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Module 3 – Lesson 7 Narrative: *Considering Alternative Energy*

By now, you surely have the idea that energy is a precious commodity in modern cities. The laws of physics tell us that we cannot create energy. We can only change its form. Although all of the energy available on earth can track its origin back to the sun, we tend to use it in forms that are not easily renewable on a human time scale. Fossil fuels, such as petroleum, coal and natural gas are powerful sources of energy, but their supplies are limited. The rich supplies of these fuels were created millions of years ago by the breakdown of organisms that occurred during previous changes in the earth's climate. Under current conditions on earth, no new sources of these fuels are being created. However, we are consuming these fuels as though they are supplies that will never run out. This could not be farther from the truth.

Current world consumption of fossil fuels is staggering. Nearly 75 million barrels of oil are consumed each day in the world, 19 million barrels in the United States. Each year, 5 billion tons of coal are used worldwide, with the United States using over 1 billion tons. During the industrial revolution of the past century, fossil fuel was relatively cheap. Consumption grew twenty-fold and replaced the traditional dependence on biomass fuels such as wood and animal dung. These traditional biomass fuels were renewable, but packed less energy and so were not as efficient in powering industrial activities. Demand for fossil fuels is still rising as giant nations such as China and India rush to modernize their economies. Many experts in the field of energy believe that the accessible supplies of coal and oil are running out and the risk and expense of getting the remaining supplies are overwhelming. In this lesson, we will explore some of the alternatives that are emerging in the energy marketplace. Some of the energy alternatives are renewable and some are new that can take on old sources like clean coal and natural gas. Some of these sources are still polluters and produce varying amounts of greenhouse gasses.



Left: The Brayton Point coal fired electrical power plant in Somerset Massachusetts. The site is an important source of power generation for Boston. This plant is one of the worst industrial polluters in New England. According to the Conservation Law Foundation, the plant emitted 45,000 tons of sulfur dioxide (acid rain) in 2000, along with 8 million tons of carbon dioxide (global warming) and 240 lbs. of mercury. Coal produces nearly half of all of the electricity consumed in the United States and 90% of all the coal mined is used for electrical power generation. Modern technologies have found ways to make the burning of coal less of an insult to the environment, but impacts of mining the coal take a huge toll on the earth's ecosystems. The 2006 Sago Mine disaster in West Virginia where a dozen miners died reminds us that mining coal can be very dangerous.

With traditional fossil fuel reserves dwindling and becoming much more expensive, humans are challenged to find alternative forms of energy generation that can be relied upon for relatively clean and affordable power. Despite efforts to change the energy use patterns of people, energy demands are accelerating in the United States and worldwide. As a species, we must find ways to power our technology and do as little damage to the earth as possible. Many scientists and technology experts believe that renewable sources of energy provide a possible solution to our energy dilemma. All potential sources of energy have economic and environmental trade-offs. There is simply no way of generating energy that does not have some negative impacts on the ecology of systems. However, as a species we can make wise choices with respect to energy generation and consumption that can help to preserve the earth's biosphere. Here we investigate some of these alternative energy sources and consider the challenges associated with their use. Some are renewable, such as solar power. Other sources not, such as natural gas.

Renewable energy sources cannot be exhausted. That is good news for humanity. They are constantly being generated by nature. Sunshine, wind, tides and water continue to impact the earth's surface. They are tremendous sources of potential energy if the technology can be created to capture the energy in affordable ways. For instance, the tide rises and fall more than ten vertical feet twice each day in Boston Harbor. Billions of gallons flow into and out of the harbor basin each day. Their movement generates enormous amounts of energy. Some cities have found ways to capture the energy of the tides and use it to make electricity. A tidal power plant on the Rance River in France generates nearly 700 Gwh of renewable electrical power each year. The power plant produces practically no air pollution, which is a great advantage. However, the silting of the river caused by the turbines that create the electricity, has devastated the local biodiversity and altered the flow of the river. Engineers are learning from this installation in an effort to create less negative impact on future projects. Other renewable sources of power include solar energy, hydropower, wind energy and nuclear fusion. In this lesson, we try to power a city with renewable and non-renewable energy generating as little negative impact as possible.



Left: North Hoyle wind farm in the Netherlands. A proposal to build 130 Turbines such as these is proposed for a site off the coast of Cape Cod, near Boston. Designed to generate nearly 400 MW of electrical energy under peak conditions, the wind farm could power a city of nearly 250,000 people with clean renewable energy. However, the potential environmental impacts to the natural ecology and the visual impacts of the coastline have many people worried and against the project. State and Federal reviews have found that the turbines will have a relatively low impact on the environment and as oil tops \$80 a barrel, many local residents are coming out in favor of the windfarm. Proponents of the project hope to start building by 2009.