Individual Room Heating and Air Conditioning Investigation:

Record the room data using the following operational definition(s) for *taking a temperature reading*:

Please turn into _____ by _____.

Individual Room Name/Number: **Teacher's Name:**	**Date of Investigation:** **Times of Investigation:**
Do you see any blocked air vents or ducts?	☐ Yes Comments: ☐ No
Are the seals of the windows between the frame and the pane tight?	☐ Yes Comments: ☐ No
Windows: How many windows does the room have? Which direction do the windows face? (N, S, E, or W). Can the windows be opened and closed?	Number of Windows: _____ Direction Windows Face: _____ ☐ Yes Comments: ☐ No
Are there window coverings that could be used to control the room's temperature?	☐ Yes Comments: ☐ No
Does your classroom have a programmable thermostat?	☐ No ☐ Yes –Current Temperature Setting ____
Can the thermostat be adjusted by the teacher?	☐ No ☐ Yes –Current Temperature Setting ____
After the room has been occupied for a couple of hours (per operational definition), **use a thermometer (regular or infrared temperature gauge)** to measure and record the room temperature in the following locations. **To more accurately take a temperature reading, take the temperature at each location three times, add those readings together and divide by 3 and record the average for each location. To find the room average, add the five room readings together and divide by 5.**	Near outside wall/windows: _____ Middle of the room: _____ Open doorway: _____ Far away from the windows: _____ At or near an air-output vent: _____ Average Room Temperature: _____ In the hallway outside the room: _____ Outside Temperature: _____ Other Location: _____ Time: _____
During the afternoon at time designated by operational definition, **use a thermometer (regular or infrared temperature gauge)** to measure and record the room temperature in the following locations. **To more accurately take a temperature reading, take the temperature at each location three times, add those readings together and divide by 3 and record the average for each location. To find the room average, add the five room readings together and divide by 5.**	Near outside wall/windows: _____ Middle of the room: _____ Open doorway: _____ Far away from the windows: _____ At or near an air-output vent: _____ Average Room Temperature: _____ In the hallway outside the room: _____ Outside Temperature: _____ Other Location: _____ Time: _____

Do the indoor room temperatures vary depending on the location of the temperature reading?	☐ Yes Explain: ☐ No
Does the room temperature vary based on the time of day the temperature is taken?	☐ Yes Explain: ☐ No
Where is the warmest temperature in the room?	
Where is the coldest temperature in the room?	
What is the average temperature in the room?	
Are most students comfortable with the temperature in the room? (Consider developing a survey)	☐ Yes Comments: ☐ No
Recommendations: Given this information, what recommendations, changes or improvements should be made to conserve energy in your classroom?	

Artificial Lighting Investigation (Individual Rooms):

Distribute to classrooms that are willing to complete this Energy Investigation for you. Use this chart for other spaces such as the gym, library, etc. You can then pool all the results together in the end to make any recommendations or notice any trends in energy use in your school. In the average school, about 14% of the energy costs are spent in lighting (*Managing Energy Costs in Schools*, www.mge.com). So exploring the lighting in your school is a good place to look for potential savings. **Please turn into _____ by _____.**

(Bulb type will be written on bulbs or you can measure bulb diameters to determine bulb types. See the Lighting Information Sheet above for more lighting details).

Teacher Name (if applicable):		**Room Number:**		**Date of Investigation:**		
Type of Bulbs	Number of Fixtures	Number of Bulbs per Fixture	Average Wattage of the Bulb	Average Hours "On" per Day	Energy Consumed per Day (kWh)	Daily Cost for Electricity ($) (use average of .10 or actual cost, see p. 16)
	A	**B**	**C**	**D**	**E=AxBxCxD/1,000**	**F = E x $0.10**
 Compact Fluorescent:						
 T12 Fluorescent Tubes:						
 T8 Fluorescent Tubes:						
 LED Fluorescent Tubes:						
 Incandescent:						
Totals:						

For Column D: Collect "on time" data each day for one week (Monday-Friday), and then divide the total hours by 5 to get the "Average Hours "On" per Day."

For Column E: Calculate the kWh used per day by multiplying the number of light fixtures of each type by the number of bulbs per fixture, the average bulb wattage, and the average time in use per day, and then dividing by 1,000 to obtain the correct units.

For Column F: Calculate the daily cost for using each bulb type in your classroom by multiplying the daily energy use (column E) by cost/kWh (use the National average of .10 or actual cost, see p. 16 of this packet).

1. Is this space lit by any natural lighting?
   - ☐ Artificial Only
   - ☐ Primarily Artificial and some Natural
   - ☐ Primarily Natural w/ Artificial as needed
   - ☐ Natural Only

Did You Know??? Establishing a habit for classrooms to shut off their lights, even for a few minutes, helps conserve energy! The most efficient light is a light not used.

2. Are lights turned off when the room is not in use?
   - ☐ Yes
   - ☐ No
   - ☐ Sometimes

3. Are lights controlled by motion and/or photo sensors?
   - ☐ Yes
   - ☐ No

If yes, what type? _____

(Photo sensors automatically turn lights on /off depending on the amount of natural light in the room. Motion sensors automatically turn lights on/off based on movement in the room.)

4. If fluorescent tube light fixtures are present, are the ballasts the newer electronic type?
   - ☐ Yes
   - ☐ No

(Older light fixtures may still be using the magnetic-type ballasts. A ballast tester can be used to determine the type, or ask a member of your school's maintenance staff. Electronic ballasts increase energy efficiency.)

How to identify fluorescent bulbs: The letter T is used in front of the number to show the fluorescent bulb is a tube type. Following the letter is a number representing the diameter of the bulb measured in fractions of an inch. Fluroscent bulb widths are measured in eights of an inch. For example, a T5 bulb is five-eighths of an inch wide, a T8 bulb is one inch wide (eight-eighths) and a T12 is 1-1/2 inches (12/8ths) in diameter. Installing T8's in place of T12's can reduce lighting energy consumption by 35%! Read more: What is T5, T8 and T12 Lighting? eHow.com http://www.ehow.com/about_6464110_t5_-t8-t12lighting.html#ixzz1MuRu8DR7

Daylighting Investigation (Individual Rooms):

Distribute to classrooms that are willing to complete this investigation for you. Use this chart for other spaces such as the gym, library, etc. You can then pool all the results together in the end to make any recommendations or notice any trends in energy use in your school. Daylighting is the illumination of indoor spaces by natural light from windows or skylights. A light meter measures the amount of light falling on a surface. Measurements are typically made in units called a foot-candle (fc), which is a unit for measuring illumination. You may be able to borrow a light meter from a photographer or purchase one online. If you have access to a light meter, take the following measurements and record data on this chart. If you do not have a light meter, record "adequate" or "inadequate" on the chart. Standards for adequate lighting in classrooms have been established.

Turn into _____ by _____.

Using Light Meter: **Time of Day:**				**Natural light adequate with…**	
Teacher Name: **Room #_____**	**Light Quantity with All Lights On (foot candle-fc)**	**Light Quantity with Half of Lights Off (foot candle- fc)**	**Light Quantity with All Lights Off (foot candle-fc)**	**Half of Lights Off (Yes or No)**	**All Lights Off (Yes or No)**
On a desk near the windows					
On a desk in the middle of the room					
On a desk away from the windows					
In the hallway outside the room					
Conclusions:	Average fc with All Lights On	Average fc with Half Lights Off	Average fc with All Lights Off		

Note: Assuming that 50 foot candles (fc) provides adequate lighting for the students, it may be possible to use fewer lights and ultimately less energy. To test if 50 foot candles provide enough light, students can try reading at different light levels and determine what level of lighting is most comfortable for them.

The Illuminating Engineering Society of North America has set standards for indoor lighting. The typical classroom should be in the range of 30 to 50 foot candles, depending on the task being performed. *For example, reading very small print will require more light than reading large print or viewing a computer screen.* ***Hallways and lower-use areas can be approximately 25 fc.*** *With daylighting, it may be possible to use fewer lights and ultimately less energy. (Source: www.iesna.org)*

1. Type of weather on the day measurements were taken: circle one
   Sunny Partly Cloudy Cloudy

2. If the weather was cloudy, try repeating the measurements on a brighter day. Do the readings change?
   - ☐ Yes
   - ☐ No
   - ☐ Explain _____

3. Do the light meter readings vary depending on the location of the reading?
   - ☐ Yes
   - ☐ No
   - ☐ Explain _____

4. Are any rooms or areas of the room over lit or under lit for the tasks being performed?
   - ☐ Yes
   - ☐ No

   Explain: _____

5. Are all light bulbs on when the space is in use or can lighting be adjusted to take advantage of natural light when available?
   - ☐ Yes
   - ☐ No

6. How could this information be used to help conserve energy in the room?_____
   _____
   _____

Disposing of fluorescent bulbs: You may have heard that fluorescent light bulbs shouldn't be thrown in the regular trash. This is because they contain small traces of mercury. For more information on how to properly dispose of fluorescent bulbs, go to http://www.epa.gov/wastes/wycd/howdoirecyclemy.htm

Did You Know??? "LED" Exit Lights are as much as 75% more visible than traditional exit lights; cuts energy costs by 90%, and can last up to 10 years!

Part 4: Equipment and Appliances in Our School

Items we plug in and school equipment account for the remainder of energy use in the school or about 20% of overall energy usage. Explore ways that your classrooms and school are using equipment and look for ways to conserve energy. Print off the Equipment and Appliance Investigation and distribute to classrooms to collect data for school wide investigation.

Classroom Equipment and Appliance Investigation

Turn into_____by _____. Date of Investigation:_____

If you have access to watt meters, they can calculate the kWh used per hour, day, month, year and the estimated costs per hour, day, month and year.

Teacher Name:			**Room #:**					
Equipment or Appliance	**Quantity** (Number of devices in the room)	**Average Watts Used:**	**Estimated Hours Used per Day** (Consider whether it is turned off at night and/or when not in use)	**Energy Used Per Day (kWh)**	**Number of School Days per Year** (consider if the appliances are unplugged during breaks and holidays)	**Total kWh Used per Year**	**Estimated Cost per Year** (use average of .10 or actual cost, see p. 16)	**How Many of these Devices have an Energy Star Label?**
	A	**B**	**C**	**D= B x C**	**E**	**F= D x E**	**G= A x F x $0.10**	**H**
Computers		Unit On: Unit Off:						
Printers		Unit On: Unit Off:						
Radio		Unit On: Unit Off:						
Television		Unit On: Unit Off:						
DVD/VCR Players		Unit On: Unit Off:						
Smart Boards		Unit On: Unit Off:						
Coffee Pot		Unit On: Unit Off:						
Microwave		Unit On: Unit Off:						
Mini Fridge		Unit On: Unit Off:						
Clock		Unit On: Unit Off:						
Fans		Unit On: Unit Off:						
Overhead Projector		Unit On: Unit Off:						

LCD Projector		Unit On: Unit Off:						
Other:		Unit On: Unit Off:						
Totals:								

Energy Investigation Appliance Instructions

Note: 1. Average electricity cost of $0.10 per kWh (nationwide average in 2009) or the actual electricity cost (see p. 16 of this packet).

A—Total quantity: Add up and record the number of devices of each type.
B—Average watts used: Record an overall average watts used for each device type when it's on and off if possible. This overall average value can be based on the typical or most common value found.
C—Hours used per day: Add up the hours used per day for each device type and record the result.
D—Energy used per day: Multiply average watts used (column B) by hours used per day (column C). Then divide by 1,000 to get power used per day in kilowatt hours (kWh). Record the result.
E—Number of school days per year: Record the number of days per year that your school is in session.
F—Total kWh per year: Multiply energy used per day (column D) by number of school days per year (column E) to get the total electricity use while school is in session for each device type in kWh.
G—Total cost per year: Multiply the number of devices (column A) by total kWh per year (column F) by the U.S. average of electricity cost to get the electricity cost of operating the devices while school is in session.
H- ENERGY STAR: Many devices have an ENERGY STAR label indicating that they have been certified as energy conserving. Look for the ENERGY STAR label on each device. Count and record the number with labels.

1. Are any of the above equipment or appliances turned on in the morning and left on all day? If yes, list them:
   _____
   _____
   _____

2. Look at column A, Number of devices in school.
   Which device was the most common? _____
   The least common? _____

3. Look at column B, Average watts used.
   Which device had the highest average watts used? _____
   The lowest average watts used? _____

4. Look at column G, Total cost per year.
   Which device type had the highest total electricity cost? _____
   The lowest total electricity cost? _____

5. Are computer monitors turned off after use?
   - ☐ Yes
   - ☐ No

6. Do classroom computers have a sleep function or sleep mode software that allows them to “sleep” when not in use?
   - ☐ Yes
   - ☐ No

7. Are power strips or smart strips used with appliances or electronics to turn off multiple devices at once?
   - ☐ Yes
   - ☐ No

8. Do any of the appliances or devices have a phantom load?
   (A phantom load is the amount of energy that a device uses while in standby mode or when switched off. Some appliances, such as TV’s or DVD players with remote controls, use energy even when they are turned off, because they are in standby mode and not actually turned off. Devices with an internal clock, such as a microwave, also carry a phantom load. You can use a watt meter to check for and measure phantom loads.)
   - ☐ Yes
   - ☐ No
   - ☐ If yes, list the devices:

     _____

     _____

Did you know? Your appliances are using electricity even when they are turned off? This is called “phantom energy.” To help save energy in your classroom or school, unplug appliances when they are not in use or plug them into a power strip or another option is a smart strip. When you turn the strips off, the appliances no longer draw phantom energy and save energy and money.

Did you know? Sensors or vending machine misers can save nearly 50% of the $170-$250 in annual electricity costs to operate.