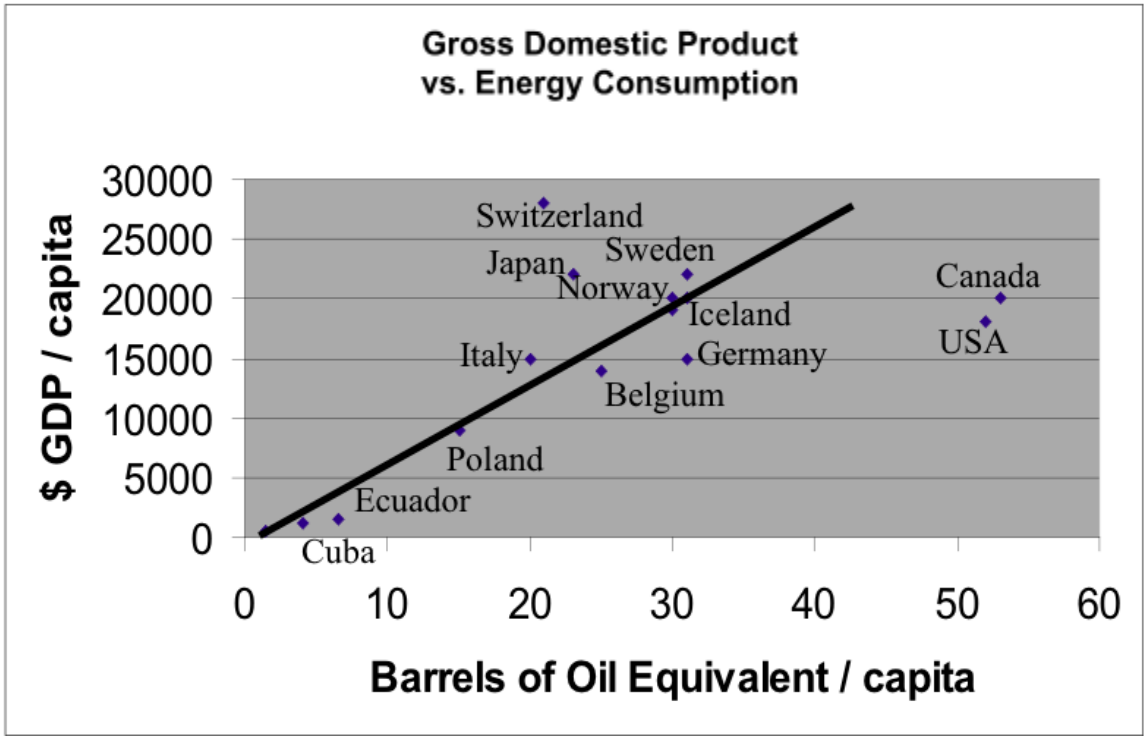
Environmental Physics **IB HL Physics Lab**
Planning U.S. Energy Policy for the 21st Century

Introduction:

Humans use vast amounts of energy from sources like coal, oil, natural gas, nuclear, hydro, and biomass. Maintaining and improving the world's standard of living in the face of decreasing fossil fuel supplies and increasing population is a very difficult task that requires planning for the long-term and making tough choices. In this activity, you will review the United States' historical energy use and develop an energy plan for the next century.

In the graph below, there appears to be a trend for most of the world's nations in which higher energy consumption produces a greater GDP, which is often linked to standard of living. Notable exceptions to the trend are Switzerland and the United States, largely due to their radically different approaches to transportation. Another way of describing the United States' position on the graph: The United States has 5% of the world's population, but accounts for about 24% of the world's energy consumption.



As shown in the table below, American energy use per capita has increased dramatically over the past 150 years, but that has also raised the standard of living.

Year	1850	1900	1920	1940	1960	1970	2000
Yearly Energy use per capita in millions of BTU's	105	110	186	181	252	339	351

Of course, these numbers are averages – those of us in suburban and rural areas use more energy than the average, while people who use public transportation use less than the average. As you plan America's energy future, keep this "energy per capita" number in mind, and think about what kinds of lifestyle changes a decrease in this number would require.

Purpose:

The purpose is to model the possible energy consumption of the United States over the next 80 years. This computer model will take into consideration not only energy consumption, but also the type of energy, the total possible supply of non-renewable energy sources and even the population growth of the US. Your work is to look forward and plan the future of the country's energy policy based upon current and realistic data.

Materials:

"US Energy Policy" Spreadsheet

Procedure:

1. Open the file "US Energy Policy" on the class website.

2. This leads you to a split spreadsheet – the two halves are identical but the left half can be scrolled independently of the right – developed by Pat Keefe of Clatsop Community College (OR) for his students to plan U.S. energy sources for the 21st century.

You will see displayed data for energy consumed in the U.S. per year for each of several energy sources for several selected years in the past. The units are in Joules x 10^{18}.

Guidelines for filling out the spreadsheet

You will need to determine the amounts of each source of energy to be used in the U.S. in 2030 and thereafter in 10-year intervals through the year 2100. As you do this, you will need to be guided by the following:

1) The resources of coal, natural gas, and petroleum in the U.S., indicated in green. These numbers may not become negative.

2) The total population, determined by the annual percentage growth rate in blue. It is given as 0.9%/year for 2020, but you can control it in future years by entering annual population growth rates for the years beginning in 2030.

3) The energy per capita. This has increased throughout the years but has stayed pretty much the same since 1980. "Conservation" measures could allow it to decrease.

Evaluation:

You will be evaluated according to how well you can provide energy sources to meet energy needs on a continuing basis without causing abrupt changes in people's lifestyles. You are to show this in two ways:

1. Complete the spreadsheet. Save and print your completed spreadsheet.

2. On a separate word document (2-3 pages in length), describe the policies you are using to achieve energy sufficiency for the United States in the 21st century:
    a. What plans or policies do you have for using fossil fuels?
    b. What plans or policies do you have to use more non-fossil fuel energy sources?
    c. What plans or policies do you have to reduce the amount of energy used through conservation measures?
    d. What plans or policies do you have for future population growth?
    e. It is expected that, unless drastic policies are implemented, changes in the use of fossil fuels, non-fossil fuels, energy per capita, and annual population percentage growth will be small. Abrupt changes in these numbers must be fully explained in your description of your policies.

You may work alone or in pairs for this assignment. Individuals must have a 2-page minimum word document, while pairs should have a 3-page document. Individuals should include a minimum of 2 outside cited sources and pairs with 3 sources.

Good Luck!