Going Green! Middle Schoolers Out to Save the World (MSOSW)

Standby Power Conservation Project

Student Information Packet

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Student Information Packet

Table of Contents

University of North Texas Institutional Review Board

Informed Parent Consent Form

Before agreeing to your child's participation in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted. We will be collecting data materials to assist with determining the effectiveness of the energy curriculum we are developing.

Title of Study: Going Green! Middle Schoolers Out to Save the World (MSOSW)

Investigator: Gerald Knezek, Ph.D., University of North Texas (UNT) Department of Learning Technologies.

Purpose of the Study: You are being asked to allow your child to participate in a research study which involves participating in a science curriculum that allows students to use energy monitoring equipment at home or in a classroom setting to build models of energy consumption under the guidance of their teachers. By the conclusion of the study, students will understand the relationship between energy, economics and climate change, and long-term interest in STEM (science, technology, engineering, and mathematics) related careers will be established.

Study Procedures: Your child will be asked to complete a brief, 25-item questionnaire about what they think makes great science curriculum. This questionnaire will be administered twice, once at the beginning of the program and once at the end. It will take approximately 15 minutes to complete the survey each time (pre-test and post-test), but will be administered in the classroom and will require no time commitment outside of class. Your child will also be asked to complete a 12-item questionnaire on whether or not a career in science would interest them. The questionnaire will be administered twice, once at the beginning of the program and once at the end. It will take approximately 10 minutes to complete and will require no time commitment outside of class.

Foreseeable Risks: No foreseeable risks are involved in this study. However, students will be required to measure electricity consumption of standard, plug-in household electric appliances, such as televisions, computers, and other 110-volt consumer appliances. This will require that students handle common 110-volt electrical cords, plugging and unplugging the cords into standard 100-volt, household electrical outlets and circuits. Students will be required to study electricity safety procedures under the supervision of a parent or guardian, and pass an examination administered by teachers, before using the monitoring equipment.

Benefits to the Subject or Others: We expect the project to benefit your child by giving them an understanding of the relationship between energy, economics, and climate change. We anticipate that long-term interest in STEM-related careers will be established. The foundation for this project strongly promotes the philosophy of "giving back" to one's community, in this case by contributing a model of energy usage. The project could be the beginning of a path toward choosing a STEM education and careers as a means of empowerment to act upon a deep student concern – saving the world.

Compensation for Participants: None

Procedures for Maintaining Confidentiality of Research Records: Only aggregate-level data (classroom averages, etc.) will be reported for outcomes of the project. Individual student data will never be used to report findings. Each student enters a pre-assigned ID number in place of their name for the purpose of initially matching pre- and post- measures and demographic information for analysis. They will not be asked to enter their names. Individual student identifiers are removed from the researchers' records once each student's pre-assessment is matched to its post-assessment. This safeguards privacy for individuals even down to the level of research assistants, etc. that may work on analysis of the data sets. The confidentiality of your child's individual information will be maintained in any publications or presentations regarding this study.

Questions about the Study: If you have any questions about the study, you may contact Gerald Knezek, Ph.D. at telephone number 940-565-4195 or by email at gknezek@gmail.com.

Review for the Protection of Participants: This research has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- The study has been explained to you and all of your questions have been answered. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to allow your child to take part in this study, and your refusal to allow your child to participate or your decision to withdraw him/her from the study will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your child's participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as the parent/guardian of a research participant and you voluntarily consent to your child's participation in this study.
- You have been told you will receive a copy of this form.

_____

Printed Name of Parent or Guardian

_____ _____

Signature of Parent or Guardian Date

For the Investigator or Designee: I certify that I have reviewed the contents of this form with the parent or guardian signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the parent or guardian understood the explanation

_____ _____

Signature of Investigator or Designee Date

Student Participant Assent Form

You are being asked to be part of a research project being conducted by the University of North Texas, Department of Learning Technologies.

This study involves participating in a new science curriculum that will allow you to use energy monitoring equipment in diverse home and community settings to build accurate, scientifically important models of energy consumption in homes and communities, under the guidance of your teachers.

In addition to the science project that will be part of your science curriculum for the year, you will also be asked to complete a brief, 25-item questionnaire about what you think makes a great science class. This questionnaire will be administered twice, once at the beginning of the program and once at the end. It will take approximately 15 minutes to complete the survey each time, but it will be administered in the classroom and will require no time commitment outside of class. You will also be asked to complete a brief, 12-item questionnaire about whether or not a career in science would be interesting to you. This questionnaire will also be administered twice, once at the beginning of the program and once at the end. It will take approximately 10 minutes to complete the survey each time with no time commitment required outside of the class. As part of instruction involved with the unit, you will be asked to complete a quiz which assesses how much information you know about energy consumption.

If you decide to be part of this study, please remember you can stop participating any time you want to.

If you would like to be part of this study, please sign your name below.

_____
Printed Name of Student

_____ _____
Signature of Student Date

_____ _____
Signature of Investigator Date

Safety First

1. Never plug device in near water. (Machines aren't waterproof and this can cause severe bodily damage.)
2. Don't plug in a damaged (ripped, torn, broken) cord to a device.
3. When you unplug the device, don't unplug by pulling on the cord; hold on gently to the plug and pull it out of the outlet.
4. Don't let your best friends (pets) use cord as a chew toy. ☺
5. Don't touch your home's fuse box.
6. Never put anything besides a plug into an outlet.
7. Don't overload an outlet – limit the number of things that are plugged into each one.
8. Never use a plug that is damaged. Look for bent or broken prongs.
9. Never place heavy objects on top of electrical cords.
10. If in doubt ask an adult for help, or if in an emergency (fire, you or someone else is hurt) call 911 immediately.

Exploring STEM Careers

There are several energy-related careers within *WhyPower* in *Whyville*. Each of the careers in WhyPower has two levels – a technician level and an engineer level. Choose one of the following careers to explore. The number of clams you will earn will depend on which career you choose to explore.

Careers in *WhyPower* related to energy

Power Planner
Technician
Power Planner Engineer

Peak Power
Power Plant Operator
Power Plant Engineer

Electric Farm
Electric Farm Technician
Electric Farm Engineer

Green Build
Home Energy Technician
Home Energy Engineer

Power Line
Powerline Technician
Powerline Engineer

Vampire Power
Vampire Power Technician
Vampire Power Engineer

Which of the careers did you explore?_____

What was most interesting to you about the career you chose to explore?

_____

_____

What knowledge did you learn in your exploration that can you use now or in the future to help conserve energy? _____

_____

_____

Prepare a summary of your career to share with your classmates in the Career Fair.

_____

_____

_____

Plug-In Appliance Inventory Worksheet

Name:_____Teacher:_____

Instructions: Go through your house making note of the items you have in your home. In the 1st column, include the number of these items that you have at home. In the 2nd column, include the room code where the item is located (from key below). In the 5th column, write the specific brand or model for scientific data comparison. If you have items not listed on this inventory that you would like to include write them in the blank rows.

Write in number of these you have	Room Code(s)	Appliance (model, etc.)	Stand-by Power Estimate (Watts)	Brand/Model
		Portable stereo	2.2	
		Compact audio system	9.7	
		Component system	3.0	
		DVD player	4.2	
		Radio, clock	1.7	
		iPod/MP3 player		
		iPod dock		
		Speakers		
		Battery charger (AA, AAA, etc.)	0.9	
		Lawnmower		
		Power Tool	2.0	
		Vacuum Cleaner	2.1	
		Garage Door Opener	3.0	
		Security System	13.7	
		Bread maker	1.6	
		Microwave Oven	2.9	
		Rice Cooker	2.0	
		Coffee maker		
		Slow cooker		
		Water cooler		
		Toaster oven		
		Can opener		
		Computer (desktop)	1.7	
		Computer (laptop)		
		Printer, Ink Jet	5	

Room Codes:

lr = living room	of – office	kt = kitchen	ot = other
bd = bedroom	ba = bathroom	fr = family room	
hl = hallway	bm = basement	ga = garage	

Write in number of these you have	Room Code(s)	Appliance (model, etc.)	Stand-by Power Estimate (Watts)	Brand/Model
		Phone/Fax/Copier	1.5	
		Computer docking station		
		Printer – laser (specify color or B&W)		
		Cable Box	10.8	
		Internet Terminal	10.6	
		Satellite System	12.6	
		Video Game	1.3	
		XBox		
		PlayStation (specify #)		
		Wii		
		Other: specify _____		
		Internet Router		
		Answering Machine	3.0	
		Cordless Phone	2.6	
		Cell Phone Charger		
		Television (Specify Plasma, LCD, LED, etc.)	5.0	
		TV/VCR Combo Unit	7.6	
		VCR	6.0	
		DVR/TIVO		
		Range	2.7	
		A/C window unit or portable		
		Other		
		Treadmill or other exercise equipment		
		Fish Tank		
		Lava Lamp		
		Electric toothbrush		
		Message Chair		

Room Codes:

lr = living room	of – office	kt = kitchen	ot = other
bd = bedroom	ba = bathroom	fr = family room	
hl = hallway	bm = basement	ga = garage	

It is important enter the appliance manufacturer, brand, type and model if possible.
For example – Sony 42” Bravia LCD Flat Panel Model number: KDL-42V410 is much more scientifically useful than Sony TV.

Name: _____ Grade-Period: _____

Energy Production

For this assignment, you and your group members will research one particular type of energy production. You'll create a complete definition for the production type and list several benefits and risks or drawbacks to that form of energy production as well. You will do one as a class so that you can get an idea of how to complete the task.

With your group, you'll also put together a short presentation that will educate your classmates about your assigned form of energy production. Please pay attention to the grading rubrics shown here so that you can receive full credit!

When researching your assigned form of energy production:

- Work well with your group mates and spend your time wisely.
- Use several sources to make sure you have an accurate and complete definition.

When creating your presentation – these are the things your teacher will be grading you on when you present:

- Length – presentation should be 2-3 minutes in length
- All group members should participate.
- You should speak with a loud, clear voice and look at your audience.
- Definition should be clear and given in such a way that other students can record it onto their worksheet.
- Multiple benefits and drawbacks of the energy production type should be discussed in detail (also able to be recorded).

When you're watching other presentations:

- Give your full and complete attention! You need this information.
- Record the definition given (can be in your own words).
- Record the benefits and drawbacks discussed by the group.
- Ask questions!

The area for recording all your information begins on the next page.

Coal Energy	Definition	
	Benefits	Risks/Drawbacks
Natural Gas Energy	Definition	
	Benefits	Risks/Drawbacks
Petroleum/Oil Energy	Definition	
	Benefits	Risks/Drawbacks

Biomass Energy	Definition	
	Benefits	Risks/Drawbacks
Geothermal Energy	Definition	
	Benefits	Risks/Drawbacks
Hydro Power	Definition	
	Benefits	Risks/Drawbacks

Nuclear Energy	Definition	
	Benefits	Risks/Drawbacks
Solar Energy	Definition	
	Benefits	Risks/Drawbacks
Wind Energy	Definition	
	Benefits	Risks/Drawbacks

GETTING TO THE CORE: THE LINK BETWEEN TEMPERATURE AND CARBON DIOXIDE

VOSTOK, ANTARCTICA, ICE CORE DATA

NAME: _____ **DATE:** _____

Carbon Dioxide Concentration and Temperature Anomaly Data
(398,000 BC to 400 BC)

Year (BC)	CO_2 concentration (ppm)	CO_2 concentration rounded to nearest whole number	Temperature anomaly (°C)	Temperature anomaly (°C) rounded to nearest tenth of a degree
398,000	278		-1.64	
388,000	255.2		-5.34	
378,000	245.9		-4.88	
368,000	229.7		-5.42	
358,000	206.4		-5.8	
348,000	193		-7.64	
338,000	220.4		-7.44	
328,000	234.2		-4.9	
318,000	271.8		-0.12	
308,000	256.3		-3.32	
298,000	241.9		-3.08	
288,000	240.2		-6	
278,000	207.7		-6.17	
268,000	231.4		-5.95	
258,000	184.7		-8.3	
248,000	203.9		-6.52	
238,000	230.4		-2.12	
228,000	245.2		-6.15	
218,000	212.2		-4.31	
208,000	244.6		-3.07	
198,000	242.6		-2.68	
188,000	231.4		-6.49	
178,000	213.2		-6.34	
168,000	197.9		-7.01	
158,000	204.4		-6.25	
148,000	191.9		-7.34	
138,000	192.3		-8.99	

GETTING TO THE CORE: THE LINK BETWEEN TEMPERATURE AND CARBON DIOXIDE

Carbon Dioxide Concentration and Temperature Anomaly Data
(398,000 BC to 400 BC)

Year (BC)	CO_2 concentration (ppm)	CO_2 concentration rounded to nearest whole number	Temperature anomaly (°C)	Temperature anomaly (°C) rounded to nearest tenth of a degree
128,000	263.4		1.47	
118,000	265.2		-0.86	
108,000	245.7		-5.53	
98,000	225.9		-3.45	
88,000	208		-4.69	
78,000	221.8		-3.66	
68,000	227.4		-7.84	
58,000	210.4		-6.53	
48,000	190.4		-5.18	
38,000	209.1		-6.91	
28,000	205.4		-7.95	
18,000	189.2		-7.62	
8,000	261.6		-0.28	
400	284.7		0	

Data source: National Oceanic and Atmospheric Administration (NOAA): www.esrl.noaa.gov/gsd/outreach/education/poet/Global-Warming.pdf.

GETTING TO THE CORE: THE LINK BETWEEN TEMPERATURE AND CARBON DIOXIDE

VOSTOK DATA INSTRUCTIONS

Instructions for Filling Out the "Vostok, Antarctica, Ice Core Data" Worksheet

1. In the space provided in column three, round the carbon dioxide (CO_2) concentration to the nearest whole number.

2. In the space provided in column five, round the temperature anomaly to the nearest tenth of a degree.

Instructions for Plotting the Graphs

1. You will create two graphs: one for CO_2 concentration and one for temperature anomaly.

2. On both graphs, your x-axis will represent years. Start with 400,000 BC on the left and number as far as the the year 0 on the right, counting by intervals of 10,000 years. Label the axis.

3. On the first graph, the y-axis on the left side of the paper will represent the CO_2 concentration using units of parts per million (ppm). Begin with 100 ppm at the lower end, and number up to 400 ppm, counting by intervals of 10 ppm. Label the axis.

4. On the second graph, the y-axis on the left side of the paper will represent the temperature anomaly in degrees Celsius (°C). Begin with -10.0 °C at the lower end and number up to 2.0 °C, counting by intervals of 0.5 °C. Label the axis.

5. Using different colored pencils, plot the points for CO_2 concentration and temperature anomaly.

6. Write a title on each graph.

GETTING TO THE CORE: THE LINK BETWEEN TEMPERATURE AND CARBON DIOXIDE

CARBON DIOXIDE CONCENTRATION AND TEMPERATURE RATE OF CHANGE

NAME: _____ **DATE:** _____

48,000 BC to 400 BC
Length of time: ____ years

Variable	Value in 48,000 BC	Value in 400 BC	Change	Rate of change per year
CO_2 concentration (ppm)				
Temperature anomaly (^oC)				

1901 to 2011
Length of time: ____ years

Variable	Value in 1901	Value in 2011	Change	Rate of change per year
CO_2 concentration (ppm)	296.1 ppm	391.6 ppm		
Temperature anomaly (^oC)	-0.16 ^oC	0.51 ^oC		

Data source: U.S. EPA, *Climate Change Indicators in the United States*: http://www.epa.gov/climatechange/science/indicators/.

CO_2 concentrations are from Antarctica (1901) and Hawaii (2011).
Temperature anomaly is a global average.

NAME: _____ TITLE: _____ DATE: _____

Name: _____ Grade-Period: _____

Standby Power Notes

This sheet will help guide your note-taking during the discussion on standby power.

Standby Power - _____

_____

_____

_____

Devices I think might use standby power:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Ways to tell a device uses standby power:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Number of standby power watts used by device tested in class: _____

How many kilowatt-hours could that device use in a day?

In a month?

In a year?

The average electricity cost (per kWh) in your area is: _____

If the above device was plugged in all year but never actually used, how much money would it cost you?

Standby Power Usage in the United States:

What percentage of the average electricity usage is due to standby power?

What is the average monthly electric bill in the US?

Show your calculations here to show how much money could be saved each year if standby power was reduced:

Name: _____ Grade-Period: _____

Standby Power Worksheet

1. What is standby power?

2. Based on the descriptions, check the devices that probably use standby power:
   - € A coffee maker that has a clock display.
   - € A lamp with an on-switch on the cord.
   - € A stereo with a remote control.
   - € A fish tank light that changes color when it's on.
   - € A game console (like a Playstation) that displays a red light when off.
   - € A curling iron with an on-off switch and heat control.
   - € A power strip that has a lighted on-off switch.
   - € A cell phone charger that feels warm to the touch all the time.
   - € A computer that turns on quickly when you move the mouse.

3. If a family's standby power usage is 8% of their total energy use and their average monthly bill is $100, how much money could they save in one year by reducing their standby power use by 3%? (Show your work.)

4. If a family's standby power usage is 15% of their total energy use and their average monthly bill is $150, how much money could they save in one year by reducing their standby power use by 5%? (Show your work.)

5. Let's assume the average family in the US has an average monthly electric bill around $100 and 10% of that is used for standby power. There are around 130,000,000 (130 million) homes in our country. Using that information, how much money is being spent each year in the US on standby power? (Show work.)

Name: _____ Grade-Period: _____

Student Definitions Worksheet

For each of the terms below, you're going to create a short definition. Your definition must follow the guidelines listed. It might be a good idea to work on this on a separate sheet of paper and then write your completed answer here. Work quickly and well with your partner.

Your definition should:

- Be accurate and clear.
- Be 1-3 sentences in length.
- Be easy to understand. If you use a term you didn't completely understand, make sure you explain it in the full definition.
- Include 3 sources you used to create the definition. (List at end in space.)

Carbon Footprint:

Sources:

Global Climate Change:

Sources:

Name: _____ Grade-Period: _____

Solutions Guidelines

Now that you've learned about what global climate change is and why it's occurring, you now get a chance to propose your own solution. You're going to research and propose two different ideas that will help alleviate the issue of global climate change.

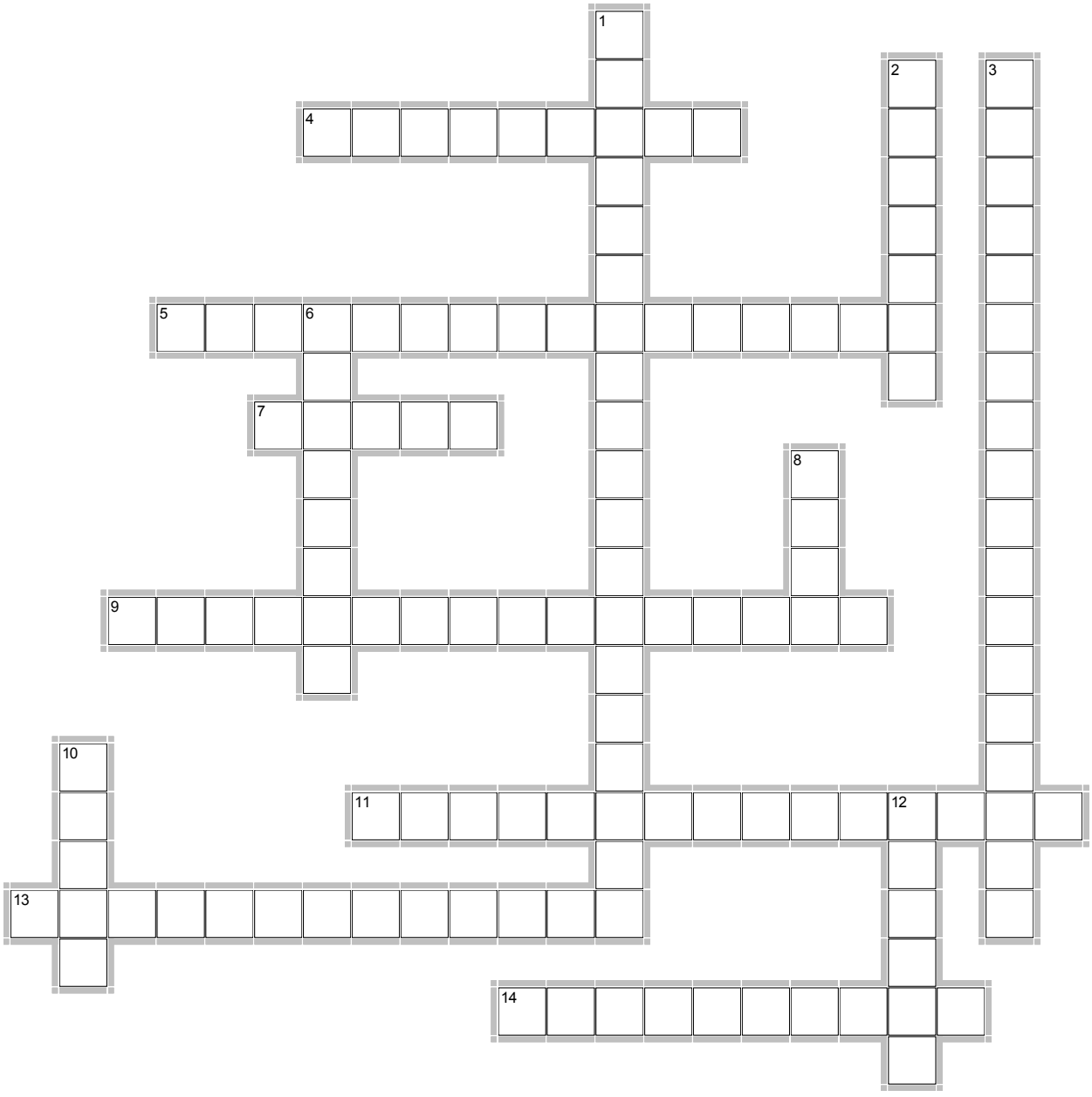
These ideas could be a way to reduce the amount of greenhouse gases released into the atmosphere or a way to remove some of the gases already present in our atmosphere. Alternatively, your solution could be a way governments could prepare for changes occurring because of global climate change – it's up to you!

You will be typing your solutions. They don't have to be long, but they should include all of the following to ensure you get full credit:

- Clearly stated solution (in first sentence)
  - What is your idea?
- Explains how the solution could be implemented (put into place)
  - How will this idea happen?
- Explains benefits of the solution (why it would work)
  - Why will this idea help?
- Discusses the costs/drawbacks of the solution
  - What are the costs or drawbacks of your idea? (No solution is perfect!)
- Grammar and spelling count!

Name: _____ Grade-Period: _____

Global Climate Change Crossword



EclipseCrossword.com

Across

4. These "hot-headed" structures are one of the natural causes of climate change on our planet.
5. These words are used by scientists to indicate a 99% or greater probability that a prediction will occur.
7. This group of organisms cannot handle higher temperatures and will likely suffer as temperatures continue to increase.
9. Refers to the process in which much of the sun's energy (heat) is kept inside our atmosphere by specific gases on our planet.
11. The amount of greenhouse gases that are produced in our day-to-day lives through the burning of fossil fuels.
13. A greenhouse gas; Levels of this gas have increased by approximately 80% since 1970.
14. Over the last 150 years, we've observed that the global sea and air temperatures are _____.

Down

1. The identifiable change in the climate of Earth as a whole that lasts for an extended period of time.
2. One of the greenhouse gases.
3. These words mean that scientists are more than 90% certain the data they have are accurate.
6. There are close to one _____ scientists that work with the Intergovernmental Panel on Climate Change.
8. Abbreviation for the research group created by the United Nations in 1988 to compile information on global climate change.
10. According to the data, "Most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in _____-caused greenhouse gas concentrations."
12. Over the last 100 years, we've observed that the global sea levels are _____.

HOW-TO GUIDE:

Using the Belkin Energy Monitor

You'll use this sheet in class to complete your Belkin Energy Monitor Training! Once at home, you can also use it as a reminder of the steps involved in using the Belkin device.

http://www.belkin.com

1. Plug the Belkin energy use monitor into the wall socket near the item you are going to measure. The display should come on and will give you a reading of 0 – 0.5 W until you plug a device in. The default reading will be in dollars but we are currently interested in Watts. (The third possible reading is CO^2.) One more thing to note is pressing the Dollar or CO^2 button is a toggle and will display for 30 days for a month or 365 days for a year.

2. Plug any household device into the energy monitor. Press the button to the right (lightning bolt) to view the number of Watts. You are now ready to measure your device.

3. Turn the device on. How much power is it using now, in Watts? Some devices may fluctuate up and down and you will have to estimate a middle reading. If the device has different settings (like a 3-way light bulb or heating pad), try each setting and see if extra energy is used at different settings. Record your observations on a sheet of paper.

4. Turn the device off. Watch the display on the energy monitor. Is this device using power even though it is turned off? Record your observations on a sheet of paper.

5. Double-check that the appliance/device is off and unplug it from the Belkin monitor. Trade appliance devices with another and allow a different group member to use the energy monitor. Continue until all group members have used the energy monitor.

6. Write down at least one thing you found surprising in your investigation today.

7. Write down one question you have after recording this data.

How Much is it Using? – Belkin Energy Monitoring Sheet

1. Device Measured: _____

	Device Off	**Device On**	**Does the device use standby power?**
Watts			Y or N
CO2 (30 day reading)			
$$ (30 day reading)			
Notes:			

2. Device Measured: _____

	Device Off	**Device On**	**Does the device use standby power?**
Watts			Y or N
CO2 (30 day reading)			
$$ (30 day reading)			
Notes:			

3. Device Measured: _____

	Device Off	**Device On**	**Does the device use standby power?**
Watts			Y or N
CO2 (30 day reading)			
$$ (30 day reading)			
Notes:			

4. Device Measured: _____

	Device Off	**Device On**	**Does the device use standby power?**
Watts			Y or N
CO2 (30 day reading)			
$$ (30 day reading)			
Notes:			

5. Device Measured: _____

	Device Off	**Device On**	**Does the device use standby power?**
Watts			Y or N
CO2 (30 day reading)			
$$ (30 day reading)			
Notes:			

How Much is it Using? – Belkin Energy Monitoring Sheet

Belkin Data Collection Protocol

1. Ask parent or guardian to verify your measurements. Have them initial here: _____

2. Plug the Belkin into the wall socket.

3. Plug the device you are measuring into the Belkin. Adjust the readout on the Belkin so that you're seeing the Watt measurement (lightning bolt).

4. Turn the device on put it in use mode. Then, take a reading from the Belkin and record it in the appropriate column on your Belkin Energy Monitoring Sheet (Belkin Reading Appliance "on").

5. Shut down the device if necessary (if computer or anything else with a hard drive) and then switch the device off. Let the device sit for at least 1 minute with the device turned off. While you're waiting, record as much information as possible on your sheet about the device you're measuring. You should at least write down the brand name, and hopefully you can get the model name or number as well if they're listed on the device.

6. Take a reading from the Belkin and record it in the appropriate column on your Belkin Energy Monitoring Sheet (Belkin Reading Appliance "off"). This device may or may not use standby power. If it is off and not serving any useful function but still using power, it is using standby power.

7. Repeat Steps 2-6 for the rest of the devices on the list. Do not worry if you don't have all the devices listed – just write DO NOT HAVE for that appliance in the third column and move on to the next.

REMEMBER TO BE AWARE OF ELECTRICITY SAFETY AT ALL TIMES! DO NOT DO ANYTHING THAT SEEMS DANGEROUS!

Note: The Belkin meter can only detect power consumption of more than 1 watt. Power consumption below 1 watt will register "0" watts.