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Family Home and Sustainability

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FAMILY HOME AND SUSTAINABILITY

1. INTRODUCTION

For several years, governments and the media are making us aware of the global problem of energy supply and other supplies, because they affect the sustainability of the planet. However, in recent years, electricity consumption continues to increase significantly due, on the one hand, to the increase in electrical appliances in all homes and, on the other hand, to the lack of responsible consumption. Of course, the lack of such responsible use is mainly caused by the paucity of data that is available in practice in daily life.

Sustainability, in a broad sense, is defined in more comprehensive terms by covering the cultural, social, economic and environmental spheres. So among the indicators of development, one of the most used at present is the Human Development Index (HDI), drawn up by the United Nations. The HDI combines three indicators: life expectancy, literacy and gross domestic product (GDP).

There are more than 6.3 billion people in the world. Consumers of advanced countries, which control most of the planet's resources, make up 33% of the population; poor countries, 47% and countries in situations of misery account for 20%. In Western countries we spend about 20€ daily, per person; in poor countries, 2€; and people in countries in situations of misery try to survive on less than 1€ / day.

The majority's poverty and the minority's immoderate consumption boost environmental degradation, personal despair and social dissatisfaction, and provide an underground source of future conflicts of every kind.

Today's society seems to be willing to prove that happiness is based on economic progress and that economic progress is achieved by increasing energy consumption. Science says that energy consumption accelerates climate change and that climate change is altering the physical-chemical characteristics of the biosphere that guarantee the survival of the human species. If we believed both of these statements, we would fall into a contradiction: the happiness of individuals leads to the extinction of humanity.

Policy measures set by governments and public authorities in relation with very different environmental and social issues are very important, and they determine in turn the evolution of the production system. It is also true that some of the causes of environmental problems originate in the processes of resource exploitation and industrial transformation, fields in which our capacity for regulation and control as consumers is limited.

Citizens have, as consumers and workers, a major responsibility and a real ability to influence the transformation of society towards consumption patterns which are "sustainable", using our critical thinking, our personal involvement and our real participation in public decisions that may affect the environment.

"There are alternatives that can turn the fact of consumption into an act of social responsibility. Consumption is necessary and therefore inevitable; with the effort of every one we can make it responsible and ethical: it is our choice and a part of our freedom of social action." (Seville Platform for Responsible Consumption).

1.1. The main energy sources

Energy sources are the elements of nature that can provide energy. Renewable energy sources are those that can be re-used permanently, because they are inexhaustible, such as sun, water, wind. These energies are characterized by the lack of environmental impact related with the emission of greenhouse gases.

Non-renewable energy is that whose reserves are limited, and decrease as we consume them: oil, coal or natural gas, for example. As reserves dwindle, the extraction process becomes more difficult and its cost increases.

In Spain, non-renewable energy sources provide 93% of the energy consumption.

The energy contained in fuels is known as primary energy, whereas energy as it is used in consumption points is called final energy. It could be expressed as follows:

Primary Energy = Final Energy +Loss of Transportation +Loss of Transformation

We all know that the production of electricity has a high environmental impact. If it stems from nuclear power plants, its use involves generating radioactive waste. If it stems from thermal power plants, emissions of carbon dioxide have a great influence on global warming and climate change. For this reason it is necessary to increase awareness of purchasing and consumption habits in relation with domestic appliances to prevent unnecessary waste that severely affects the biosphere.

1.2. Supply by solar energy and photovoltaic solar energy

1.2.1. Solar Energy

1.2.1.1. Warming

Spain is one of the European countries that receives more annual solar radiation per unit area. Its main use today is the production of hot water, but it can be complementary to those facilities that use water at temperatures below 60 °C. Anyway, solar thermal power plants need support from other power systems to produce hot water.

In Spain, since the Technical Building Code came into force (2006), solar thermal energy is required in all new buildings where there is hot water consumption.

The solar panels currently most used are called flat panels. There exist various brands and models with which different efficiencies are achieved. This variety enables final users to choose the model best suited to the envisaged use.

In much of Spain, to contribute with 50% of the hot water needs for a four-people household of reference would require an equipment of 2-4 m2 and 200-300 l. of accumulation capacity. The cost of this equipment is around 820€ / m2 and its lifespan exceeds twenty years. The amortization of the installation will depend on the fuel to be replaced, the geographical area and the configuration of the building:

Replaced fuel	Amortization period of solar thermal
Gas	Between 10 & 12 years
Electricity (not night rate)	Between 5 & 6 years

These investments are partially subsidized and can be amortized in 3 years of use, the facilities' average lifespan being much longer and its maintenance being small.

1.2.1.2. Cooling

Moreover, energy demand for cooling buildings in order to attain acceptable comfort conditions greatly increases year after year in developed countries. The use of solar energy for cooling is one of the thermal applications with the greatest future, as the periods when it is more needed to cool the space coincide with the highest solar radiation.

Its technical background is based on the thermal use of solar radiation. Solar rays hit on a solar panel thus heating a fluid (usually water with additives) that circulates inside of it. There is a heat exchange between this fluid and the consumption water which is stored in an accumulator for later use.

1.2.2. Photovoltaic Energy

Photovoltaic energy is still undergoing a process for improving its efficiency, but the outlook for this technology makes it one of the major alternatives for the future. The first applications of this type of energy aimed at the electrification of isolated houses; yet the sector's real development is related with facilities connected to the grid.

Off-grid applications include rural electrification, farming and livestock related applications; and in the signalling and communication fields it has been used for air and sea navigation, repeaters for mobile telephony, etc.

There are also photovoltaic installations in places where there are no buildings; as yet, this development has no special interest for domestic use.

2. HOUSEHOLD CONSUMPTION

Households consume about 17% of the final energy.

In 2004 there were in Spain around 14.5 million first homes. Without taking into account the consumption in transport, petroleum products are the source of energy most used in homes, covering more than a third of total energy needs. Another third is covered by electric power, the next major energy source being natural gas. Coal consumption has been dwindling over the years, and at present it represents only 1%.

According to a study of IDEA (Institute for the Diversification and Saving of Energy, under the Ministry of Industry) from 2004, the Spanish household consumption in 2003 could be distributed as follows: (*)

Heating 41%
Hot water 26%
Appliances 12%
Kitchen 11%
Lighting 9%
Air conditioning 1%

(*) Source: IDEA, Guia práctica de la energía. Consumo eficiente y responsable. 2 edition 2007.

In addition, since 2007 it is mandatory for new buildings to have housing "energy label" like

those used for appliances, indicating how much energy will be consumed by the house when it is inhabited.

From the moment we start building the house, and through the use we make of it, we can contribute to energy savings and, therefore, to the sustainability of the planet, just by keeping in mind a few simple points:

Traditional Mediterranean architecture (economical and scarcely aggressive towards the environment) is based on simple physical facts:

- The sun rises in the east;
- A day has 24 hours
- Winds, rains and droughts have their own local and differentiating rules
- The environment imposes its own rules on the country e.g. determining which farm animals and crops will flourish
- The best techniques are those that are endorsed by use, economics and practice
- Appropriate materials are those that can be obtained from nearby, and which are durable and easy to maintain

The best architectural styles in the recent past and at present are also indebted to this knowledge. Technical and industrial advances are "sustainable" if they show real energy efficiency and its ability to reduce the impact on the environment, and if they combine with an acknowledgment of the wisdom of traditional architecture. It is also about subordinating technique to science, and economics to the sovereignty of the welfare of all human beings.

From the point of view of environmental protection, the basic criterion which must govern the choice of a home is that the house allows for energy and water savings. Concerning this, it is important, as an example, to have windows towards two outdoor spaces (street, square, a courtyard large enough,...) facing different ways, if possible opposite to each other so that once these windows are opened a natural draught is generated that crosses the house from side to side. In any case, it is convenient to avoid the west. In our climate, the ideal configuration would be to have north-south windows.

Regarding building materials, it is important to know the characteristics of their finish. When vertical elements (façade and partition walls, etc.), as well as horizontal ones (floors), are thicker and heavier, the thermal inertia of the house is improved, which ensures the stability of the inner temperature and reduces heating and cooling needs. Insulation and ventilation conditions are also basic.

With regard to housing facilities, it is preferable that as many of these as possible are common (for instance, hot water and heating): they not only are much cheaper, but sharing facilities provides us with the opportunity to interact with our neighbours.

The functions of the roof are:

- To keep out rainwater and to evacuate it with maximum effectiveness
- To insulate the living space directly below it, allowing ventilation and protecting it from the Sun.

It is not easy to make habitable those so-called “under the roof” spaces that in the past were used as attics, lofts, etc. These areas were protected from direct sun and permanently ventilated, thereby ensuring proper thermal behaviour. By closing them, sun protection, ventilation and insulation features are reduced. When trying to make them habitable, the energy consumption can shoot up.

Heat losses caused by substandard enclosures account for between 25 and 30%, so governments – at least in Spain – have for over three years been subsidizing the refurbishment of joinery in windows and other enclosures.

A window's insulation depends on its glass quality and the type of joinery of the frame. In the winter, the energy lost through each square meter of single-glazed pane is equivalent to that contained in 12 kg of diesel.

Systems with double glazing or double windows reduce heat loss, draughts, water condensation and frost formation by half.

The joinery has to be thermally insulated, that's to say, containing insulating material between the inner and outer sides of the frame.

However, at present, in the house building world, technology has a debt with the environment. Many of the materials, building components, systems, facilities, manufacturing and production methods, etc., which are commonly used are not optimal for creating an atmosphere that is respectful with the environment. A good part of this "only" way of housing production can and should be investigated from the standpoint of energy efficiency and find a response in constructive technologies. It is urgent and essential to review the technical and theoretical basis that determines today's characteristics of products offered by the market, from systems and complementary elements of natural ventilation and cooling (to render unnecessary the use of air conditioning) to hydrogen cells, through mechanisms and devices that encourage the reduction of water consumption and the comprehensive recovery, purification, treatment and reuse of grey and sewage water, etc. Typologies, concepts and methods of planning and development, ordinances and technical standards, etc., should not be alien to this process of review and adjustment.

3. ENERGY CONSUMPTION

"Energy is one of the pillars for the development of society, and it is present in most of our daily activities: every time you press a switch, drive a car, turn the heating on... However, for all of us and future generations to continue to have energy we must commit to a more rational consumption. Only if we understand the energy situation can we be part of the solution. We must preserve the environment, and we must take two paths: energy efficiency, consuming only what we need; and renewable energy, reducing use of fossil fuels and nuclear energy."

"According to the International Energy Agency, 58% of the potential reduction of CO2 emissions would be achieved by improving energy efficiency, and 20% with renewable energy. We are responsible in our homes for over 15% of the energy consumption in Spain. It is within our power to help reduce this consumption, not only by saving money, but because we are part of the solution. The potential saving of the Spanish households is 19,611 GWh. This saving would suffice to light all Spanish homes for a year.

16.8% of the total energy consumption in our country originates in our homes. That is, we are directly responsible for much of the consumption in Spain and it is within our power to reduce it. "

Source:
Guía del consumo responsable. FENOSA-Gas Natural. Posted in www.hogareficiente.com.

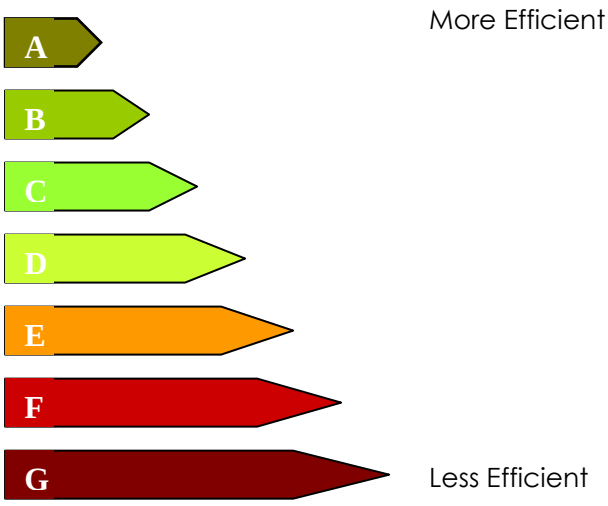
White goods, electric ovens, air conditioning and light sources are equipment commonly used in our homes. Buying an efficient piece of equipment is important, and these are easily identifiable, thanks to the energy label. Its scope is European and it is an information tool for buyers. The energy label is compulsory on each released appliance.

Appliances requiring such labelling are:
- Refrigerators and freezers
- Washing machines
- Dishwashers
- Dryers

- Combined washer dryers
- Ovens
- Air Conditioning

The labels have a common section, stating the manufacturer, type of appliance and energy efficiency class, and another section, varying from one appliance to the other, which makes reference to other features, according to the functionality of the appliance (such as freezing capacity for freezers, or water consumption in washing machines). There are seven energy efficiency classes identified by a code of colours and letters.

The benefits regarding energy consumption can be almost three times higher for Class A appliances as compared to Class G. Since most household appliances last an average of about ten years, savings in the electricity bill as a result of using more efficient appliances (class A) can be quite considerable in an average household economy.



By way of example, the following table shows a comparison of the different energy efficiency classes:

CLASS	Energy consumption in 5 years (kw / h)	Economic cost in 15 years (€)	Savings to replace one Class A (€)
A++ (**)	2.956	414	-
A+ (**)	4.138	579	165
A	5.420	759	345
B	6.406	897	483
C	8.130	1.138	724
D	9.855	1.380	966
E	10.348	1.449	1.035
F	11.580	1.621	1.207
G	12.319	1.725	1.311

(*): Price = 0.14 € kWh

(**): Classes A + and A + + apply to freezers and refrigerators. Class A+ appliances include those consuming less than 42% of the average consumption of an equivalent device; Class A++ appliances include those consuming less than 30%.

Source: Guía práctica de la energía. Publication of the Institute for the Diversification and Saving of Energy, 2nd edition. 2007.

3.1 Appliances

From these general concepts, and from the energy standpoint, it can be stated:

3.1.1. Refrigerator and freezer:

1. The refrigerator uses around 25-30% of the annual energy consumed in an average home. It is very advisable to check its energy efficiency when purchasing it.

2. A 5 mm layer of ice on the walls of the freezer increases its energy consumption significantly.

3. To improve the energy efficiency of refrigerators, it is desirable to clean the coils on the back at least once a year and keep the door seal clean to ensure that it closes tightly.

4. The refrigerator should be placed in a well ventilated area, not in a small or closed room or near heat sources. Performance improves if we place it at least 10 cm from other equipment and from walls.

5. Adjust the thermostat at different times of year. In hot areas it is usually enough to keep it between 3 and 4 on a 1 to 5 scale. You can decrease it during the winter, the lowest levels of consumption being more than enough to preserve food. For every degree Celsius that the temperature is lowered, consumption increases by 5%.

6. As a reference, refrigerator temperatures can be set in the range of 3 to 7 °C, and freezers in the range -18 to -15 °C.

7. The average consumption of a "combi" refrigerator with a capacity of 320 litres and an energy rating D is 1.63 kWh / day. An equivalent refrigerator with the highest efficiency energy rating consumes only 0.94 kWh / day, saving up to 42% compared to the first fridge. In a year, one could save more than 250 kWh, equivalent to about 20 euros per year. The lifespan of the refrigerator is more than 10 years, so you can save more than 200€ over this period.

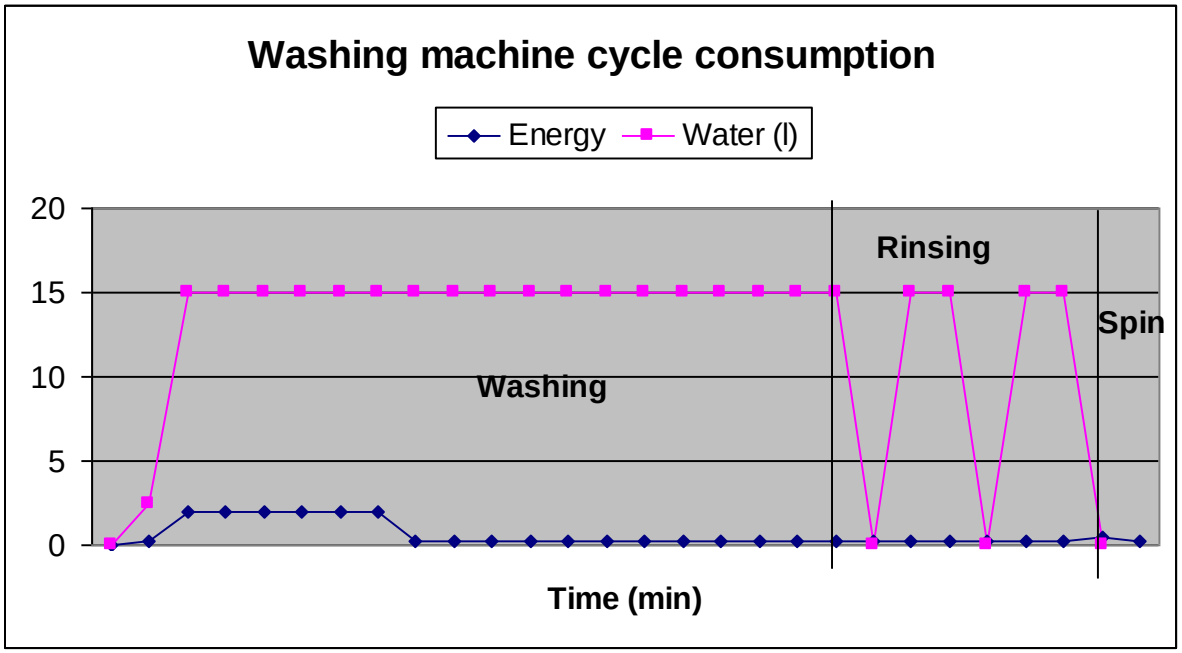
8. Seek to open the refrigerator as little as possible and take out / put in everything that is needed at once. You lose a lot of cold air and consumption increases when you hold the door open.

9. Thawing food in the refrigerator means making the best possible use of the cold stored in them. On the other hand, warm food should be cooled down before it's placed in the fridge.

3.1.2. Washer:

After the refrigerator and the TV, the washing machine is the domestic appliance with the highest consumption in Spanish homes. Most homes have a washing machine which is typically used between 3 and 5 times per week. Most of the energy consumed is used for heating the water, rendering the use of low temperature programs particularly interesting.

The energy label on the washing machine indicates its washing efficiency, its spin efficiency, its water consumption and the energy consumption per washing cycle.
This can be graphically represented as follows:



Some tips:

1. Use the washing machine at full capacity, trying to have it work always at full load. In addition, there exist at present washing machines with half-load capacity that significantly reduce consumption.

2. There are as well washing machines with a water probe that measures the degree of dirtiness in the water, thus allowing for the water to be changed only when needed and significantly reducing water and energy consumption.

3. It is preferable to use low temperature programs, except for very dirty clothes. Nowadays, detergents are made to work efficiently at low temperatures. Therefore, you can select the cold water programme, or the one at 30 °C one, avoiding the 90 °C programme.

4. If the clothes are well spun, you can avoid using the dryer, which uses much more energy.

5. Using descaling products and cleaning the filter regularly improve the washing machine's performance.

6. For most fabrics, washing with warm water and rinsing with cold water is just as effective as doing it all with hot water. It is preferable to limit the prewash to very dirty clothes.

3.1.3. Dishwasher:

Its use is almost daily in 25% of the Spanish households that have one. It is an appliance that consumes a lot of energy, 90% of which is used to heat the water. Its energy label shows the effectiveness of the washing and drying, and the water and energy consumption per cutlery item, as measured in the economic programme.

There are bi-thermal dishwashers in the market that have two separate inlets for cold and hot water. Hot water is then directly supplied by the house's hot water circuit, and thus using energy for this function is avoided. This may represent savings of 25% of the total washing time and therefore energy savings as well.

Some tips:

1. Use the dishwasher at full load.

2. Use cold water if rinsing the dishes is needed before placing them in the dishwasher.

3. A good maintenance of the machine improves performance. Maintaining an adequate level of salt deposits and rinse agent reduces the energy consumed in washing and drying respectively.

3.1.4. Dryer:

After spinning at 1000 rpm, the residual moisture in the clothes is typically of about 60%. Therefore, with a 6 kg load in cotton clothing, there remain 3.5 litres of residual water at the end of the washing process, which is what needs to be removed through the drying process.

Most of the consumption of a dryer is a result of heating the air. Improvements aimed at enhancing energy efficiency in a dryer are therefore related with the way in which moisture is removed, or the reutilisation of residual heat, or the electronic control of the process.

Drying can be:

a) By extraction: the heated air is thrust outside.
b) By condensation: the heated and moist air is circulated through a condensation circuit, which removes the water.

Drying control may be:
a) Through a moisture sensor: the process stops at a target moisture level set by the user;
b) Through a timer: the process stops after a pre-scheduled time.

There are dryers that consume less: those that use gas and those that include progressive cooling cycles and thus finish drying the clothes with the residual heat of the dryer.

With all this in mind, we suggest some tips:

1. Try to have the dryer work always at full load.

2. Before putting clothes in the dryer, make sure they are sufficiently centrifuged.

3. Sort and separate the clothes before putting them in the dryer.

4. A gas dryer saves energy and money.

3.1.5. Oven

There are two types: gas ovens and electric ovens. Although from the standpoint of the energy the former is more efficient (and therefore better for sustainability) yet in practice the latter uses less energy because it can be tightly sealed, and is more popular than gas ovens.

Although the electric oven has a significant energy consumption, it does not overall consume more energy compared to other appliances, because it is not as frequently used as them.

Therefore, keep the following in mind when using an oven:

1. It is preferable, as always, that it is rated class A.

2. Do not open the oven unnecessarily, every time you open the oven it loses about 20% of the energy stored inside.

3. Seek to make the best possible use of the oven's capacity, cooking, when possible, the maximum amount of food at one time.

4. In general it isn't necessary to preheat the oven when cooking for more than 1 hour.

5. You can turn off the oven before finishing the cooking, the residual heat is enough to complete the process.

6. Convection ovens favour an even heat distribution, saving time and therefore reducing energy consumption.

7. Do not use the oven to reheat or defrost.

3.1.6. Cookers

Depending on the energy they use, they are classified as gas cookers and electric cookers. The former are more efficient but, in the long run, they have all the difficulties of those devices that use non renewable energies.

Electric cookers are, in turn, classified as conventional, glass-ceramic and induction cookers. Induction cookers heat the food generating magnetic fields: they are the fastest and most efficient, but in general we can say that gas cookers are more efficient than electric.

As an example, on an electric hot-plate, keeping 1.5 litres of water at boiling point using an open cooking pot with a bottom that is a poor heat diffuser requires 850 W, The same process in a pressure cooker with a thick bottom needs only 150 W.

Some tips:

1. When cooking, it is preferable that the cooking container has a slightly larger diameter than the cooking area, so as to avoid the flames reaching beyond the pan or pot's bottom. In this way we make the most of the cooker's heat.

2. When using electric cookers, saucepans with thick bottoms are preferable, as this results in a more even temperature throughout the saucepan.

3. Whenever possible, it is highly recommended to use a super fast pressure cooker. With no steam loss, they consume less energy and save time.

4. Covering the pot while cooking uses much less energy.

5. In general, it is preferable to use gas cookers rather than glass-ceramic and conventional electric ones, which are less energy efficient, especially the latter. In addition to the use of energy in order to heat the plate, more energy is wasted through residual heat in the plate after the cooking is finished Gas cookers provide heat as and when needed without delay or accumulation of heat.

3.1.7 Small electric appliances and other electric appliances

In this section we will refer to those appliances that do not have an energy label. Many of them just perform some mechanical action, e.g. blending, chopping ... They are generally low-power appliances (except for the vacuum cleaner). Those appliances that produce heat require typically more power and result in a significant energy consumption.

Typical power values for these appliances are:

Appliance	Power (Watts)
Food processor	1.950
Vacuum cleaner	1.300
Hairdryer	1.200
Iron	1.000
Toaster	700
Juice Extractor	600
Fan	500
Blender	200
Juicer	50
Electric Shaver	30

Some tips:

1. If the task needs to be interrupted, then it is preferable to turn off the appliance (iron, toaster…).

2. Once the iron is heated up, it is preferable to use it for large amounts of clothing.

3. Some of the most common household appliances - such as the iron, coffee maker, microwave oven or vacuum cleaner - consume between 2 and 4 times what a washing machine or refrigerator does. The important thing is to control the amount of time they are turned on and to use them efficiently.

4. In general, note that using multiple sockets and/or extensions cords for the electrical connections reduces efficiency and increases consumption.

3.1.8. TVs, audiovisual equipment, computers

The demand for this type of equipment has grown exponentially in recent years. In almost all Spanish households there is at least one television, a VCR, a stereo and a computer.

The current trend points towards a progressive increase of the demand for equipment with ever-larger screens and more power.

Therefore:

1. A TV in sleep mode (stand by) can consume up to 15% of the energy used under normal operation. Thus for extended absences or when you're not watching television it is better to turn it off completely with the on/off switch.

2. The display is the most energy-consuming part of a computer. Flat displays (TFT) consume less energy than conventional models.

3. Office equipment tagged "energy star" goes into sleep mode when it has not been used for a certain length of time. In sleep mode, consumption is 15% lower than normal consumption. When you expect no use of this equipment for over half an hour you should turn it off completely.

4. Printers that print double sided and fax machines using regular paper are more profitable.

5. When not using the computer for short periods you can turn the screen off: it saves energy and when its use is resumed you do not need to wait for the computer to restart.

3.2. Lighting

Light is one of the most important energy needs in our homes, representing approximately one fifth of the electricity consumed. To get good lighting it is necessary to analyze the light required in each of the parts of the house. You must not associate the amount of light that a light bulb gives with the amount of electricity required to produce that light.

The luminous efficiency of a lamp is the amount of light emitted per unit of power consumed. There are different types of household lamps on the market:

a) Incandescent lamps: light is produced by the passage of an electric current through a filament. They have the highest electricity consumption and the shortest life, and are the cheapest. Their luminous efficiency ranges between 12 and 20 lm / W (lumen per watt).

b) Halogen lamps: they have the same basic principles as incandescent lamps, but are characterised by a higher durability and the special quality of their light.

c) Fluorescent tubes: they are based on the emission of light by certain gases such as fluorine as a result of the passage through them of an electric current. The luminous efficiency is much higher than that of incandescent lamps. They are more expensive than ordinary light bulbs, but consume up to 80% less for the same light output and last between 8 and 10 times longer.

d) Energy saving lamps: they are small fluorescent tubes that have been gradually adapted to the size, shape and lamp holders of conventional bulbs. They are more expensive than these, but because the electricity savings they are amortized much before the end of their typical lifespan.

They last eight times longer than conventional bulbs and provide the same light, consuming 20-25% of the electricity required by incandescent lamps. The energy consumption in an energy saving lamp is the highest the moment it is switched on; but this peak only lasts for one or two seconds, and the consumption is only double that under normal operation, so this behaviour is not significant when measured against overall consumption. The lifespan of these lamps is considerably reduced when placed in locations in which they are frequently switched on and off.

The following table shows a comparison between conventional bulbs and energy saving lamps:

Conventional bulb to be replaced	Energy-saving lamp that offers the same light intensity	kWh savings over the lifespan of the lamp	Electricity cost savings over the lifespan of the lamp (€)
40 W	9 W	248	35
60 W	11 W	392	55
75 W	15 W	480	67
100 W	20 W	640	90
150 W	32 W	944	132

Therefore:

1. The benefits of these compact fluorescent lamps as compared to incandescent lamps are:

- They last up to 10 times longer
- They provide more light
- They consume one-third of the energy
- They release less heat

Currently there is a large variety of models of compact fluorescent lamps which directly replace incandescent lamps.

2. Bulbs should be cleaned periodically. The dust decreases luminosity and increases consumption by 15-20% yearly and even more so for incandescent lamps.

3. Traditional 30 and 38 mm. fluorescent bulbs can be replaced by the more modern 26 mm. bulbs; the latter have a lower consumption and require fewer raw materials.

4. Partial switches can be installed so as to light only those areas where it is needed, as well as dimmers so as to adequate the light intensity to suit every need.

4. WATER CONSUMPTION

Water is a precious and scarce commodity. Today it is a cause of conflicts in various parts of the world (the Middle East is a clear example of this affecting relations between nations such as Palestine, Israel, Egypt, Jordan, Turkey and Iraq), and it is expected that this trend will increase in the future (UNESCO, 2003).

Climate change predictions for the Iberian Peninsula are not promising. The models predict drier, longer and hotter summers, with increased potential evapotranspiration, with shorter periods of rainfall, yet more torrential in nature. In addition, our watershed system is already badly damaged.

Water conservation is absolutely necessary in today's world. Although most of the planet is composed of water (about 70%), we all have to make an effort to look after this fluid commodity and to keep it always in the best possible conditions, to make it drinkable.

Rational use is recommended not only for saving money (turning off the tap while brushing one's teeth or taking showers instead of baths) but we will be helping future generations by conserving one of nature's most precious materials: a basic element for the survival of the species

In Europe, the estimated daily calculation of water loss amounts to more than 50 litres (approximately one third of daily household consumption), (Sources: Waterwise).

Spain is one of the biggest consumer countries within the European Union, about 300 litres per day. The average total household water used for each person in Europe is approximately 170 litres per day and of these, only between 2 to 5 litres are used for drinking. More than half of daily household water is used in the bathroom and toilet. People usually wash in cold water (less than 30 degrees) which means a substantial energy saving. Approximately 40% of our water is hot; when you heat it the price of water is multiplied by 4 or 5.

Therefore, here are some suggestions for improving the sustainability of the planet from home:

1. An open tap dispenses between 5 and 10 litres of water a minute. A leaky tap loses 30 litres per day. So it is worth turning off taps and ensuring that they do not drip.

2. About 75% of our water at home is used in the bathroom; 30% is used in the shower and another 40% in the toilet.

3. Shower or bath: The consumption is reduced from 150-200 litres if you have a bath to about 30-40 litres in a 5-minute long shower.

4. It is possible to reduce the flow of water in the shower from 15-25 to10 litres per minute by placing a low consumption shower head.

There are also heads with built-in flow switches that allow for the water to be turned off without touching the handles. They are especially useful in those cases with a traditional two-handle mixer where it is more difficult to repeatedly adjust the temperature of the water.

5. Dual flush toilet tanks can be installed or with the possibility to stop the flushing as needed.

Many of the older toilet tanks do not have these savings features, but it is possible to regulate their flush load using traditional home-made methods:

• having systems of weights placed so as to close the shutter when the button is released, or simply lowering the handle (on models with floor tank) or the stopper lever (in the older high tanks)

• introducing containers (bottles) filled with water inside the tank that allow one to adjust the volume of discharge, as this is frequently oversized as compared to actual needs.

Each time you flush while using this container method, an equivalent volume of drinking water is saved.

Some examples of devices that help to save water:

Swivel aerator:

It is the best selling device in Europe, saving 40% water and energy. These models, tested in November 1997 by the German magazine OKO, are the most recommended. The two alternative functions are the bubbling jet and power shower. Its internal venturi triples the

speed of the output for easy cleaning of dishes and vegetables. It revolves reaching all corners.

Reducing limiters:

If you do not want to change the shower, this device can be installed: it limits flow with jets of 30% less water and energy and reduces pressure thus increasing the lifespan of the hose.

Anti-leakage devices:

If the water intake hose breaks, this device will prevent a flood. It can be installed on the water supply of washing machines, dishwashers, pressure coffee makers, etc. The internal valve cuts off when water pressure dips suddenly.

Shower Switches:

For use during soaping and shampooing, they cut the water flow off while maintaining its temperature. Highly recommended in dual control taps.

Tanks with a break of downloads:

The use of tanks with devices that allow you to interrupt the flush results in a more rational use of the water. European legislation limits the capacity of toilet tanks to 9 litres, although several major manufacturers have launched 6-litre volume models with a cut-off push button for 3-litre flushing, or else with a double push button. The success of these models is based on the ability of the siphon to flush properly with less water.

For older sanitary equipment, manufacturers have produced several discharge cut-off devices that are easily fitted to the tank. The figure shows switches recommended by the German magazine OKO.

Features of toilet tanks with water saving devices:

- They save water.
- They clean perfectly with 6 litres of water.
- Interruptible flushing.

• Press once for full flush. Press again for half flush.
• Easy to clean.
• Semi-integrated tank.
• Toilet seat removable for cleaning (no need to use abrasive agents).
Individual water meter:

You can keep better control of your consumption if you have an individual water meter, because you are more careful if you monitor your own consumption than if you have a common water meter. (Nowadays the individual meter is more common).

6. Using two drums or sinks for washing and rinsing, and turning off the tap while soaping the dishes, saves a lot of water. Use of soap or detergent dispensers can also reduce detergent consumption.

7. Washing machines and dishwashers are considered efficient when they do not consume more than 15 litres of water per kilogram of clothes when washing at 60 °C, or more than 15 litres per cycle, respectively). It is therefore convenient to ensure that the dishwasher and the washing machine work at full load, that the "economic" mode is selected and that the pre-wash and hot water programmes are only used in those cases with very dirty clothes or dishes.

When there are few people (particularly with only one or two) in the household, or when dish washing is infrequent, a dishwasher might not be that necessary, but in that case it is very important to minimise water usage by turning the tap off when it is not needed and by using appropriately sinks or washbowls.

5. HEATING AND COOLING SYSTEMS

5.1 Air Conditioning

At present very few homes are built with central air conditioning installations.
There are several types of air conditioners:

a) Compact systems and split systems: compact systems have the evaporator and the condenser inside the same housing. The most common ones are those placed in windows. In air conditioning split systems there is an outdoor unit (the condenser) and an indoor unit (the evaporator) connected by refrigerant piping through which the refrigerant can flow.

Within these types there is a category of portable cooling devices known as "penguins." They are less efficient than wall units, but incur a much lower initial cost.

b) Reversible and non reversible systems: reversible systems are those that can provide cooling and heating.

c) Fans: a simple fan can be used in many cases to maintain a comfortable environment. Air movement conveys a feeling of temperature drop of between 3 and 5 °C, and electricity consumption to produce such movement is very low.

The energy label for air conditioning equipment contains the following information:

• Yearly energy consumption

• Cooling capacity
• Energy efficiency coefficient in cold and heat

As a guideline, when choosing the cooling capacity of air conditioning:

M² surface to cool	Cooling capacity in kW
9-15	1,5
15-20	1,8
20-25	2,1
25-30	2,4
30-35	2,7
35-40	3
40-50	3,6
50-60	4,2

Therefore:

1. It is important to maintain air conditioners: cleaning air filters regularly and making periodic checks every 2 or 3 years.

2. 24 °C is a proper cooling temperature, neither too cold nor too hot. And at this temperature consumption is lower.

3. It is important to place the cooling apparatus so as to minimize its exposure to the sun and to ensure good air circulation.

4. Awnings and outdoor blinds are highly recommended for windows and doors where the sun beats down directly. These create a cooler microclimate. During the hottest hours, temperature outside is always much higher than in the interior. Opening the windows does not help at all; on the contrary, it lets hot air in.

5.2 Heating

Most of the annual electricity consumption in a house, around 30-40%, is spent on heating, but obviously – in Spain – this varies greatly from one geographic area to another.

Approximately 80% of the heating or cooling of a building is dissipated through windows, walls and ceilings. It is highly recommended, whenever possible, to install double glazing.

The majority of Spanish households have independent heating elements (heaters, radiators, etc.) and more than a quarter of the households have individual heating installations. Only 10% have a central heating system, servicing all households in the neighbouring community.

5.2.1. Central heating systems

The most common systems of central heating consist of the following items: a boiler that heats the water; the pipes; and radiators to distribute and release the heat; and, in some cases, a kind of thermostat that controls the system's response to the heating needs.

According to the energy efficiency requirements for boilers, there is a classification that ranges from one to four stars. According to the nominal power of a boiler, the higher its efficiency the more stars it will be rated with.

For example, let's take a boiler with a nominal power of 50 kW, operating at 100% of its nominal power and at an average temperature of 70 °C: for a boiler of such characteristics the efficiency will be 87% if it is rated one star, and 96.4% if it is rated four stars.

Radiators are heat-exchange elements. Nowadays they are usually made of sheet metal, aluminium or steel. The best placement is under a window, matching the length of the radiator with that of the window to enhance the diffusion of heat across the room. It is important not to cover or block the radiators so as to make the most out of the heat they emit.

Other heating systems currently used are: under-floor heating, where radiators are replaced by plastic tubes inserted into the floor (e.g. in tiles), inside which there is hot water circulating; or electrical systems with independent appliances which work with electric resistors.

Some tips:

1. A temperature of 20 -22 °C is usually sufficient to maintain comfort in a home in both winter and summer.

2. The air inside the radiators makes heat transfer difficult. Therefore it is desirable to bleed the radiators (getting rid of the air) at least once a year. When air stops flowing and water starts coming out, the bleeding of the radiator is completed.

3. To fully ventilate a room it is sufficient to open the windows for 10 minutes.

4. In winter remember to lower the blinds and close the curtains at night, drawing them during the day to take maximum advantage of light and solar heat. Closing blinds and curtains at night avoids major heat loss.

In summer, the same should be done but at different times: lowering the blinds and closing the curtains when the temperature begins to rise at midday to avoid over heating the rooms. Open windows when the environment is not as stuffy and keep them open during the night to cool the house.

5. With proper maintenance energy consumption of boilers and furnaces can be reduced by 5%.

6. Make sure furniture or draperies do not cover the heating devices.

7. Save energy by closing the radiator valves in unused rooms.

8. Turning off the heating an hour before leaving home or going to bed is an energy saving measure because heat can be used from the walls.

9. Central heating is more efficient and economical than individual heaters.

10. It is preferable to use radiators rather than resistance heaters, as the former are more efficient. A good solution is to install devices that collect heat during the night and release it during the day (this requires to contract the electricity at a specific rate). These devices are called night storage heaters.

11. Placing rugs and carpets on the floor in winter increases comfort so one does not feel the cold floor and heat loss is reduced as insulation is increased.

5.3 Hot Water

There are two main types of hot water systems:

a) Instant systems: they heat water on demand. This is, for instance, the case with gas heaters. The fact that, until the desired temperature is reached, a large amount of water is wasted is a major drawback. In addition, as the heater is switched on and off according to the demand, this type of operation increases consumption and the wear of the equipment. Furthermore, these systems, in general, cannot supply hot water to two places at the same time.

b) Storage systems. These systems can be of two types: equipment that heats up the water plus a heat accumulator; or a water heater accumulator with an electric resistor inside it. The system most commonly used is the former.

For its proper operation it is important that the storage tanks and pipelines are well insulated.

Another aspect to take into account is that, for proper personal hygiene, a water temperature between 30 and 35 °C is adequate.

You should also keep in mind that the hot water system is best used with a single mixer taps rather than with separate taps.

What has been said in the chapter on water consumption is also relevant here.

6. CONCLUSIONS

As a conclusion we would like to show the saving that has resulted in the home of a five-member family, living in a semi-detached house built two decades ago, in which the appliances are rated A+. The study was conducted over six months, from January to June.

1. Monthly water consumption:

Using dual flush toilet tanks, placing a low-consumption shower head. Washing machine and dishwasher at full load and the remaining water to water the plants:

Savings of 40%

2. Electricity – average summer/winter – 80€:

Switching off the stand-by of the appliances. Replacing incandescent lamps with low-consumption ones and replacing halogen bulbs with high-efficiency halogen bulbs:

Savings of 25%

3. Natural Gas

Regulating the heating temperature, setting it at 17 – 18 °C when the house is empty and during the night, and between 20 and 21 °C during the periods of activity. Applying for a subsidy from the Spanish Government to install double-glazed windows.

Savings of 30%

Considerable savings are produced, which means that the additional expenses that one incurs in when aiming at energy saving are quickly paid back. For the total yearly overheads in water, electricity and gas supply amounting to 1,200€ / year, we are looking at global savings of **67%**, approximately.

SUMMARISING:

In this paper we have outlined some general ideas on how to help the sustainability of the planet from the home. We are all responsible for the maintenance of a better world and we each have to make our contribution to this world: not only politicians, businessmen, etc, it is a task that belongs to all citizens.

Despite the importance of the subject, this work can be completed with the study of products used in households for cleaning, washing clothes or dishes, etc, studying their environmental impact. The subject is very extensive, further research is needed to cover it satisfactorily.

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