Program	**Manufacturing Technology: Scientific Inquiry**
Eight	Teacher's Guide

A modern kitchen is a much different place now than what it was 50 years ago. While you might find the same appliances -- a stove, a refrigerator and a dishwasher -- they would look and function much differently. As time has passed, consumers needs have changed.

The dishwasher, once viewed as a status symbol, is now seen by many as a necessity for our busy lives. According to the Department of Energy, in 2001, 53 percent of U.S. households had dishwashers. This represents a sizeable number of families, and as a consequence, the possibility of a significant environmental impact. This impact could be measured in terms of energy use, water use and waste production.

Our need to protect the environment and conserve energy has increased, and home appliances have had to improve to meet that need. Home appliances, such as dishwashers, are now designed as much to save water and electricity as they are to address the needs modern households.

Companies such as Whirlpool, in Findlay, Ohio, need not only address the design needs of consumers, but the broader needs of the community as well.

Program Objectives

Students will learn that:

- Science and scientists are at work in northwest Ohio solving the problems posed by declining resources and high energy costs.
- Businesses and governments routinely apply the process of scientific investigation to access risk and cost to the community and environment.
- Science skills learned in high school are needed in the workplace.

Ohio Science Standards

Life Science

Benchmark G

Describe how human activities can impact the status of natural systems.

Indicator 18, Grade 10

Describe ways that human activities can deliberately or inadvertently alter the equilibrium in ecosystems. Explain how changes in technology/ biotechnology can cause significant changes, either positive or negative, in environmental quality and carrying capacity.
Indicator 19, Grade 10
Illustrate how uses of resources at local, state, regional, national and global levels have affected the quality of life (e.g., energy production and sustainable vs. nonsustainable agriculture).

Scientific Ways of Knowing
Benchmark D
Recognize that scientific literacy is part of being a knowledgeable citizen.
Indicator 9, Grade 9 and Indicator 7, Grade 10
Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.

Science and Technology
Benchmark A
Explain the ways in which the processes of technological design respond to the needs of society.
Indicator 3, Grade 9
Explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined.
Benchmark B
Explain that science and technology are interdependent; each drives the other.
Indicator 2, Grade 10
Describe examples of scientific advances and emerging technologies and how they may impact society.

Materials
- Computer with access to the Internet
- Paper and pen
- Handouts

Pre-Viewing Activity – Prepare to Learn
Dishwashers are found in most homes and apartments. While it is hard to imagine thinking critically about appliances, it is possible. Discuss the features associated with today's appliances. For example, the water and energy saver features reflect changes that have come with the realization that we need to reduce our impact on the environment. While within any model year the change might be incremental, over the years the changes have been significant. For example, the change in the detergents we use has led to a significant reduction in algae growth in Lake Erie and improved water

quality as a consequence. In northwest Ohio we take water for granted, but in large desert communities such as Phoenix, Arizona, water is precious and the benefit of water saving appliances is immense. We live in a big country and much of it is dry. Protecting and saving water is important.

Discuss some of the design considerations that might go into an appliance. Clearly there are style considerations, but what about environmental ones? Think about this, ecosystems sustain the basic processes that affect humans and animals, and activities such as washing dishes and clothes can affect an ecosystem in a dramatic way. For example, the way we wash dishes, in many cases, we use less water and energy by using a dishwasher than by washing dishes by hand. While on an individual level this might not seem significant, on a societal level the savings are huge. Dishwashing is one of many factors that effect environmental quality; it is part of a broader system of human activity that in total has a substantial impact on the environment. Small changes can yield big results.

Vocabulary

- Tall tub
- ENERGY STAR

Related Discussion Items

- How important are appliances that conserve power to your family's well being?
- How important are appliances that conserve water to your family's well being?
- Designs need to be continuously reevaluated in light of changing social needs and improving scientific knowledge.
- Communication is an important skill in the workplace, as is the ability to make accurate observations and communicate those observations to others.
- The use of home appliances can have a substantial impact on the environment.

Activity

Create a cognitive map as a follow-up to the guided discussion. Some possible items might be the social and environmental benefits of sustainable energy versus non-renewable sources. This discussion might evolve around how cost savings might benefit job creation.

Quiz

1. The workplace has changed over the years. Industries today need workers to be highly knowledgeable in math and science.

   True or False

2. There are many advantages to modern dishwashers. The invention of the "tall tub" not only allows a family to load more dishes, but in addition, results in less water and electric use.

   True or False

3. The use of dishwashers is a human activity that has a clear impact on the environment.

   True or False

4. The design of appliances, such as dishwashers, needs to be continuously reevaluated to address the changing needs of society, from both a stylistic, as well as an efficiency stand point.

   True or False

5. When working on a production line, it is necessary to be able to present accurate data using clear language and also be able to propose solutions to workplace problems.

   True or False

Related Lesson Plans

Ohio Watershed Network
(ORC# 350)
The purpose of the Ohio Watershed Network is to improve and protect Ohio's water resources through the creation of a statewide information and education network in support of local watershed protection efforts. The web site resources include a virtual watershed tour of Ohio, a glossary of watershed related terms.

False Assumptions Can Get You in Trouble
(ORC#686)
Little deceptive problem stories are presented to the class, and students are challenged to solve each problem by asking only yes/no questions. The key is for students to recognize that the False Assumption is what makes the solution tricky, and that many common problems are difficult to solve because we tend to assume a particular paradigm.

Educational Resources

Additional Resources Using: D3A2

Search String = environmental management
impact on environment

The **D3A2** helps educators analyze data, and then points them to resources such as lesson plans, assessments and activities designed specifically to address the academic need identified by the data. In addition to linking content to data analysis, educators will have general search capabilities to locate education content resources aligned to the Ohio's Academic Content Standards. Examples of the state resources queried are:

INFOhio
http://www.infohio.org/

Ohio Resource Center
http://ohiorc.org/

Other Resources

ENERGY STAR – Dishwasher Energy Saving Campaign
http://www.energystar.gov/ia/partners/downloads/meetings/DesMarais_DW_Campaign.pdf

ENERGY STAR http://www.energystar.gov/

ENERGY STAR – Dishwashers
http://www.energystar.gov/index.cfm?c=dishwash.pr_dishwashers

ENERGY STAR - Saving Water
http://www.energystar.gov/index.cfm?c=products.pr_protect_water_supplies