

# Non-Renewable versus Renewable Resources

## Aim

The aim of this exercise is to illustrate the concepts of non-renewable resources and renewable resources by comparing oil power and solar power.

## Introduction

Fossil fuels like oil and gas are referred to a non-renewable resource whereas solar energy is referred to as a renewable resource, but what do these terms really mean? In this exercise we will do some simple calculations to find out.

We will calculate the annual rate at which energy is produced by oil formation and compare it to the rate at which we use it. We will then repeat the exercise for solar energy.

We will see that oil energy is produced more slowly than we use it up. In other words it is a diminishing resource that is not renewing itself faster enough. In contrast we will see that the sun is producing energy more rapidly than our global energy needs. In other words, the sun's energy is renewing itself.

## Numbers

This exercise involves simple calculations. However the numbers you will handle are very large indeed. You will need to be extremely careful in your working and always use a calculator. Before beginning the exercise, note that:

A million is $1 \times 10^6$ ,	or 1,000,000	
A billion is $1 \times 10^9$ ,	or 1,000,000,000	
A trillion is $1 \times 10^{12}$ ,	or 1,000,000,000,000	A
quadrillion is $1 \times 10^{15}$ ,	or 1,000,000,000,000,000	

## Energy production from oil

Oil is a fossil fuel. It forms through the build up of plankton on the sea floor and slow heating in the Earth's pressure cooker over many million years. Over the past 200 million years, oil source rocks have produced somewhere in the region of 2.2 trillion barrels of oils.

Calculation 1: Work out the number of barrels of oil formed each year as an average over the past 200 million years

We can express the amount of energy in a barrel of oil using British Thermal Units (BTU). One barrel of oil provides energy equivalent to 5.8 million BTU

Calculation 2: Work out the average number of BTUs produced each year by oil formation (i.e. 5.8 million multiplied by your answer in Calculation 1)

## Energy production from solar power

Solar power is energy captured from sun. The amount of solar power produced can also be expressed in BTUs. Averaged over the whole surface of the Earth, the sun produces about 100,000 BTU per square metre per year. The surface of the Earth is approximately 510 trillion square metres.

Calculation 3. How many BTUs are available each year from solar energy?

## Comparison

Globally we use about 400 quadrillion BTU of energy each year. Compare this figure with your annual rates of energy production for oil power and solar power. What does your comparison tell us about the future of oil as an energy resource? What is the difference between a non-renewable and renewable resource?

## Answers

Calculation 1. An average of 11,000 barrels of oil have been formed each year over the past 200 million years.

Calculation 2. Oil formation has produced energy equivalent to about 63.8 billion BTU per year

Calculation 3. Solar energy produces about 50,100 quadrillion BTU per year

## Comments

It would take about 6 million years to produce enough oil to supply global energy consumption for one year (i.e. 400 quadrillion divided by 63.8 billion). In other words we are using oil energy **six million times faster** than it is being produced. Oil is therefore a non-renewable resource.

By contrast, it would only take a long weekend for the sun to supply our global energy consumption for one year, if we only used solar power. In other words, the sun is producing energy **one hundred times faster** than we use it. Solar energy is therefore a renewable resource.