Unit 1 ENERGY

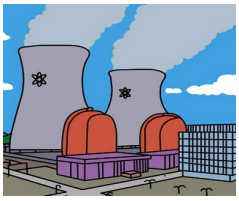
1. ENERGY

Energy is the driving force in the universe. We can use energy en many different ways every day:

- Turning lights on in our house
- Warming[1] our houses
- Keeping our body temperature
- Driving our cars, trains, buses, planes....
- Giving us power to work, jump, run, ...

Nothing can work without energy. Our bodies need energy to grow and energy allows[2] our minds to think. We use energy for everything we do.

Energy is the ability to make **changes** and **transformations**.



Activity 1. Indicate if the following sentences are true or false:

Energy does not exist because we cannot see or touch it.	
Energy can be measured.	
Only living things, like animals and plants, can have energy.	
A stone cannot have energy because it is not a living thing.	
Only substances that can be burned, such as wood or coal, can provide energy.	
A bike does not need energy to work because it does not have a motoran engine	
Living things do not need energy to live if they do not move and stay still.	

Activity 2. Choose the correct answer and complete the following sentences:

a) Wind *has / ~~does not have~~* energy because *it can move objects.*

b) Coal *has / does not have* energy because _____

c) A stone on the ground *has / does not have energy* because *it can cause / it cannot cause* changes into other bodies, but a stone on top of a wall *has / does not have energy* because _____ for example _____

d) Light _____ changes or transformations in other bodies, and for this reason it *is / is not* a type of energy.

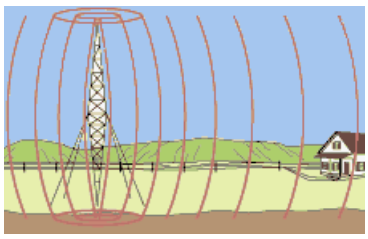
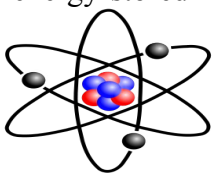
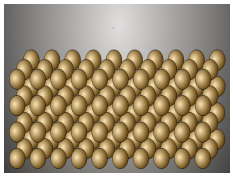
Activity 3. Match the following sentences:

Plants		food
Animals		electricity
Cars	obtain their energy from	wind
Radios		sun
Sailing ships		elastic bowstrings[3]
Arrows		oil

1 Warming_quentando; to allow_permitir; bowstrings_cuerdas de arco

2. TYPES OF ENERGY

There are many forms of energy, but we can classify into two categories: **potential** and **kinetic**.

Enerxía cinética(Ec) Esta é enerxía de **movemento**	**Enerxía potencial(Ep)** Esta é enerxía **almacenada**
Enerxía **radiante** é a enerxía **electromagnética** que viaxa en ondas transversais. Esta enerxía inclúe **luz,** raios X e ondas de radio.  	Enerxía **química** é a enerxía almacenada nas ligazóns de átomos e **moléculas.** Gas natural, carbón, petróleo e baterías conteñen este tipo de enerxía. As cousas vivas usámolla para permanecer vivas.  
Enerxía **eléctrica** é transportada por pequenas partículas **cargadas**	**Nuclear** energy is energy stored in the **nucleus** of an atom. 
Enerxía **de movemento** é a enerxía que vén do **movemento** dos obxectos e calcúlase **Ec= ½ mv²** onde **m** é a masa e **v** a velocidade. A enerxía cinética dun ladrillo de 1 kg viaxando a 5 m/s, sería, entón: E_c=1/2.1 kg. (5 m/s)²= 12,5 J 	Enerxía **gravitacional** é a enerxía almacenada por un obxecto al estar a unha determinada **altura**. Calcúlase: **E_p= mgh** onde **m** é a masa, g é a gravidade (~10 m/s²) e **h** é a altura. A enerxía potencial dun ladrillo de 1 kg que está a 2 m de altura sobre o solo é: E_p= 1 kg. 10 m/s².2 m=20 J 
Son é a circulación de enerxía a través de sustancias en ondas lonxitudinais **(vibracións).** 	Enerxía **potencial elástica** é a enerxía almacenada nos obxectos por **tensión,** tales como arcos, cordas elásticas estiradas, muelles, etc, ... 
Enerxía **térmica**, se atopa en obxectos **quentes.** Esta enerxía se almacena como **enerxía cinética** das partículas que forman a sustancia, pois vibran, desprázanse respecto a súa posición de equilibrio, para os sólidos e tamén desprázanse os líquidos, o gas e o plasma. Ligazón	 Preme na imaxe para ver como vibran

Mechanical energy is the total energy of a system and we calculate it adding the kinetic and potential energy. We can see it in this formula **Em = Ec + Ep**

Así, a enerxía mecánica do noso ladrillo de 1 kg, a 2 m de altura e movéndose a 5 m/s é:

$E_m = E_c + E_p$= 12,5 J + 20 J =32,5 J

Activity 4. Classify the followings types of energy into the two categories: **potential** and **kinetic**.

Chemical energy, x- rays, electric energy, gravitational energy, motion energy, sound, light, elastic potential energy, nuclear, thermal energy (heat).

Kinetic energy (Ec) .	Potential energy (Ep)

Activity 5. Calculate the energy of a 2 Kg stone that is located 2 m above the floor.
Which type of energy does this stone have? g = 10 m/s^2.

Activity 6. Calculate the energy of a 0,5 Kg rabbit running at 15 m/s.
Which type of energy does the rabbit have?

Activity 7. A 3 Kg object is moving at 20 m/s and it is located 3 m above the floor. Calculate the mechanical energy (total) of this object.

Activity 8. Indicate the type of energy that the following systems have .

Systems	Type of energy	Systems	Type of energy
Food		An arrow placed in a bow	
Battery		Flower pot on the wall	
Hot stove		Uranium	
Coal		A moving car	
Radio waves		A charged particle	

Activity 9 . Do you think that energy always stays in the same form, or can energy change to another form?

3. LAWS OF ENERGY

There are many different forms of energy. One form of energy can be transferred to another form but the **total amount[2] of energy is constant** (conservation of the energy). **Energy is never created or destroyed**. When we use energy, it doesn't disappear. We **change it from one form of energy into another.**

A car engine burns petrol, converting the chemical energy in gasoline into kinetic energy. Solar cells change radiant energy into electrical energy. Energy changes form, but the total amount of energy in the universe stays the same.

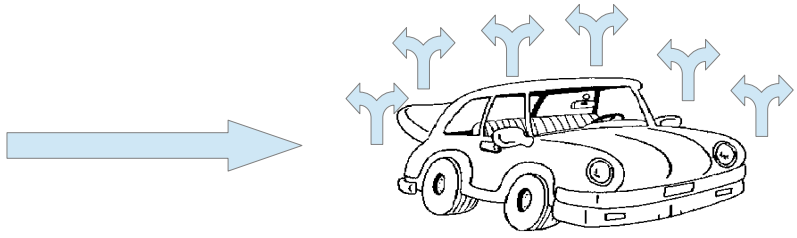
However, some energy goes out of the system in each change and it is lost . We can determine the amount of energy in a system, the amount lost (almost always as heat) , and the efficiency of the system is always less than 100 %.

Activity 10 . 50 L of gasoline produces 1740 MJ of energy, but a normal car only uses 522 MJ of this energy. Complete the following gaps and calculate :

$$Energy\ efficiency = \frac{Useful\ energy}{Total\ energy} * 100$$

a) Useful energy
b) Wasted energy (heat)
c) Energy efficiency

WASTED ENERGY =
TYPE OF ENERGY :



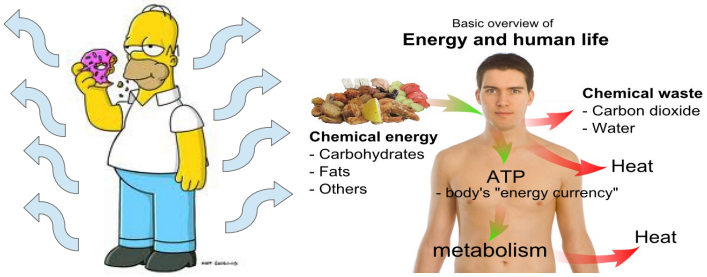
TOTAL ENERGY =
TYPE OF ENERGY:

USEFUL ENERGY =
TYPE OF ENERGY:

Energy efficiency = _____ *** 100 =** **%**

Activity 11 . The human body obtain the energy it needs from food. Daily food provide about 3000 food calories (about 12561 MJ) , but the body only uses about 628 MJ. Complete the following gaps and calculate: a) useful energy, wasted energy and Energy efficiency

WASTED ENERGY =
TYPE OF ENERGY :



TOTAL ENERGY =
TYPE OF ENERGY:

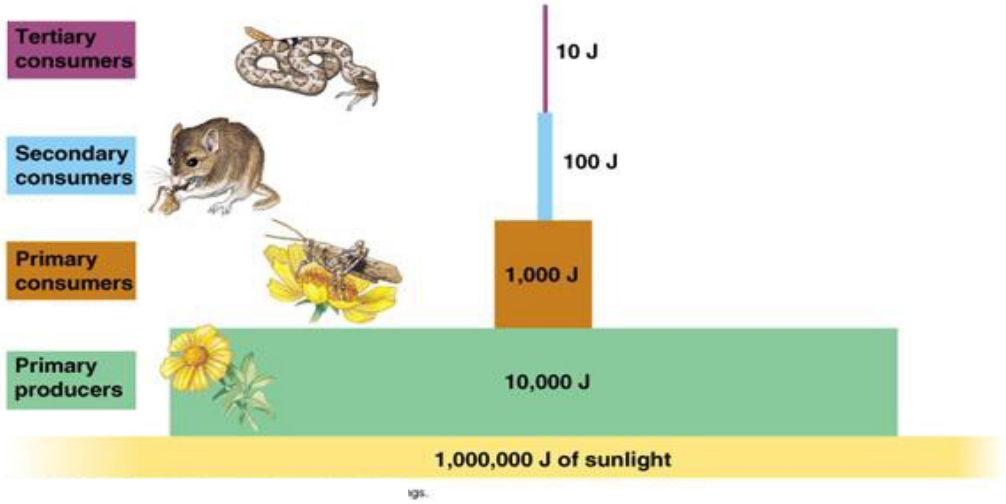
USEFUL ENERGY =
TYPE OF ENERGY:

Energy efficiency = _____ *** 100 =** **%**

2 amount_cantidade;

Activity 12 . If the brain spends 20% of the total energy, how much energy does the body's brain consume in activity 11?

Activity 13 . Typically, just 10 percent of the energy presented in one trophic level is passed along to the next level in an ecosystem. Calculate the energy efficiency of an ecosystem

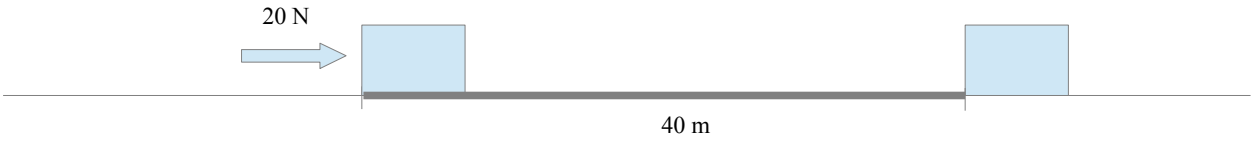


Energy efficiency = $\frac{\qquad}{\qquad}$ *** 100 =** **%**

4. ENERGY TRANSFER

There are only **two ways to transfer energy** from a system to another: **work** and **heat** . **Work** is the energy transferred by forces. Work is the product of force and distance. **W = F . d** where **F** is the force and **d** the distance.

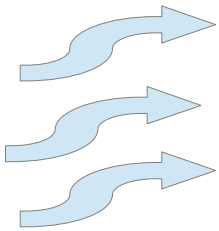
Activity 14 . Calculate the energy transferred to a body if it is pushed by a force of 20 N for 40 m



On the other hand, **heat** is the energy transferred to a body because there is a difference in temperatures. It is calculated using this formula **Q = m. ce. ΔT** where **m** is the mass, **ce** is a constant that depends on the substance and **ΔT** is the difference of temperatures ($T_2 - T_1$). So, to heat 2 kg of water from 5 to 15ºC, we have to give it Q= 2 kg.4180 J/(kg.ºC).(15ºC-5ºC)=83600 J.

Substance	Ce (J/Kgº C)	Substance	Ce (J/Kgº C)
Water	4180	Copper	376
Ice	2090	Iron	418
Water vapor	1881	Silver	250
Olive oil	2508	Led	125
Alcohol	2424	Gold	125

Activity 15 . A glass of water with 40 J of energy receives 30 J of energy from a heater. Calculate the amount of **heat** received and the **final energy** of the water.


Activity 16 . It is necessary to heat water for showering.

a) Calculate the amount of energy that 30 kg of water need to increase its temperature from 10 ° C to 40 ° C. Indicate the type of energy received.

Q = _____ * _____ * (_____ - _____) = _____ J

b) Calculate the amount of energy that requires 70 kg of water need to increase its temperature from 10 ° C to 60 ° C. Indicate the type of energy received.

Q = _____ * _____ * (_____ - _____) = _____ J

c) What do you think it is necessary to save energy?

Activity 17 . Explain why the following bodies become hotter.


a) A space ship coming into atmosphere (friction)

b) The brakes of a car

c) A drill


d) Rubbing one's hands together

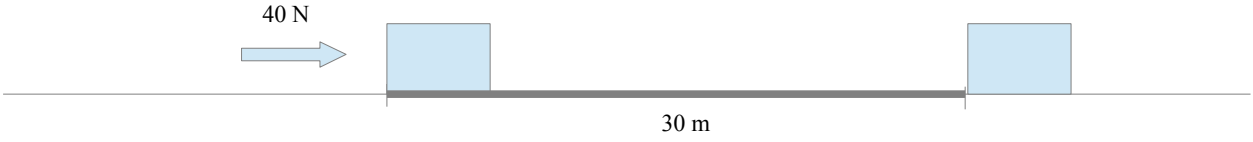
Activity 18 . Why is the shape of cars important ?

Activity 19 . Complete the following gaps:

efficiency **heat** **reduce** **improve**

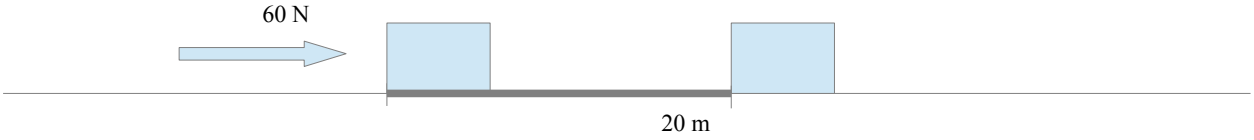
Friction among bodies transforms the energy into _____, for that reason, it is necessary to _____ it to avoid energy loss and _____ the energy _____ (performance)

Activity 20 . a) Calculate the energy transferred to a body if it is pushed by a force of 40 N for 30 m



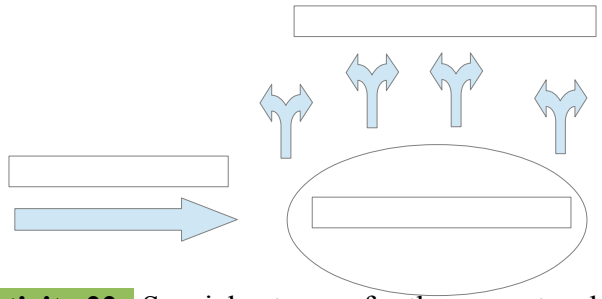
W = ☐ * ☐ = ☐ J

b) Calculate the energy transferred to a body if it is pushed by a force of 60 N for 20 m



W = ☐ * ☐ = ☐ J

Activity 21 . A body, which has 30 MJ of energy, receives 10 MJ of work and wastes 15 J of heat. How much energy has the body at the end?

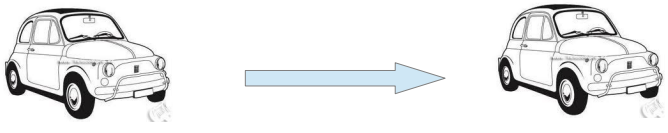


E = ☐ + ☐ - ☐

E = ☐ J

Activity 22 . Special category for those want a challenge people. Refrain lazy people .

Calculate the work that a motor did if a 1000 Kg car has increased its speed from 5 m/s to 30 m/s.



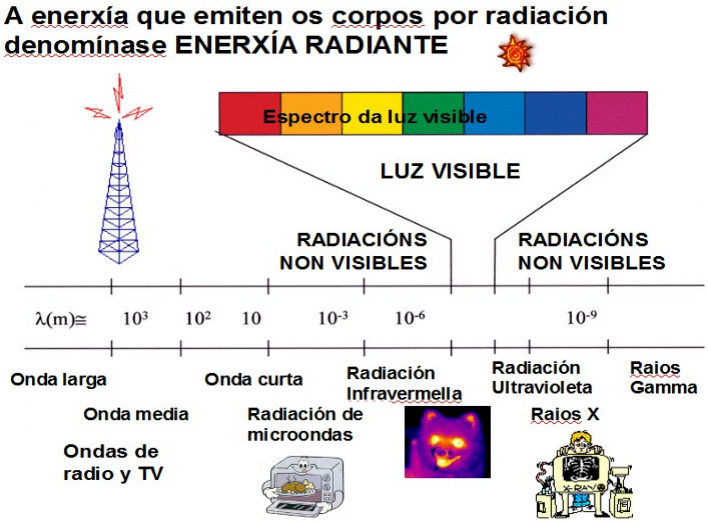
5 m/s 30 m/s

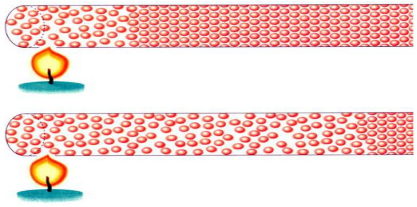
The heat can be transmitted in three different ways:

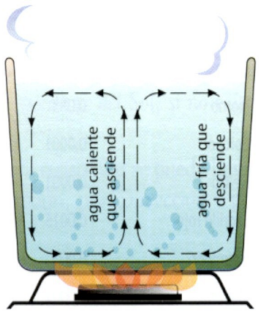
Conduction: is the process in which energy is transmitted from one point to another without transferring matter. The more energetic atoms collide with the less energetic ones. These less energetic atoms have less temperature (and less thermal energy) and they transmit some of this energy.

convection: is the process by which heat energy is transferred from one point to another of a fluid (liquid or gas) by the motion of the fluid itself. In convection energy is transmitted by the transport of matter.

Radiation: Radiation is the process by which bodies emit energy that can propagate through the vacuum[3] (space) by waves.



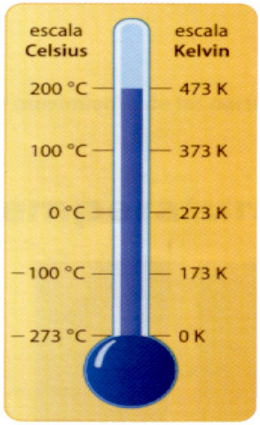




A enerxía térmica dun obxecto pódese medir cun aparello denominado **termómetro.** Un termómetro mide a temperatura dun corpo, e a temperatura está relacionada coa vibración das partículas. Canta máis temperatura, máis vibran as partículas, e así tén máis enerxía cinética, que como xa vimos, chámase enerxía térmica.

Un sólido pode ter tanta enerxía térmica que pode chegar un momento no que se afunda pois os enlaces non son quen de manter xuntas as partículas que forman o sólido e este afundese, e se seguimos quentando, pasa a fase gaseosa.

A temperatura pode medirse en **distintas escalas**. As máis importantes son a escala Celsius ou centígrada, a Kelvin ou a Farenheit, usada nos países anglosaxóns. A escala Celsius toma o 0ºC a temperatura a que funde o xelo e 100ºC a que, a presión normal, o auga líquida pasa a vapor. A escala Kelvin, pon o 0 K a temperatura na cual a vibración das partículas détense, a temperatura máis baixa que se pode alcanzar, -273,15 ºC.



Para pasar dos graos centígrados aos kelvines: K = ºC + 273

Activity 23. What method of heat transfer is the when: it heats the air in a room with a radiator heats the earth with the light of the sun, it heats a spoon stuck in hot food.

Activity 24. Changing the following temperatures K or ° C:
Melting temperature of iron: 1808 ° C
T which is obtained liquid oxygen at normal pressure: 90 K
Minimum temperature recorded on Earth: -89 ° C (Anctartica)
Maximum temperature recorded on Earth: 58 ° C (in the Shadow)

3 Vacuum_vacío;

5. UNITS

The International System of Units is the modern form of the metric system. It is the used system system al over the world. There are only three countries that have not adopted this system : Burma, Liberia and the United States.

It is necessary to **translate all the units into International System of Units** (SI) to do the calculations.

Quantity	Unit	Unit Symbol
Length	meter	m
Mass	kilogram	Kg
Time	second	s
Speed	Meter per second	m/s
Energy	Joule	J

The **SI** unit for energy is the **Joule (J).**
There are others units of energy:

Calorie	**1 cal = 4,18 J**
Kw.h	**1 Kw.h = 3.600.000 J = 3,6 .10^6 J = 3,6 MJ**

Activity 23 . Translate the following units, using conversion factors:

1) MASS

Translate into grams			Translate into Kg		
3 Kg =		**g**	670 g =		**Kg**
0,450 Kg =		**g**	1235 g =		**Kg**

2) LENGTH

Translate into cm			Translate into m		
10 m =		**cm**	500 cm =		**m**
0,25 m =		**cm**	25 cm =		**m**

3) ENERGY

Translate into J			Translate into J		
2 cal =		**J**	0,25 Kw.h =		**J**
3 Kcal =		**J**	2,4 Kw.h =		**J**
0,50 cal =		**J**	5 Kw.h =		**J**
0,20 MJ =		**J**	2,25 Kw.h =		**J**
10 KJ =		**J**	0,02 Kw.h =		**J**

6. SOURCES OF ENERGY

LINK 1

Energy sources produce all energy we need. These sources are divided into two groups :

Renewable . They are energy sources that we can use over and over again.

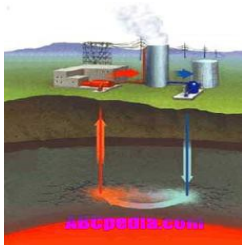
Non renewable . They are energy sources that we are using up and cannot recreate in a short period of time.

RENEWABLE

Solar energy , which comes from the Sun

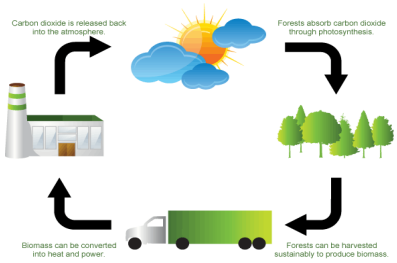
Wind energy

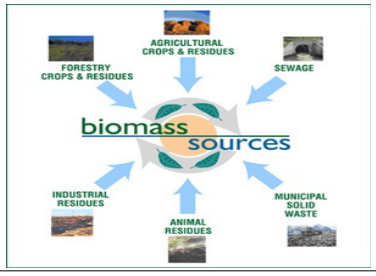
Geothermal energy from inside the Earth



Hydroenergy from water

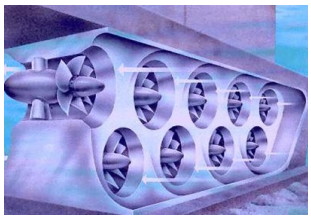
Biomass from plants



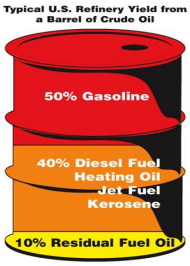


NONRENEWABLE

Ocean energy from oceanic water

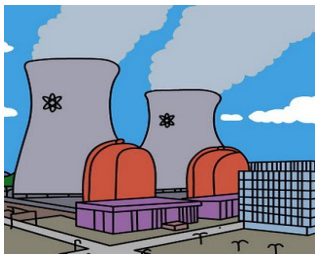
Oil (petroleum)

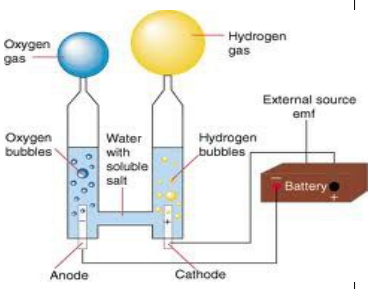
Natural gas


Coal


Uranium



Hydrogen. It can be obtained from water and burned, then it releases H_2O and a lot of energy without pollution. The only problem is that there is not a cheap way to obtain hydrogen from the water. Scientists are still reserarching this source of energy.



[A enerxía en Galicia]

[Infografías enerxía]

Advantages and disadvantages:

TYPE OF ENERGY	ADVANTAGES	DISADVANTAGES
RENEWABLE	- They do **not pollute** the air or water. - They can be used over and over again	- They are **irregular** and they are not always available. - Some of them are expensive.
NONRENEWABLE	- They are usually cheap. - They are **regular** and available.	- They **pollute** and can seriously damage the environment. - They cannot be used over and over again, they have a limited period of time

[No renovables] [Renovables]

7. SAVING ENERGY

We need energy to do a lot of things. Sources of energy are limited ,expensive and they can cause contamination. For these reasons we need to save energy. We can do different things to save energy. For example, turning off machines when we are not using them. These actions impact our enviroment an our lives.

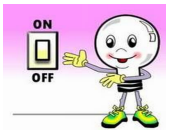
We can do many things to use less energy (saving) and use it more carefully (efficiency).

Saving energy is any behaviour that results in the use of less energy. Turning off the lights when you leave the room, closing windows to avoid wasting heat and recycling materials are all ways of saving energy.

Energy efficiency is the use of technology that requires less energy to perform the same function . A compact fluorescent light bulb that uses less energy than an incandescent bulb to produce the same amount of light is an example of energy efficiency.

There are many things you can do at home to help your family become more energy efficient. Several ways to save energy:

1) **Turn off** lights, computers, TV and other electrical stuff when you are not using it.



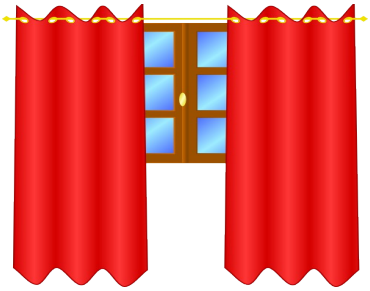
2) **Replace** regular light bulbs with energy saving compact fluorescent light bulbs or LEDs.

3) **Do not leave** the refrigerator door or **windows opened** . Cold or heat escapes and this uses a lot of electricity.

4) **Taking a short shower** instead of a long bath can help save energy.

5) Lower the thermostat during the winter. To keep warm, put on a sweatshirt or snuggle[4] under a blanket.

6) **Close the curtains** during hot summer days to block the sun. During the winter, keep the curtains open.



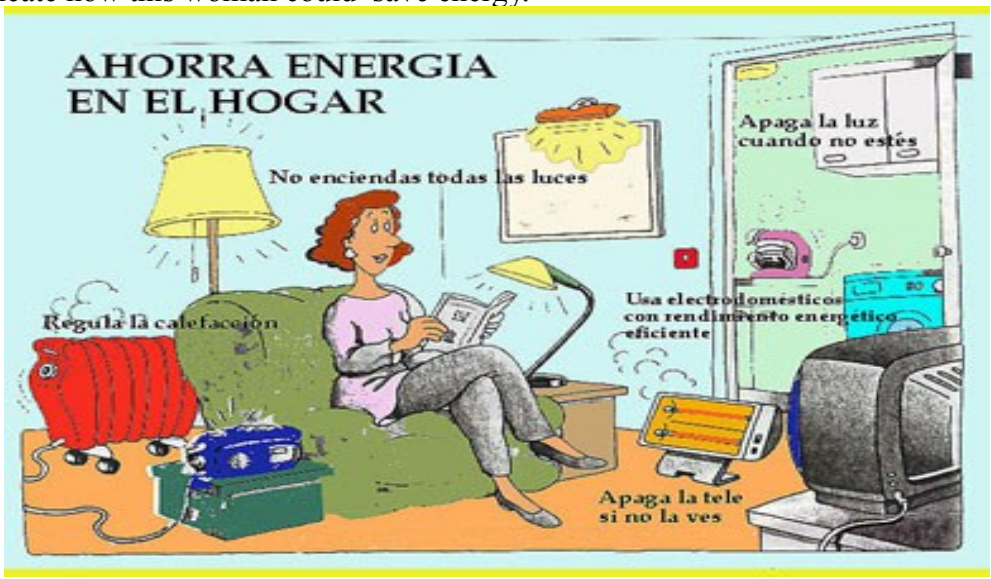
7) **Turn off dripping faucets .** One drop per second can add up to 625 L of hot water a month.

8) **Try to use cold water in the washing machine and fill it completely.** Hot water will not get clothes any cleaner, and it wastes a lot of energy.

9) **Plant a tree.** Trees create shade around your house and help keep it cool.

4 snuggle_acurrucarse

Activity 24 . Indicate how this woman could save energy.



8. ELECTRICITY LINK

O quilovatiohora é a unidade de facturación máis comumente usada para a enerxía entregada aos consumidores por empresas de enerxía eléctrica. Cando un usa 1.000 vatios durante 1 hora, gastou unha enerxía de un quilovatiohora

Ten coidado, non confundas watio e quilowatio-hora

Vatio (W)é canta enerxía consume un aparello por segundo é unha unidade de **potencia.**

Quilovatiohora (kW.h) é a **enerxía** total utilizada ao longo do tempo.

Para calcular os quilovatioshora, tome a potencia do aparello, multiplique polo número de horas que usalo, e dividir por 1000 (dividindo por 1000 cambia-lo de W.h para kW.h).

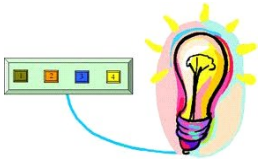
Se o seu dispositivo non presenta potencia, pero trae os Amperios (A), a intensidade de corrente que pasa polo aparato, para calcular a potencia multiplicar os A pola tensión para obter vatios. Por exemplo: $P = I \cdot V = 2\ A \cdot 220\ V = 440\ W$

Por exemplo:.Calcular a enerxía gastada por unha máquina de 500W de potencia que traballou durante tres horas

500 W * 3 h / 1000 = 1,5 kW.h

Para calcular o diñeiro gasto, tés que atopar que estás pagando por kWh (bótalle un ollo á última conta de enerxía eléctrica)

Por exemplo: As luces na súa cociña e sala de estar xuntos usar 200 Watts. Canto custa as luces están acesas 10 horas? Supoña 0,141 € / kW.h



200 W * 10 h / 1000 = 2,2 KW.h * 0,141 € /1 kWh = 0,31 €

Standby power, also called vampire power or leaking electricity, refers to the electric power consumed by electronic appliances while they are switched off or in a standby mode.

Activity 25 . Imagine that a stove uses 1200 W. How much does it cost if it is on 10 hours a day, for a whole month? Imagine that each kW.h costs 0,141 €.

Activity 26 . Imagine a lamp uses 60 W and that the lamp is on for a month continously. How much does it cost?. How much per year? Assume 0,141 € /kW.h

Activity 27 . How much kW.h does a 60 W lamp waste working an hour? How long must a 15 W lamp be on to waste this same energy?

Activity 28 . The power adapter on a laptop computer says its output is 24 V and 1,875 A. What's the maximum number of watts your computer could ever use?

Activity 29 . A power adapter of a computer has the label shown in the picture. Calculate:

a) The device's power.

b) How much does it cost to run it continuously for a month?. How much per year?. Assume 0,141 € /Kw.h

c) What can we do to save energy?

TASKS TO WORK IN GROUPS:

Divided into pairs, you have to make a powerpoint presentation or write an essay in a text processor about activities 30 and 31.

Activity 30 . a) Calculate how many power adapters are on in your class at the same time.
b) Take a look at their labels . How much does it cost to run them continuously for a month? How much per year? Assume 0,141 € /Kw.h

Activity 31 a) Find out how many power adapters are on in your house at the same time. Find out how many devices, such as TVs, DVDs, radios, etc, are in stand by in your home.
b) Take a look at their labels or link here. How much does it run them continuously for a month? How much per year? Assume 0,141 € /Kw.h

LINKS:
a) Stand by. http://standby.lbl.gov/summary-table.html
b) Energy kids. http://www.eia.doe.gov/kids/
c) Kids zone. http://www.touchstoneenergykids.com/
d) Energy stars. http://www.energystar.gov/index.cfm?c=kids.kids_index
e) Energy and kids. http://www.kids.esdb.bg/index.html
f) Google energy. http://www.google.com/translate?hl=en&sl=es&tl=en&u=http://tiki.oneworld.net/energy/energy.html
g) Alliant energy kids. http://www.alliantenergykids.com/index.htm
h) Energy resources. http://home.clara.net/darvill/altenerg/
i)Saving electricity. http://michaelbluejay.com/electricity/cost.html

ENERGY

1) ENERGY

ENGLISH	GALEGO	ENGLISH	GALEGO
Turn on / off		**Transformation**	
Allow		**Change**	
Measure		**Arrow**	
Bowstring		**Bow**	

2) TYPES OF ENERGY

ENGLISH	GALEGO	ENGLISH	GALEGO
Potential		**Tiny charged particle**	
Kinetic		**Chemical energy**	
Moving		**Atom**	
Store		**Molecule**	
Light		**Nuclear**	
Hot		**Nucleus**	
Thermal		**Nuclei**	
Sound		**Mass**	
Motion		**Matter**	
Movement		**Speed**	
Electric		**Height**	
Tension		**Elastic**	
Stretched		**Compress**	
Spring		**Rubber**	
Band		**Mechanical**	
Above		**Battery**	
Below		**Wave**	

3) LAWS OF ENERGY

ENGLISH	GALEGO	ENGLISH	GALEGO
Amount		**Useful**	
Created		**Energy efficiency**	
Destroyed		**Wasted Energy**	
Form		**Obtain**	
Burn		**Provide**	

4) ENERGY TRANSFER

ENGLISH	GALEGO	ENGLISH	GALEGO
Transfer		Force	
Heat		Received	
Work		Save	
Substance		Improve	

5)UNITS

ENGLISH	GALEGO	ENGLISH	GALEGO
Unit		Calorie	
Adopted		Joule	

6) SOURCES OF ENERGY

ENGLISH	GALEGO	ENGLISH	GALEGO
Renewable		Olive oil	
Nonrenewable		Natural gas	
Solar		Coal	
Wind		Uranium	
Biomass		Hydrogen	
Oil		Advantage	
Disadvantage		Research	

7) SAVING ENERGY

ENGLISH	GALEGO	ENGLISH	GALEGO
Limited		Light bulb	
Expensive		Refrigerator	
Choices		Spend	
Saving energy		Waste	
Behaviour		Become	

8) ELECTRICITY

ENGLISH	GALEGO	ENGLISH	GALEGO
Power		Lamp	
Device		Stove	
Refer		Appliance	
Stand by		Label	
Power adapted		Assume	