SUGGESTED REFERENCES

- **Perpetual Motion: The History of An Obsession**
  W.J.G. Ord-Hume
  June 1998
- *Eric's History of Perpetual Motion and Free Energy Machines*
  http://www.phact.org/e/dennis4.html
- *Perpetual Motion*
  Kevin T. Kilty
  Copyright 1992, 1999 All Rights Reserved
  http://www.kilty.com/pmotion.htm
- *Professor Hibbert's Perpetual Motion Page*
  http://www.chem.unsw.edu.au/staff/hibbert/perpetual/default.html
- *The Museum of Unworkable Devices*
  http://www.lhup.edu/~dsimanek/museum/unwork.htm

NATIONAL SCIENCE EDUCATION STANDARDS

9 - 12

Science as Inquiry

Abilities necessary to do scientific Inquiry

Understanding about scientific inquiry

Physical Science

Motions and forces

Interactions of energy and matter

9 - 12

Science and Technology Standards

Abilities of technological design

Understanding about science and technology

Science in Personal and Social Perspectives

Science and Technology in local, national, and global challenges

**Source: National Science Education Standards, 1996, National Academy Press*

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THE QUEST FOR 'FREE' ENERGY

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SYNOPSIS

Can we get energy out of nothing? This is a highly debated topic. However, there is a curiosity that has motivated scientists, inventors, artists, and many others to explore the idea of a perpetual motion machine. A perpetual motion machine is a device that would work in continuous operation as an isolated mechanical device or other closed system without a sustaining energy source. Sometimes, if the premise is to produce excess energy that can be used to power another source, it is referred to as a "free energy" machine.

This edition of SCIENCE SCREEN REPORT looks at several inventors' quest in creating a perpetual motion machine. There are theories that these machines could be powered from antigravity, energy from lightning charging the ionosphere, and self-driven electromagnetic engines.

CURRICULUM UNITS

- ENGINEERING
- PHYSICAL SCIENCE
- PHYSICS

RUNNING TIME

23:50

BACKGROUND

What if all of our energy needs were totally free? The people behind the quest for perpetual motion machines tend to think that our society would be restructured. Power bills would be non-existent. Our dependency on fossil fuels would fade. Pollution could see a drastic change as coal, oil, gas, and nuclear power dissolve. Poor countries could rid themselves of famine, and prosper for a change. However, over time, thousands of promising perpetual motion designs have proven to be failures. Even in the face of adversity, these inventors still feel that somewhere there is a hidden trick, or way around some laws of physics. Even as their obsession with the subject grows, the skeptics are equally as obsessed with disproving their claims.

In the program, perpetual motion skeptic Eric Krieg discusses his stance on perpetual motion machines, offering prize money to anyone with a successful attempt. Krieg meets with French inventor Aldo Costo to inspect his claim of a large perpetual motion machine. Also under scrutiny and debate is a design by Norwegian artist/inventor Reidra Finsaud. In his design, a harmonious relationship between a rolling ball, magnets, and pendulums shows promise in attaining perpetual motion.

Conventional scientists claim that a perpetual motion machine is impossible because of the current laws of physics. It would break the Laws of Thermodynamics. The First Law of Thermodynamics, also known as the Law of Conservation of Energy, states that energy can be neither created nor destroyed. The total energy within a system is a constant; although a system can turn one form of energy into another, the net output can never be greater than the net input. The Second Law of Thermodynamics, also known as the Law of Entropy, states that heat cannot be turned into other forms of energy with 100% efficiency. In any system involving the conversion of energy, some amount of energy will be dissipated into the environment in the form of heat.

Science has always moved forward in small steps and large steps. The program discusses how an automobile uses only 30% of the energy contained in the gasoline. The other 70% is wasted in friction and heat. Even if perpetual motion is unattainable, these inventors can still make an attempt at a machine that is more effective in the work that it does and the energy it produces.

ADVANCED ORGANIZERS

Prior to viewing this video, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 1: The Nature of Science

Section A - The Scientific World View
Know by Grade 8

- When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, and it often takes further studies to decide. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as correct.
- Scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.
- Some scientific knowledge is very old and yet is still applicable today.

ADVANCED ORGANIZERS (continued)

Know by Grade 12

- Scientists assume that the universe is a vast single system in which the basic rules are the same everywhere. The rules may range from very simple to extremely complex, but scientists operate on the belief that the rules can be discovered by careful, systematic study.
- From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Change and continuity are persistent features of science.
- No matter how well one theory fits observations, a new theory might fit them just as well or better, or might fit a wider range of observations. In science, the testing, revising, and occasional discarding of theories, new and old, never ends. This ongoing process leads to an increasingly better understanding of how things work in the world, but not to absolute truth. Evidence for the value of this approach is given by the improving ability of scientists to offer reliable explanations and make accurate predictions.

Section B - Scientific Inquiry
Know by Grade 12

- Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories.
- There are different traditions in science about what is investigated and how, but they all have in common certain basic beliefs about the value of evidence, logic, and good arguments. And there is agreement that progress in all fields of science depends on intelligence, hard work, imagination, and even chance.

Benchmark 4: The Physical Setting

Section E - Energy Transformations
Know by Grade 8

- Energy cannot be created or destroyed, but only changed from one form into another.
- Energy appears in different forms. Heat energy is in the disorderly motion of molecules; chemical energy is in the arrangement of atoms; mechanical energy is in moving bodies or in elastically distorted shapes; gravitational energy is in the separation of mutually attracting masses.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

CRITICAL THINKING EXERCISES

1. After showing the video, ask your students the following:
   a) How many students think it is possible to build a perpetual motion machine? Why?
   b) If a "free energy" machine were ever created, what would be its immediate impact on society?
   c) The program discusses the efficiency of a gasoline automobile engine. How and where is energy lost in the process to make the effectiveness only 30%?

2. Have students stand up dominoes in a figure eight pattern. Have students set the dominoes in motion from two different points (once in the same direction of each other, and then in the opposite direction of each other). Have them predict the outcome and discuss the results.

3. Divide the students into groups and have them design and draw their own ideas for a perpetual motion machine. Have the groups compare ideas and explain why they think certain ideas might work, and why other ideas will not work.

CAREER POSSIBILITIES

- ENGINEER
- PHYSICIST