Solar Energy Radiometer

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Time Frame:	Standards:
4-30 minute sessions 4th grade	4.S.1.2.3 Make, describe and/or use models. (588.02.c) 4.S.1.6.1 Write questions that can be answered by conducting scientific tests. (589.01.a)

Objectives:

SWBAT define energy sources.
SWBAT define the concept of renewable energy.
SWBAT explain the concept of solar energy using a Radiometer.

Background Information:

BEGINNING OF OUR ENERGY DIARY:

ANYONE WHO'S EVER LIT A CANDLE KNOWS THAT MAKING FIRE IS AS EASY AS STRIKING A MATCH. BUT FOR OUR EARLIEST ANCESTORS, THE ABILITY TO CREATE A SPARK AND BUILD A FIRE MUST HAVE BEEN ASTONISHING. THE ENERGY THAT IT BROUGHT CHANGED THEIR LIVES. FOR THE FIRST TIME, THEY HAD THE POWER TO PRODUCE HEAT AND LIGHT WHENEVER AND WHEREVER NEEDED. CREATING FIRE WAS JUST THE BEGINNING OF OUR ONGOING QUEST TO USE EARTH'S ENERGY RESOURCES TO MAKE OUR LIVES BETTER.

OUR FIRST ENERGY SOURCES

FOR MOST OF THE HISTORY OF HUMANKIND WOOD WAS THE MAINSTAY OF LIFE — FOR SHELTER, FOR TRANSPORTATION ON LAND AND ON WATER, AND AS A SOURCE OF ENERGY TO BURN FOR HEAT AND LIGHT. BESIDES USING WOOD AND THEIR OWN MUSCLES, PEOPLE TOOK ADVANTAGE OF THE ENERGY THAT THE SUN, WIND, RUNNING WATER, HOT SPRINGS AND EVEN ANIMALS COULD PROVIDE — TO DO WORK, TO TRAVEL, AND FOR RECREATION.

Energy is essential (define) in our daily lives. It takes energy to breathe, grow, and think. We are even using energy when we sleep. We depend on energy for our heat (How do you heat in the winter?), air conditioning (What makes our air conditioners run?), lights (How do our lights work?), cloths (How do we get our clothes?), food Where and how do we get our food?), transportation (define – How does this use energy?), and communication (define – How does this use energy?).
What energy sources have you used today? (List on board)
Where does this seemingly endless supply of energy come from? The same energy sources that are available today were available thousands, even millions of years ago. But we use a lot more energy today than we used in the past.
There are many sources form which we get our energy. Some are "endless" or **renewable**,

such as energy we get from the sun, wind, and water. Other sources are limited or **nonrenewable** such as fossil fuels – coal, oil, and natural gas. Some sources are only available in certain areas such as geothermal. (Chuck)
Scientists are constantly searching for sources of energy and more efficient ways to use them. This brings us to one source of energy that has been getting a lot of attention lately. Solar Energy – (What is it? Where is it? How do we use it? How can it be used?)

National Energy Foundation – *Energy Fundamentals* – pages 5, 9,

Once the students had a basic background in energy we moved on to specialize in the use of solar energy. Using *Energy From The Sun* Student Guide, pages 3, 9, and 15, students learned how solar energy could be used as well as how the concept of solar energy worked.

Background Information:

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Materials:

National Energy Foundation – *Energy Fundamentals* – pages 5, 9,

Materials:

NEED Project – *Energy From The Sun* Student Guide - pages 3, 9, 15

Radiometers

Procedure:

Lesson:

Looking at page 5, from *Energy From The Sun* Student Guide, we discussed how the sun helps us.

Q: Does the sun help us?
A: Yes.

Q: How does the sun help us?
A: We can grow gardens – feed us. We can grow flowers, trees – helps the air we breathe. We can grow crops – feed us and our animals that then feed us. We can be healthy from the

sun.

Looking at page 9, we see how the sun can be used as energy. We learn that the sun's energy is **renewable.** That means that we cannot run out of it. The sun's energy is called solar energy.

Q: Do we use solar energy for anything now?
A: Yes, in some cars.

Q: Have any of you ever seen solar panels on the roof of a house?
Q: Why would anyone have a solar panel on the roof of their house?

Q: How many of you have gotten into your car after it has been sitting in the sun for a while?
A: I have and it was hot!

Q: Why was it hot?
A: Because the sun the sun's rays could go through the glass. The sun heated up the car.

Q: What color was the car?
A: Various answers.

Q: What color was the interior of the car?
A: Various answers.

Q: Do you think a darker color would make the car hotter?
A: Yes, black, dark green, dark blue.

Q: What about your clothes? Do you wear a lot of dark colors in the summer?
A: No.

Q: Why?
A: They are hotter.

Q: Why do you think that is?
A: Because the sun makes the black feel hotter.

Now let's look at page 15. This is called a radiometer. I show them the real radiometer. We examine how it is made. We are in the classroom so there is little to no activity.

Q: Do you think anything special will happen when the vanes spin?
A: Maybe.

Q: Which way do you think the vanes will spin? Make your prediction by coloring in the

direction on your paper. Will the vanes spin to the left or the right?
A: Students make their prediction then we head outside.

Once outside the students see the radiometer spin. We go from sun to shade. We discussed the need for more answers to the use of solar energy because the radiometer virtually stopped when in the shade.

We went back inside to check our prediction on the directions the vanes would spin.

Q: What makes the vane spin?
A: The heat. The heat pushes the paddle.

Q: Why did the vane spin the direction it did?
A: The white is chasing the black. The white helps the black move.

Q: What happens to the white paddle?
A: It gets cold. It gets hot but not as hot as the black.

Q: What happens to black cars?
A: They are hotter than white cars.

Q: What is happening to the black paddle?
A: It gets hot. The white helps the black move. It pushes the sun to the black.

Q: Does it matter how hot it is outside?
A: No, you just need the sun.

Assessment:

The assessment was observational. The discussion that incurred after the demonstration of the radiometer, led me to believe the students grasped the basic concept of solar energy.

Additional Content:

With this concept in mind we went on to make solar ovens. Because we study Idaho History in the fourth grade we decided to bake potatoes in our solar ovens. (Spuddy Buddy is an Idaho symbol.)

We used cast iron pots in our solar ovens. One with a glass lid and one with a cast iron lid. The cast iron pot that did not have a glass lid had plastic wrap over the inner box so as to trap

the heat. We made predictions as to which one would cook our potatoes quickest.

The potatoes would have cooked entirely in the solar ovens but we did not put them in the sun soon enough. The results of the two different pots and the use of the plastic wrap: The potatoes in the solid black cast iron pot with the plastic wrap over the inner box cooked quickest.

References:

National Energy Foundation – *Energy Fundamentals*

NEED Project – *Energy From The Sun*

http://www.ehow.com/how_2083_make-solar-oven.html

http://www.ft.com/cms/s/0/966a21fa-13ae-11de-9e32-0000779fd2ac.html?nclick_check=1l