Mobilne laboratorium Pasco

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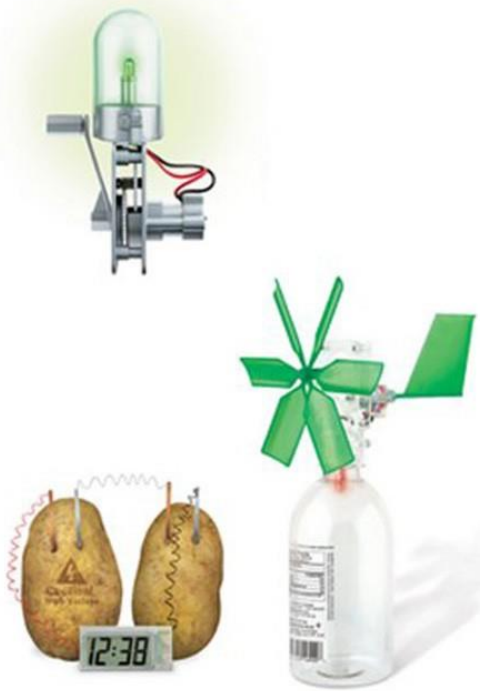
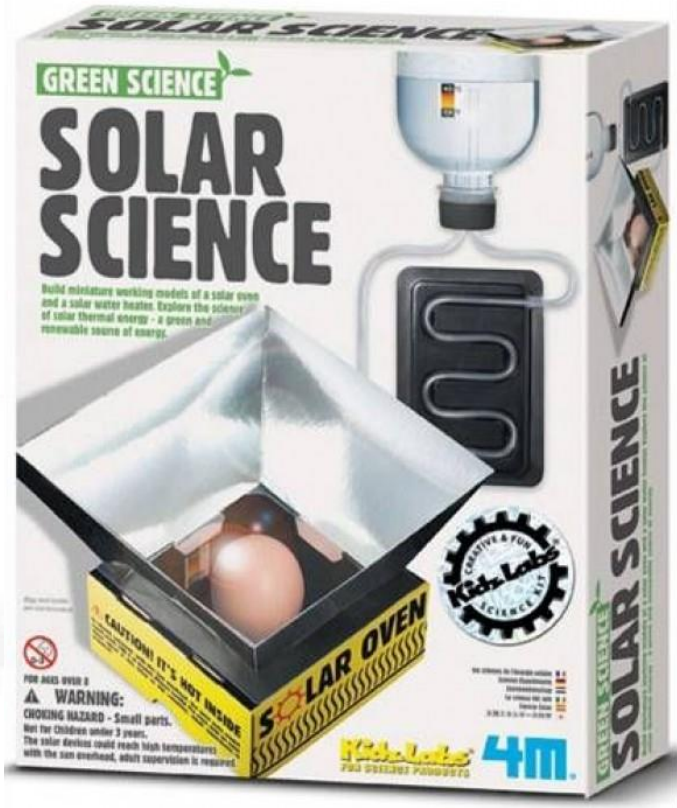
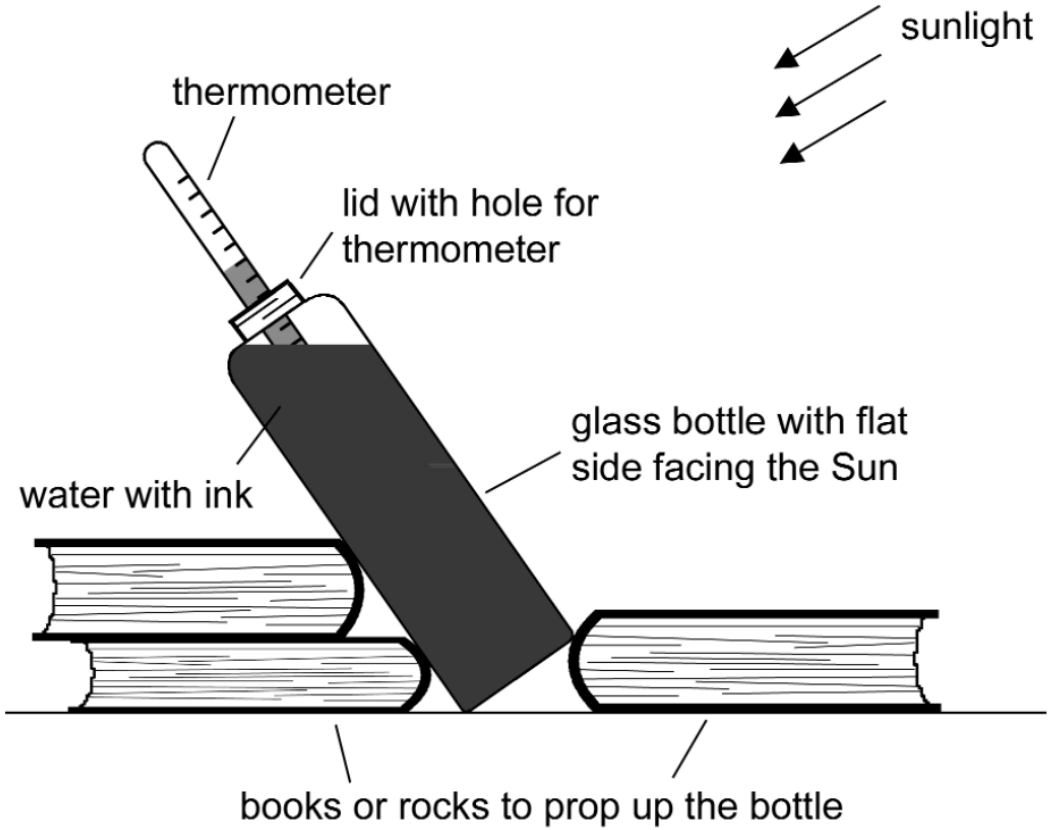
Zestawy edukacyjne: zielona energia i energia słoneczna





Pomiar stałej słonecznej, czyli ile energii dostajemy gratis ☺



Wg http://sciencenetlinks.com/media/filer/2011/10/07/measure_actsheet1.pdf

Data Sheet and Calculations

Calculations: Follow the calculations on the data sheet. These will give you a step-by-step method for determining the solar constant from the data you've gathered from your simple collector.

Volume of water used:_____liters

Mass of water used:_____kilograms

Exposed surface area:_____m^2

Trial #	Initial Temp. °C	Final Temp.°C	ΔT°C	Elapsed Time (s)
1				
2				
3				

Average ΔT/sec

I. Trial #1: $\frac{\Delta T_1}{elapsed\ time} =$

Trial #2: $\frac{\Delta T_2}{elapsed\ time} =$

Trial #3: $\frac{\Delta T_3}{elapsed\ time} =$

II. Average of the 3 ΔT/time calculations=_____°C/s

The specific heat of water is 4186 J/(kg°C). Therefore the energy absorbed by your water per second is:

$$4186 \times \frac{J}{kg \times {}^{o}C} \times your\ mass(kg) \times \frac{average\ \Delta\ T}{time}$$

$$\frac{Energy}{s} = \_\_\_\_\_ \frac{J}{s}$$

Average energy collected per unit of surface area is:

$$\frac{Energy}{s} \div your\ collection\ area\ (m) = \_\_\_\_\_ \frac{J}{s\ m^2}$$

This is your uncorrected solar irradiation for the earth's surface. Both the earth's atmosphere and the glass bottle have absorbed some of the incoming solar radiation and therefore won't show up as energy absorbed by the water. If other materials are used for your collector, then these next calculations may not be valid and more research will probably be necessary.

Multiply your uncorrected solar irradiation by 2 to correct for the glass and also by 1.4 to correct for the atmosphere:

$$solar\ constant = irradiation \times 2 \times 1.4$$

$$\_\_\_\_\_ = \frac{J}{s \cdot m^2}$$

The accepted value of the solar constant is about 1376 W/m^2.

Then your % difference is:

$$\frac{your\ solar\ constant - 1376}{1376} \times 100 = \_\_\_\_\_ \%$$ *(include your sign)*

Wersja Pasco

Solar Constant

Model No. TD-8497

Equipment List

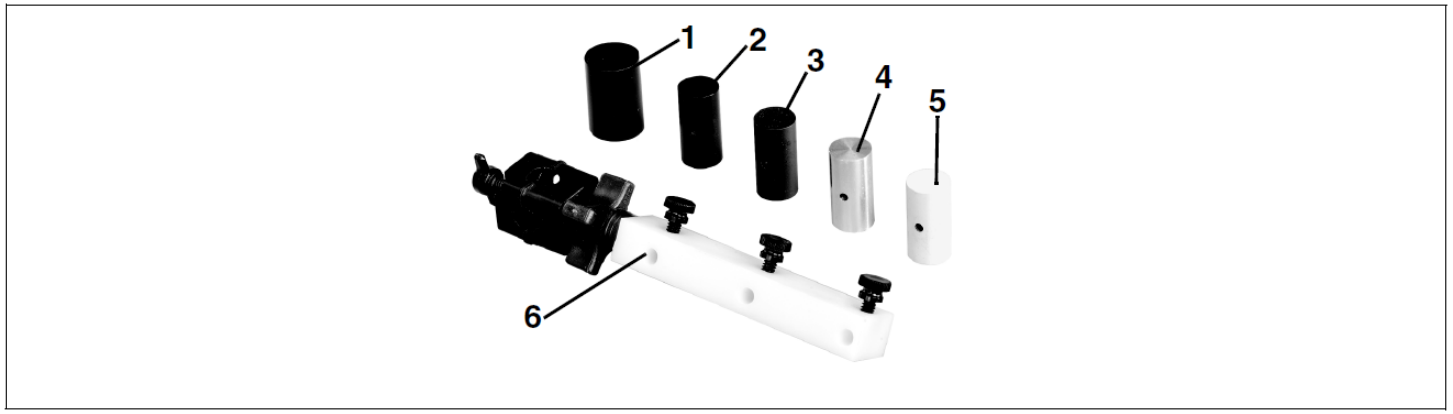


Figure 1-1: Experiment Setup

Theory:

$Q=mc\Delta T$ (1),

where Q=Thermal Energy added to the cylinder,

m=mass of the cylinder,

c=specific heat of the cylinder,

ΔT=change in cylinder temperature

$$I = \frac{Q/t}{A} \quad (2),$$

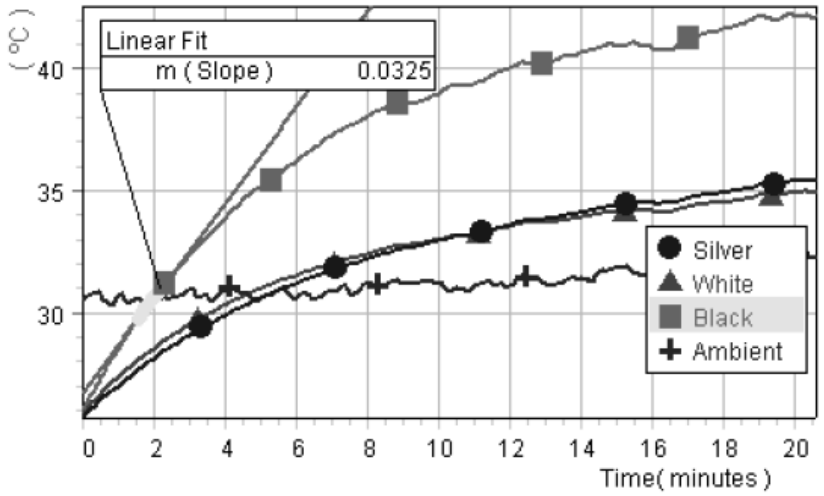
where I=intensity of sunlight (Solar Constant), A=cross-sectional area of the cylinder (area of the shadow), and t=time.

Combining equations (1) and (2) yields

$$I = \frac{mc\left(\frac{\Delta T}{t}\right)}{A} \quad (3),$$

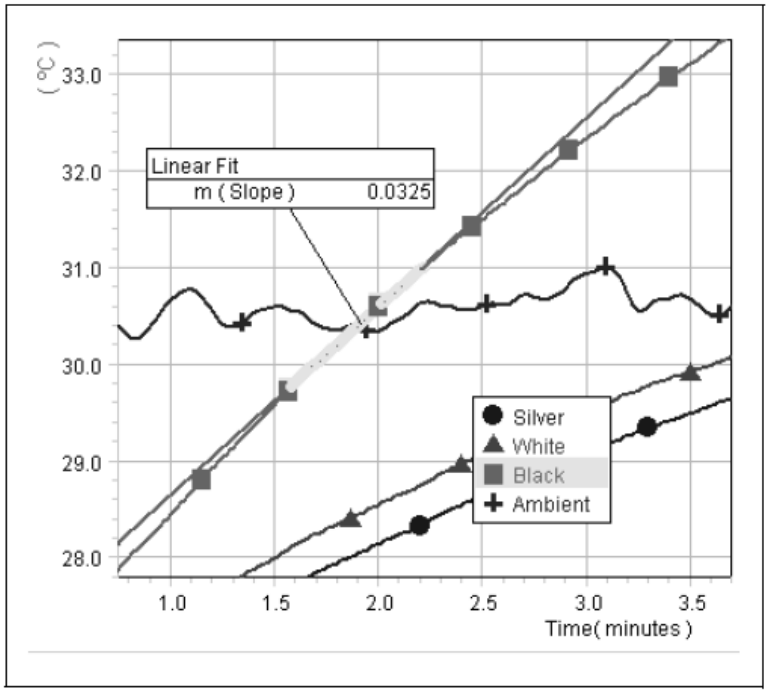
where $\Delta T/t$ is the cylinder's rate of temperature change and also the slope of the ΔT vs. t graph.

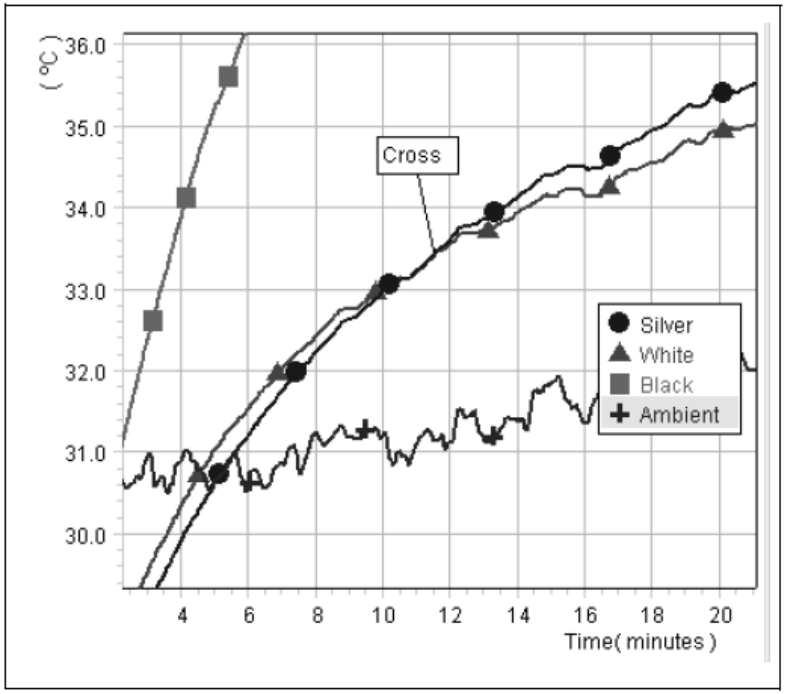
Heating Rates of Three Aluminum Cylinders with Different Surfaces



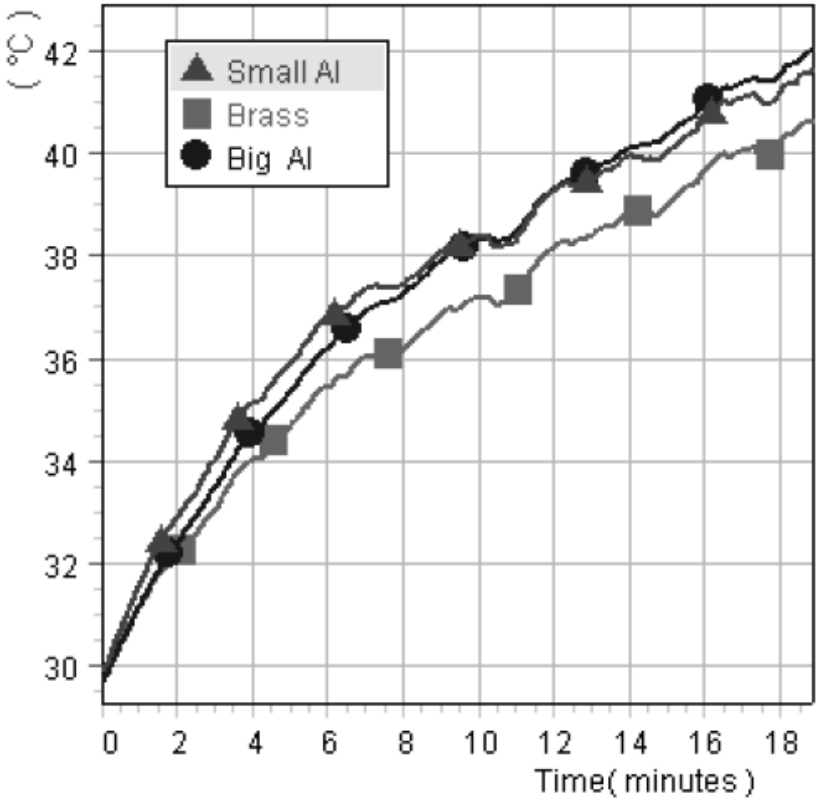
m=29.1 g (black Al)
dia=1.910 cm
length=3.835 cm
area=7.325 cm^2
slope=.0325 deg C/sec
c (Al) = 0.90 J/g deg C

I=1150 W/m^2

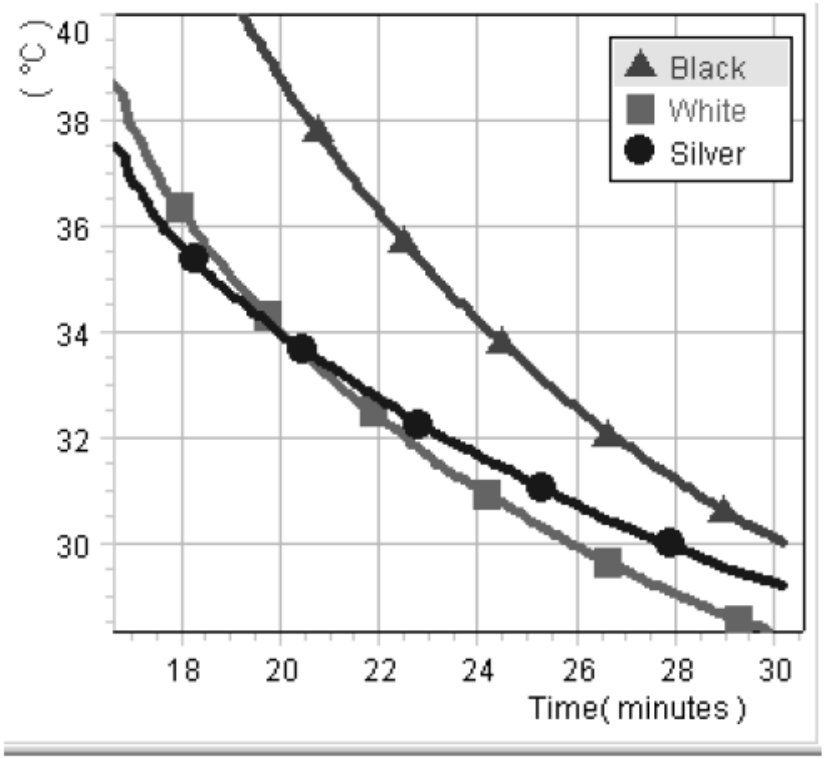




Heating Rates of Black Cylinders of Different Size and/or Material



Cooling rates of Aluminum Cylinders Moved Indoors to a Cool Room



Bezpłatne materiały do pakietu *Energia odnawialna*

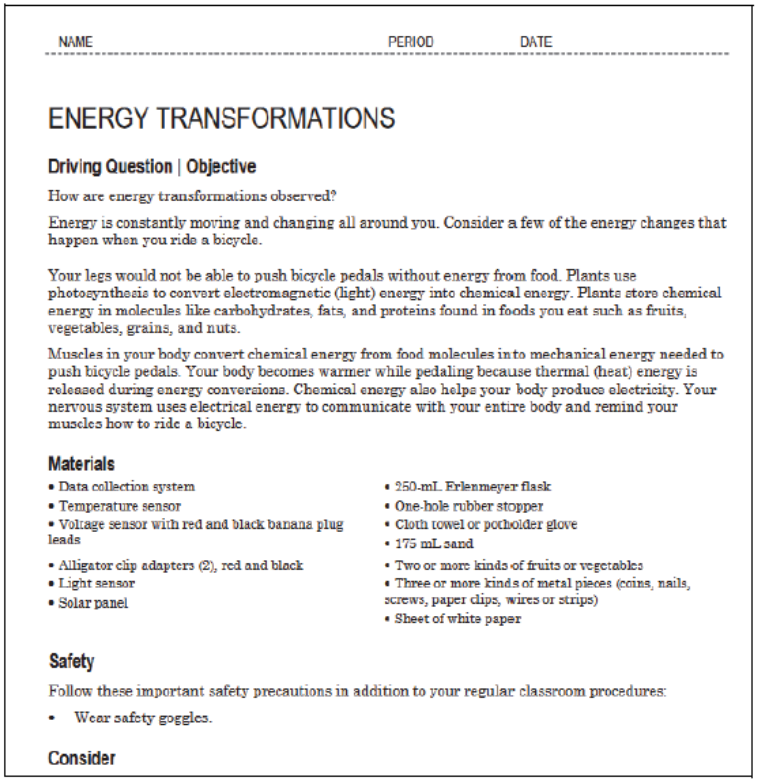
Lab Activities

The following lab activities are available as PDF and SPARKlabs files on

www.pasco.com/renewable

They are free to download and use with SPARKvue.

1. Energy Transformations
2. What is Electricity?
3. Solar Panel Performance
4. Light and Solar Panels
5. Load and Solar Panels
6. Heat and Solar Panels
7. Wind Power I: Distance and Speed
8. Wind Power II: Blade Length, Number, and Pitch
9. Power and Energy
10. Power Curves
11. Design an Efficient Turbine



NAME PERIOD DATE

ENERGY TRANSFORMATIONS

Driving Question | Objective

How are energy transformations observed?

Energy is constantly moving and changing all around you. Consider a few of the energy changes that happen when you ride a bicycle.

Your legs would not be able to push bicycle pedals without energy from food. Plants use photosynthesis to convert electromagnetic (light) energy into chemical energy. Plants store chemical energy in molecules like carbohydrates, fats, and proteins found in foods you eat such as fruits, vegetables, grains, and nuts.

Muscles in your body convert chemical energy from food molecules into mechanical energy needed to push bicycle pedals. Your body becomes warmer while pedaling because thermal (heat) energy is released during energy conversions. Chemical energy also helps your body produce electricity. Your nervous system uses electrical energy to communicate with your entire body and remind your muscles how to ride a bicycle.

Materials

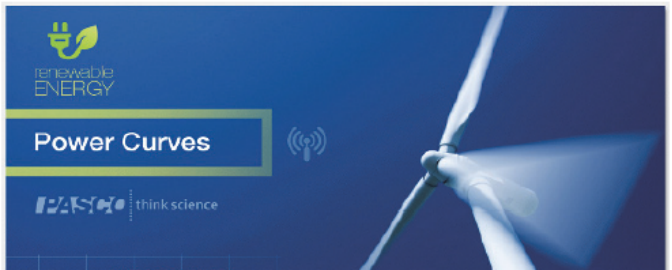
- Data collection system
- Temperature sensor
- Voltage sensor with red and black banana plug leads
- Alligator clip adapters (2), red and black
- Light sensor
- Solar panel
- 250-mL Erlenmeyer flask
- One-hole rubber stopper
- Cloth towel or potholder glove
- 175 mL sand
- Two or more kinds of fruits or vegetables
- Three or more kinds of metal pieces (coins, nails, screws, paper clips, wires or strips)
- Sheet of white paper

Safety

Follow these important safety precautions in addition to your regular classroom procedures:

- Wear safety goggles.

Consider



Kilka-(set) pomysłów

- Projekty Go-Lab – m.in. Wind Energy Simulation
- Solar Energy, Solar Lab, Solar Water Heating, solar cooking
- Climate Change: Natural, Human Causes and Consequences, Scientists of Climate Change
- Materiały wypracowane w ramach projektów IBL:

1. Ark of Inquiry
2. PLATON
3. Next-Lab
4. Scientix

Dodatkowe źródła:

- https://www.cleanlineenergy.com/learn
- Renewables Are Ready: A Guide to Teaching Renewable Energy in Junior and Senior High School Classrooms
- Vademecum energetyki odnawialnej
- Konkurs *Energia Młodych*
- Make Poland Great Again – Węgiel

Ponadto: materiały ZDF UMK, ORE.