PTI### - Green Technology Engineering
DoDEA Career and Technology Education
COURSE SYLLABUS

I. COURSE NUMBER AND TITLE: PTI###, **Green Technology Engineering**

II. CREDIT: 2 Semesters (1 Year)

III. PREPARATION: Students enrolling in this course will apply math and science to develop technology and engineering skill sets.

IV. COURSE DESCRIPTION: The Green Technology course teaches 9th through 12th grade students the engineering and design processes in alternative and renewable energy systems. Students progress at their own pace while studying and performing tasks independently and in small groups. Lessons are delivered in an atmosphere of differentiated learning using hands-on activities. Learning is supplemented with demonstrations, mentorship, and study trips familiarize students with the concepts and application of green technologies. Students will gain first-hand knowledge by performing laboratory experiments immolate the industry of our future energy systems.

V. COURSE OBJECTIVES:

Upon completion of this course, students will:

1. Address smart energy and green infrastructure.
2. Demonstrate safe behavior and practices in a laboratory environment.
3. Understand the history, global, environmental and economical impacts of green technology.
4. Identify technological systems that will function with renewable energy resources.
5. Apply math and science to develop solutions to address non-renewable energy challenges.
6. Apply the Engineering and Design processes to solve problems.
7. Practice troubleshooting techniques in the installation, function, and maintenance of green technology systems.
8. Build models that simulate sustainable and renewable green technology systems.
9. Investigate the careers opportunities from on-the-job training to jobs requiring post secondary education in the renewable energy fields.
10. Explore industry certification (Leadership in Energy and Environmental Design-LEED) possibilities through the U.S. Green Building Council.
11. Develop, and present technical reports through project learning.

VI. COURSE OUTLINE

1. Set Expectations for Student Success
2. Relate Safety to Green Technology
3. Identify Renewable Energy Systems
4. Apply the Engineering and Design Process as a foundation to Green Technology Engineering
5. Understand the impact of continued use of non-renewable energy resources
6. Investigate renewable energy systems
   a. Wind
      i. Introduction
         1. Basic concepts
         2. Source of wind energy
         3. Uses of wind energy
      ii. Science of Wind Energy
         1. Basic math that apply
         2. Scientific principles that apply
      iii. Energy Concept
         1. Kinetic Energy Concepts
            a. Electro-Magnetism
            b. Wind Turbine Technology
      iv. Electricity Concept
         1. Production of wind electricity
         2. Transmission of wind electricity
         3. Storage of wind electricity
         4. Uses of wind electricity

v. Transportation Energy Concept
    1. Production of wind fuel
    2. Storage of wind fuel
    3. Uses of wind fuel

b. Hydroelectric and Fuel Cells
    1. Basic concepts
    2. Sources of hydroelectric and fuel cell energy
    3. Uses of hydroelectric and fuel cell energy

ii. Science of Hydroelectric and Fuel Cell Energy
    1. Basic math that apply
    2. Scientific principles that apply

iii. Energy Concept
    1. Production of hydroelectric and fuel cell electricity
    2. Transmission of hydroelectric and fuel cell electricity
    3. Storage of hydroelectric and fuel cell electricity

iv. Electricity Concept
    1. Production of hydroelectric and fuel cell electricity
    2. Transmission of hydroelectric and fuel cell electricity
    3. Storage of hydroelectric and fuel cell electricity
    4. Uses of hydroelectric and fuel cell electricity

v. Transportation Energy Concept
    1. Production of hydroelectric fuel
    2. Storage of hydroelectric fuel
    3. Uses of hydroelectric fuel

c. Solar Energy

i. Introduction
    1. Basic concepts
    2. Source of solar energy
    3. Uses of solar energy

ii. Science of Solar Energy
    1. Basic math that apply
    2. Scientific principles that apply

iii. Energy Concept
    1. Reflection of solar energy
    2. Absorption of solar energy
    3. Concentration of solar energy

iv. Electricity Concept
    1. Production of solar electricity
    2. Transmission of solar electricity
    3. Storage of solar electricity
    4. Uses of solar electricity

v. Transportation Energy Concept
    1. Production of solar fuel
    2. Storage of solar fuel
    3. Uses of solar fuel

d. Biomass
    1. Basic concepts
    2. Sources of biomass energy
    3. Uses of biomass energy

ii. Science of Biomass Energy
    1. Basic math that apply
    2. Scientific principles that apply

iii. Energy Concept
    1. Biofuel
    2. Heat Energy

iv. Electricity Concept
    1. Production of biomass electricity
    2. Transmission of biomass electricity
    3. Storage of biomass electricity
    4. Uses of biomass electricity

v. Transportation Energy Concept
    1. Production of biomass fuel
    2. Storage of biomass fuel
    3. Uses of biomass fuel

7. Understand energy consumption and efficiency
8. Develop and apply STEM to optimize renewable energy solutions
9. Explore the requirements to become LEED certified

VII. REQUIRED RESOURCES:

Thames & Kosmos
Fuel Cell X7
Hydrogen Powered Car
Product #: 628777
Product Line: Electronics

Thames & Kosmos
Power House
Product # 626112
Product Line:
Alternative Energy

Horizon Fuel Cell
Technologies
Renewable Energy Kit
Product #: FCJJ-27
Product Line: Education
Kits/Toys

Safety glasses for each
student
Horizon Fuel Cell
Technologies

Renewable Energy Monitor

VIII. PREPARED: September 20, 2010

DoDEA – Career and Technology Education
Green Technology Course - Scope and Sequence

Competency Area	Duration	Major Understanding	Activities / Assessments
Quarter One			
Set Expectations for Student Success	.5 weeks	Students will demonstrate an understanding of the expectations for successful completion of Green Technology course. Students will understand the history, social impact, and fundamentals of green technology.	Pre-Test, Exercises Practicum Post-Test
Relate Safety to Wind, Hydroelectric, Fuel Cell, Solar & Biomass Technologies	.5 weeks	Students will demonstrate safe behavior and practices in a laboratory environment. *Should be integrated throughout curriculum	Pre-Test Exercises Practicum Post-Test
Introduce Wind Technology	1 week	Students will understand the physics of wind and the application of wind technology	Pre-Test Exercises Practicum Post-Test
Understand the Science of Wind Technology	1 week	Students will understand the potential and kinetic energy of wind applied to mechanical energy production.	Pre-Test Exercises Practicum Post-Test
Produce electrical energy via a wind-driven generator	4 weeks	Students will create a wind-driven model that will produce electricity. *Use Horizon kit & experiments in the Power House manual **Emphasize safety procedures	Pre-Test Exercises Practicum Technical Report Post-Test
Explore control mechanisms of wind-generated electricity	2 weeks	Students will learn how to store and control electricity that is produced from wind-generated electricity. *Use Horizon kit & experiments in the Power House manual **Emphasize safety procedures	Pre-Test Exercises Practicum Technical Report Post-Test
Quarter Two			
Introduce Hydroelectric & Fuel Cell Technologies	1 week	Students will understand the physics of hydroelectric and the application of hydroelectric technology	Pre-Test Exercises Practicum Post-Test
Understand the Science of Hydroelectric & Fuel Cell Technologies	1 week	Students will understand the potential and kinetic energy of hydroelectricity in regards to mechanical energy production.	Pre-Test Exercises Practicum Post-Test
Produce electrical energy through a hydroelectric system and through a fuel cell system	3 weeks	Students will create a water-driven model that will produce electricity. *Use Horizon-modified kit or have students build their own paddlewheel or water meter/flow meter & Use Power House experiments **Emphasize safety procedures	Pre-Test Exercises Practicum Technical Report Post-Test

Explore control mechanisms of hydroelectricity and fuel cells	2 weeks	Students will learn how to store and control electricity that is produced from wind-generated electricity. * Use Horizon-modified kit or have students build their own paddlewheel or water meter/flow meter & Use Power House experiments **Emphasize safety procedures	Pre-Test Exercises Practicum Technical Report Post-Test
Build a Hydrogen Powered Car-Fuel Cell X7	2 weeks	Students will build the Hydrogen powered car kit as a culminating activity **Emphasize safety procedures	Practicum Technical Report
Quarter Three			
Introduce Solar Technology	.5 week	Students will understand the physics of solar energy and the application of solar energy.	Pre-Test Exercises Practicum Post-Test
Understand the Science of Solar Technology	1 week	Students will understand the concepts and applications of solar energy.	Pre-Test Exercises Practicum Post-Test
Understand basic electronics	2 weeks	Students will understand parallel and series circuitry and basic electronic components. Students will understand photovoltaic cells (PV).	Pre-Test Exercises Practicum Technical Report Post-Test
Construct a photovoltaic circuit	1 week	Students will learn how collect and measure solar energy from a PV cell. * Use Horizon renewable energy kit **Emphasize safety procedures	Pre-Test Exercises Practicum Technical Report Post-Test
Construct a solar oven	2 weeks	Students will build a solar oven to learn how radiant energy can be reflected and absorbed by objects which is converted into heat. **Emphasize safety procedures	Pre-Test Exercises Practicum Technical Report Post-Test
Understand how solar energy is collected and stored	2.5 weeks	Students will understand how solar energy is collected, stored and used as needed. * Use Horizon renewable energy kit **Emphasize safety procedures	Pre-Test Exercises Practicum Post-Test
Quarter Four			
Introduce Biomass Technology	.5 week	Students will understand the physics of biomass energy and the application of biomass energy.	Pre-Test Exercises Practicum Post-Test
Understand the Science of Biomass and Biofuel Technologies	.5 week	Students will understand the concepts and applications of biomass energy.	Pre-Test Exercises Practicum Post-Test

Understand how biomass is produced	.5 week	Students will conduct an experiment (Peanut Power) that will show how biomass is produced.	Pre-Test Exercises Practicum Technical Report Post-Test
Construct and Test a Functional Green Technology Power System Model	7.5 weeks	Students will construct and apply learned theory to a model house and peripherals capable of sustainable energy generation and consumption. **Emphasize safety procedures **Thames Kosmos Power House Kit	Scenario-based Projects Capstone Project Technical Presentation Competency Profile