Direct use (example: hot water from hot springs)
  - Generating Electricity
- The main disadvantage of geothermal power is the cost, although there is danger of tapping into gas pockets when drilling or even the possibility of causing an earthquake during construction.

Performance Objectives Addressed: It is expected that students will

- Define geothermal energy.
- Explain how geothermal energy can be captured and used for power or heating and cooling.
- Identify natural sources of geothermal energy.
- Identify the concerns associated with geothermal power.

UNIT PROJECTS

Project supporting this unit will include, but are not limited to:

- Solar Show Tool
- Ice Cube Meltdown
- "Funnel the Sun"
- Shoebox Solar Water Heater
- Build a Better Pinwheel
- Using Wind to Create Measurable Power
- Design and fabricate a Hydropower Turbine
- Solar Oven
- Forces of Water Explorations
- Siting a Wind Farm
- Turbine Blade Investigation
- Working Water Wheel
- Siting a Dam
- Model a Hydropower System
- Design and Fabricate a Simple Steam Engine
- Burning Biomass
- Yeast-powered Vehicle
- "Fermentation Experimentation"
- Growing Biomass: Soil vs. Hydroponics