CRITICAL THINKING ACTIVITY:
WHAT IS EARTH'S GLOBAL ENERGY BUDGET?

OBJECTIVES: Students will:
- Describe what happens to solar energy when it reaches the Earth;
- Describe how the energy budget of the Earth is balanced;
- List some variables that affect the greenhouse effect; and
- Discuss how changes in the greenhouse effect can affect the temperature of the planet.

MATERIALS:
- Pen or pencil
- Illustrations of energy amounts within the Earth system.
- **Student Sheets 1-7**

PROCEDURE:

1. Provide students with a copy of the diagram of the **EARTH'S ENERGY BUDGET.**

    - Project a copy of the diagram and graphs on a SMART Board or with a laptop imager and discuss the information at length with the class.
    - Be sure to explain the following terms and check for comprehension: solar constant, geothermal heat, greenhouse effect, solar cycle, insolation, solar maximum, and anomaly.
    - Read over all the reading selections included with the **Student Sheets** and discuss in detail.

2. Students should then work in pairs to decipher the information on the diagram and apply the information to answer the questions in each section.

EXTENSIONS:

- Using all the information that has been presented and discussed in this activity, produce a concept map that illustrates the different influences on the global energy budget. The map should also include areas that are impacted by the energy.

- Earth is a planet with complex subsystems (water, land, air ice and life) that have evolved and developed over millions of years. In the last thousand years and especially in the last few centuries, humans have altered many aspects of these subsystems. Would a change in the global energy budget impact all of these subsystems? How? How would this change impact the human species? Support your answer with evidence.

- Do some research about the Maunder Minimum and the Little Ice Age and the effect on people. Write a short story, cartoon or poem which tells the story of the experiences of a family living during that time period.

THE EARTH'S ENERGY BUDGET

Reflected Solar Radiation 107 Wm⁻²

Incoming Solar Radiation 342 Wm⁻²

Outgoing Longwave Radiation 235 Wm⁻²

107 Reflected Solar Radiation 107 Wm⁻²

342 Incoming Solar Radiation 342 Wm⁻²

235 Outgoing Longwave Radiation 235 Wm⁻²

Reflected by Clouds, Aerosol and Atmospheric Gases 77

Emitted by Atmosphere 165

40 Atmospheric Window

Reflected by Surface 30

Absorbed by Atmosphere 67

Emitted by Clouds 30

Greenhouse Gases

168 Absorbed by Surface

24 Thermals

78 Evapotranspiration

350

390 Surface Radiation

40

324 Back Radiation

24 Latent 78 Heat

324 Absorbed by Surface