The HVAC
(Heating, Ventilation, and Air Conditioning)
and Insulation in Your Home

EnergySmart
A New Orleans Program

Entergy

Energy Smart is a comprehensive energy efficiency program developed by the New Orleans City Council and administered by Entergy New Orleans, LLC.

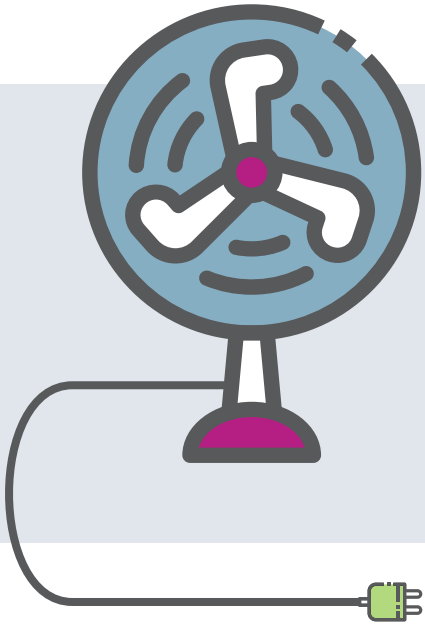
THE HVAC (HEATING, VENTILATION, AND AIR CONDITIONING) AND INSULATION IN YOUR HOME

Today we are going to examine one of the most important resources in our lives. It's the resource that allows our homes to be comfortable and bright, gives us a level of convenience never seen before in history, and makes its way into almost everything we do. That resource is **energy**.

Energy is, as scientists say, **the ability to do work**. Any time something is moving, heating up, making noise, growing, or changing in any other way, energy is present. Usually, we don't think about energy unless we suddenly can't use it. Mostly, adults think about energy use when they have to pay bills. So let's give it some thought, shall we?

Energy efficiency is the process of using energy more wisely – in other words, doing more work while using fewer resources.

ANY TIME SOMETHING IS MOVING, HEATING UP, MAKING NOISE, GROWING, OR CHANGING IN ANY OTHER WAY, **ENERGY** IS PRESENT.



In this packet:

In this packet, you'll find interesting activities about one major area of home energy use: HVAC and insulation. We sometimes call our energy bill a light bill, but HVAC (heating, ventilation, and air conditioning) accounts for about 52% of the bill – more than half of home energy use. That means that changing the way you heat and cool your home can save your family significant amounts of money and lessen your harmful impact on the environment.

Energy efficiency is the process of using energy more wisely – in other words, doing more work while using fewer resources.

52%

of our energy bill spent on heating, ventilation, and air conditioning.

ACTIVITY 1 • Essential Questions

Let's see what your thoughts are on some of these. You can look up the answers or take your best guess and test your knowledge.

Why is it crucial to conserve energy?

What are some ways to save energy at home?

How does the heat from incandescent bulbs contribute to increased use of the HVAC system in a home?

What are the most cost-effective ways to weatherize and insulate a home?

Who is the energy provider in our city?

What is the impact of using less energy than needed?

K • W • L

You're about to do what's called an "audit." Basically, that means you're going to investigate what's going on. Right now, our audit is focused on the appliances in your home, which you probably haven't given much thought. Before you begin, fill out the first two parts of this KWL chart to figure out where you are in terms of lighting knowledge.

What I Know	What I Want to Learn	What I Learned
K	W	L

ACTIVITY 2 • Read the Article

How to Find and Seal Air Leaks in Your Home

Adapted from Michael Knezovich and Kevin Brasler, March 2015

Before considering insulation improvements, first find and plug air leaks, holes, cracks, and gaps that let cold air in and warm air out in the winter – and do the reverse in the summer. If you feel drafts in the winter, that's an obvious sign of leaks.

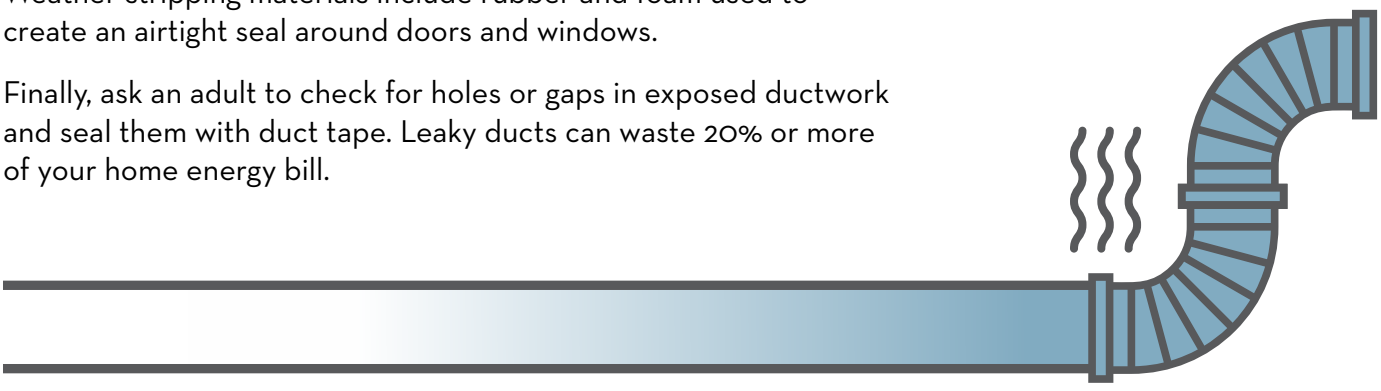
One little leak might not seem like much, but the effect of several leaks can amount to the equivalent of leaving open a window.

You can identify major air leaks in the following places around your home:

1. **Door and window frames**
2. **Mail slots**
3. **Outdoor water faucets**
4. **Where vents pass through walls**
5. **Cracks or gaps in exterior or interior siding**
6. **Around window air-conditioning units**

You can use caulk to seal any cracks or gaps. To minimize leakage around doors and windows, install weather-stripping. Weather-stripping materials include rubber and foam used to create an airtight seal around doors and windows.

Finally, ask an adult to check for holes or gaps in exposed ductwork and seal them with duct tape. Leaky ducts can waste 20% or more of your home energy bill.



OVER **20%**

of our energy bill that can be wasted by having leaky ducts.

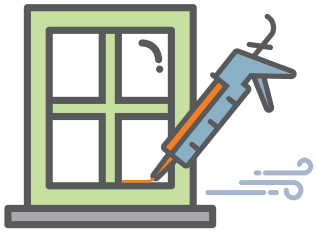
ACTIVITY 3 • Home Air Leak Audit

Create your draft detector: For this activity, you will need a pencil, tissue paper, and tape. If you don't have these things, you can substitute a candle or a stick of incense.

Instructions: Tape the tissue paper along the side of the pencil so that it resembles a flag. Presto! You have created a draft detector to help you identify air leaks around your home. Practice checking doors and windows for air flow and movement by placing the draft detector along the edges of windows and around doors. If the tissue paper moves because of air flow, that means you have found an air leak. If you're using a candle or incense, and the flame or smoke moves more when held to one of these spots, you've found an air leak. After practicing, use the chart below to audit air leaks in your home.

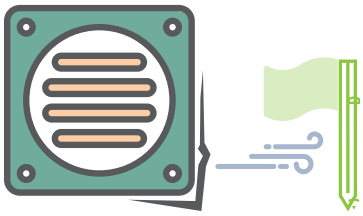
Have a conversation with your family:

WHAT CAN YOU DO TO SEAL SOME OF THESE LEAKS?



Window Air Leak
(caulking is shown here to seal window air leaks)

Door Draft
(a door draft is shown here where air can enter and escape)



Wall Air Leak
(caulking can be used to seal gaps or cracks)

WHAT AIR LEAKS DO YOU HAVE? WHERE ARE THEY?			
	Window	**Door**	**Wall**
Kitchen			
Living room			
Bathrooms			
Bedrooms			
Closets/storage			
Hallways			
Other			
Total			
Total Number of Air Leaks:			

ACTIVITY 4 • Read the Article

Facts about insulation

Every day, the heat that we lose from our homes has a significant impact on the planet (and our pockets!).

Through insulation, we can save heat, money, and the planet.

Heat travels to colder environments, so when we heat our homes, heat will escape from any uninsulated area to the cooler temperature outside. Likewise, if we cool our homes, heat from outside will try to sneak in.

In the wild, many animals have developed their own solutions for reducing heat loss. The emperor penguin lives in the world's most inhospitable climate – the pack ice of the Antarctic. Penguins have dense, oily feathers and a thick layer of fat beneath their skin – which acts like insulation, keeping their natural body heat in.

In the deepest winter, the penguins huddle together in a continually moving spiral in order to conserve heat and stay warm in freezing temperatures and high winds. The penguins on the outside of the huddle turn their backs to the wind to shield themselves and the inner core of penguins.

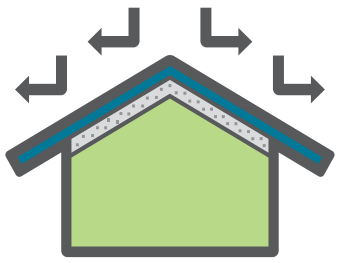
The spiral revolves to allow those on the outside to move to the center, where the heat is trapped by layer upon layer of insulated penguin bodies. It is so warm that sometimes steam can rise.

How heat can transfer:

- Radiation – how heat transfers through empty space by electromagnetic waves. This is how the heat from the sun can make your house hot during the summer.
- Convection – how heat travels in moving currents. Imagine hot air rising from your stove, then cooling and falling to be reheated to rise again.
- Conduction – how heat travels through solids. For example, imagine a saucepan used to cook vegetables. The vegetables and saucepan are both room temperature before being placed on the hot stove. After being placed on the stove, the vegetables and saucepan get warmer and warmer as heat from the stove is transferred to the vegetables and saucepan.

So what's insulation?

- Insulation is the material or technique used to reduce the rate at which heat is transferred.
- By putting a coat on, heat from your body stays close to your body, keeping you warm.
- Birds fluff up their feathers in the winter to trap air in between to help insulate them from the cold.
- Sheep grow thick wool to keep them warm on the hillside – the wool traps pockets of air, which is why we use it to make warm winter clothing for ourselves and to insulate our homes.



We can insulate our homes by adding insulating materials such as fiberglass. That way, when we air-condition our home, it stays at the temperature we want. This is a case where the heat of the external air would transfer through a solid – or conduction. When your home is well-insulated, heat from outside can't find its way inside through the walls or floor. That means the temperature inside stays at your desired level and your A/C unit doesn't have to work for as long. That saves a lot of energy!

Know Your Terms

Instructions: Look up the following terms from the previous article:

Radiant heat:

HVAC:

Conduction:

Convection:

Radiation:

Insulation:

ACTIVITY

ACTIVITY 5 • Insulation Experiment

Your A/C is a part of a system of measures in place to keep you comfortable. In addition to using an A/C in your home, you can use insulation to improve the efficiency of your A/C. Basically, insulation is material used that reduces heat loss or heat gain. Remember, the A/C uses up to 52% of the energy you pay for. You can save significant amounts on your bill by adding insulation to your home because it will help you use your air conditioner less often, saving you money.

Instructions: Your assignment is to answer the following question: **"What type of insulation will prevent the ice cube from melting before time is up?"**

Which materials are the best insulators?

For this experiment, you'll need:

- Ice in sandwich bags.
- Insulators – newspaper, foil, Styrofoam, cotton balls, socks, paper towels, etc.
- Tape.
- One shoebox or small cardboard box. (Try to choose a box with no holes or tears.)
- This sheet and something to write with.
- A thermometer if you have one. (Please do not go out to buy a thermometer.)
- A ruler.

STEP 1

Once you have collected your supplies, create a hypothesis: Your insulators all have different properties and are made of different materials. **Which ones do you think will make the best insulators and why?**

STEP 2

Use the materials to insulate the box. For example, use the foil on top of the box to block radiant heat from light. There is no limitation on how you can use the materials. Be creative! **Describe your setup here:**

STEP 3

Measure the ice cube and record its size. Then, make a prediction: What size do you predict your ice cube will be after 90 minutes in the insulated box?

Starting Size:	Ending Prediction:

STEP 4

Take the bag of ice and make sure it is sealed so that it does not leak. Place it in the box and let it sit for 90 minutes.

Record the temperature inside box and make other observations:

STEP 5

After 90 minutes has passed, open the box! Record the changes:

How big is the ice cube now?

What is the temperature of the box?

STEP 6

Answer the following questions about this experiment:

1. Was your hypothesis correct? Were your insulators good at their job?

2. Was your prediction about the size of your ice cube correct?

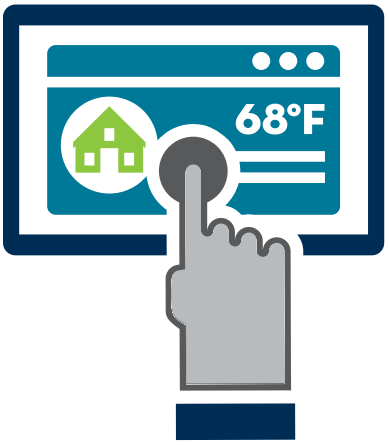
3. Would you change the way you used the materials in any way?

4. What kind of insulation would you recommend your family use?

ACTIVITY 6 • Read the Article

Thermostats

Adapted from the U.S. Department of Energy



You can save money on your heating and cooling bills by simply resetting your thermostat when you are asleep or away from home. You can do this automatically without sacrificing comfort by installing a programmable thermostat.

With a programmable thermostat, you can adjust the times you turn on the heating or air conditioning according to a pre-set schedule. Programmable thermostats can store and repeat multiple daily settings. You can program your thermostat to turn off during the week if no one is home during the hours of 8 a.m. and 3 p.m. This can save your family up to 10% on your bill according to the U.S. Department of Energy.

You can easily save energy in the winter by setting the thermostat to 68°F. This is the recommended winter setting from the Environmental Protection Agency.

In the summer, you can follow the same strategy with your A/C by keeping your thermostat set at 78°F only when you are at home and need cooling. When your A/C is closer to the temperature outside, you will save more money.

Most programmable thermostats are digital. Digital thermostats offer the most features in terms of settings.

When programming your thermostat, consider when you normally go to sleep and wake up. If you prefer to sleep at a cooler temperature during the winter, you might want to start the temperature setback a bit ahead of the time you actually go to bed. Also consider the schedules of everyone in the household. If there is a time during the day when the house is unoccupied for four hours or more, it makes sense to adjust the temperature during those periods.

The location of your thermostat can affect its performance and efficiency. Read the manufacturer's installation instructions to prevent "ghost readings" or unnecessary furnace or air conditioner cycling. To operate properly, a thermostat must be on an interior wall away from direct sunlight, drafts, doorways, skylights, and windows. It should be located where natural room air currents – warm air rising, cool air sinking – occur. Furniture will block natural air movement, so do not place pieces in front of or below your thermostat. Also make sure your thermostat is conveniently located for programming.

ACTIVITY 7 • How Much Can My Family Save on HVAC?

How much does your family spend to heat and cool your home, and how can you reduce that amount? Let's find out.

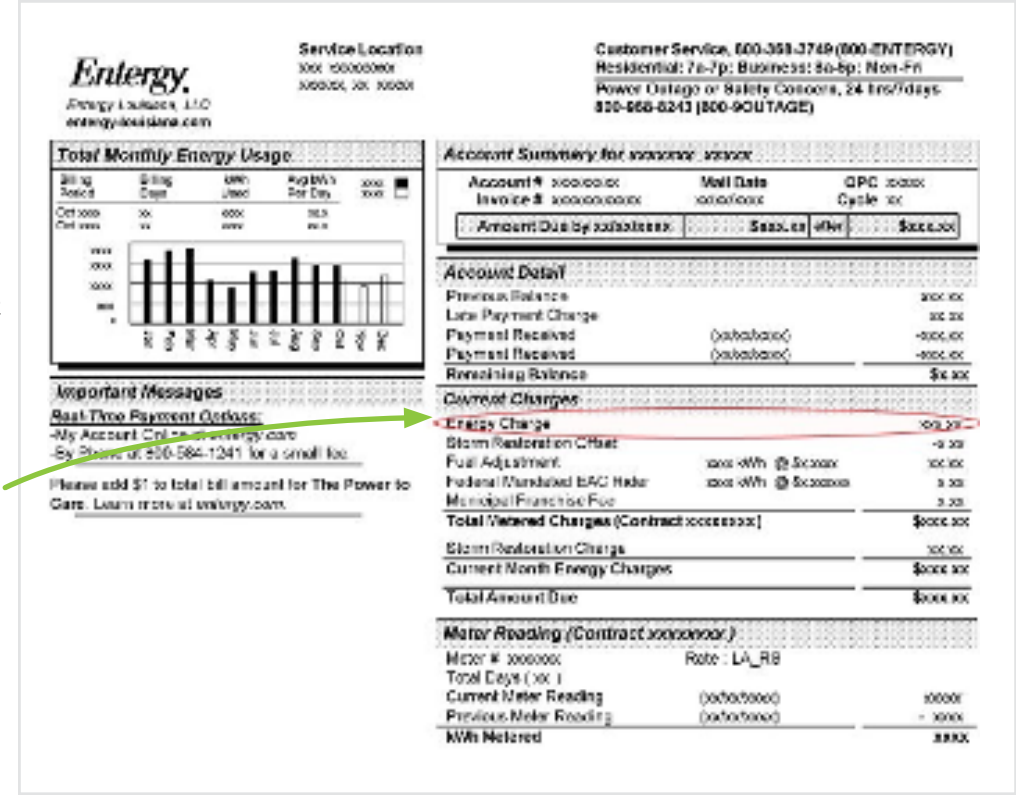
STEP 1 Locate your energy bill.

Ask the adults at home where the bill is and if you can take a look at it. If your family doesn't pay the energy bill (say, for example, if your landlord pays it), then you can either ask them to guess how much the bill is, ask another family member, or skip this activity.

STEP 2

Let's read that bill.

Not everything in your energy bill is purely for the energy you use at home. Some of it is fees for other services. Look at the line that says, "Energy Charge" or "Electric Base Rate Charge."



STEP 3 Now that you've located the amount of money your family spends on energy; take stock of what temperature your thermostat is set to.

What temperatures does your family like?

Did you set your thermostat at or near the recommended temperature of 78° in the summer and 68° in the winter? Why or why not?

Do you feel your family spends too much on heating and cooling your home after looking at the cost of your electric bill?

STEP 4 Calculate how much you spend on HVAC:

A) If you DO NOT mostly set your thermostat at or near 78° in the summer and 68° in the winter:

Energy base rate x 50% = _____

B) If you DO mostly set your thermostat at or near 78° in the summer and 68° in the winter:

Energy base rate x 40% = _____

This is what your family spends each month to heat and/or cool your home.

STEP 5 When you set your thermostat at or near the recommended setting of 78° in the summer and 68° in the winter, you can see significant savings on your bill.

From step 4: **(Energy base rate x 50%) – (Energy base rate x 40%) or simply A - B = _____**

STEP 6 How much would you save in a year?

STEP 7 What would your family do with the money that you've saved from setting your thermostat at or near the recommended setting of 78° in the summer and 68° in the winter?

STEP 8 What are three ways you can save energy and money with your HVAC system?

1.

2.

3.

HVAC, Insulation, and the Environment

So much of our environmental impact is from the energy we use at home. Our local air quality and the effect we have on global climate change are both affected by our city's choices for energy sources.

We measure the energy we use in our homes in kilowatt hours (kWh). Because most of our energy comes from natural gas and other fossil fuels, each kWh we create emits about 3 pounds of greenhouse gas into the atmosphere. **How many pounds of greenhouse gas will you prevent from entering the atmosphere if you adopt better HVAC habits?**

ACTIVITY

STEP 1

You've already figured out what you spend on HVAC (the answer to **step 4** of the last activity). In New Orleans, each kWh costs 10.5 cents. That means:

Your HVAC cost = the number of kWh you use x 10.5 cents

Divide your HVAC cost by 10.5 cents to find out how many kWh you currently use.

STEP 2

Each kWh represents 3 pounds of greenhouse gas. How many pounds of greenhouse gas are emitted due to the HVAC system in your house?

Number of kWh x 3 pounds of greenhouse gas = _____

STEP 3

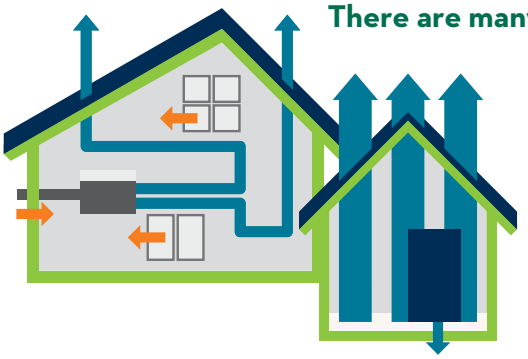
To find out how much you'd be emitting if you set your thermostat at or near the recommended setting of 78° in the summer and 68° in the winter, repeat steps 1 & 2, using your new HVAC cost (from step 5 of the last activity, or B from step 4) instead:

Your new HVAC cost = the number of kWh you use x 10.5 cents

Number of kWh x 3 pounds of greenhouse gas = _____

STEP 4

Subtract your new emissions number from the original to find out how much you would lower your impact:



There are many sources for air leaks both in and out of your house.

Common sources of air leaks INTO the house:
Windows
Outdoor faucet
Dryer vent
Doors
Electrical outlets
Fireplace

Common sources of air leaks OUT of the house:
Bathroom fan
Kitchen fan
Attic opening
Recessed lights
Furnace ducts

ACTIVITY

You've completed this set of activities on the impact of the HVAC system on your family and the environment. Return to the K-W-L chart and write out what you've learned.

EnergySmart
A New Orleans Program

Entergy®

Energy Smart is a comprehensive energy efficiency program developed by the New Orleans City Council and administered by Entergy New Orleans, LLC.

REFERENCES

www.homedepot.com/c/ah/how-to-winterize-windows/9ba683603be9fa5395fab9003f62a0a
www.energy.gov/energysaver/weatherize/air-sealing-your-home/caulking
info.betterdoor.com/blog/4-major-leak-prone-areas-around-door
ontime59.com/why-air-conditioner-leaking-fix/
www.windowworldmn.com/blog/entryid/120/how-long-does-insulation-last
www.alibaba.com/product-detail/Aluminum-foil-thermal-insulation-insulated-box_60808558026.html