Household visits

Training Module

2020 - Focus

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Introduction to energy

Forms of energy

- Fossil fuel energy: Coal, oil, natural gas
- Uranium
- Renewable energy:
  - Solar photovoltaic
  - Solar thermal energy
  - Hydropower
  - Geothermal
  - Wood
  - Wind

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Introduction to energy

Concepts of energy sobriety and efficiency

- energy sobriety: The energy sobriety is an approach aimed to reducing its need by changing behavior. It is therefore to avoid waste. This is the first action and the easiest way to reduce energy or water consumption.
- energy efficiency: Energy efficiency goal is to reduce energy or water need firstly by improving the efficiency of equipment. This is a second step towards better energy efficiency and reduced C02 emissions. The third step is to produce energy from renewable sources.
- Example: The first step is to save energy by a rational behavior, systematically turning off the light when it is not useful. The second step is to replace conventional bulb by a low-energy bulb, which uses at least 5 times less energy. The final step would be run this light with electricity from renewables.

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Key energy concepts

- Energy: anything that enables to perform a work, that creates heat, or light, that produces a movement. Example: Electricity to light a bulb, petrol to move a car, food vital to human beings, etc
- Thermal loss: loss of heat. Example: A cup of tea cools down in contact with the room temperature
- Thermal comfort: wellbeing sensation of the human body according to its external environment.
- Thermal resistance: is the ability of a material to slow down heat loss between a heated environment and an unheated environment.
- Thermal insulation: process that fights heat losses. An insulating material has a strong thermal resistance, and retains better heat within a close interior.
- Temperature (T): warm or cool sensation that a body feels in a specific place. Temperature is stated in Celsius degrees (°C).
- Heat: is a high body temperature. It can be defined as a sensation produced by a hot thing. Heat always moves from the hottest temperature to the coolest one.

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Units

- Power (P): is the maximum energy that a system can provide. Power is stated in Watt (W). Example: A vacuum cleaner has a power of 1 600 W.
- Kilo Watt (kW): 1 kW = 1 000 W. Example: A 1.6 kW vacuum cleaner.
- Consumption (C): is the power used in 1 hour. Consumption is stated in Watt Hour (Wh). Example: If my TV has a power of 60W and if I watch it during 1 hour, it will have consumed 60 Wh
- Kilo Watt Hour (kWh): 1 kWh = 1000 Wh. Example: On my electricity bill, it is shown that I have consumed 100 kWh within 2 months.

Consumption of an appliance (in Wh or kWh) =

Power (in W or kW) X Operating time (in h)

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Time and power experience

Let’s say that we would like to heat 1 liter of water from a temperature of 20°C to 100°C. Depending on the power of the system used, this process will take more or less time.

- Almost instantaneous: in an industrial oven
- Several hours: with a lighter
- Few minutes: on hot plates

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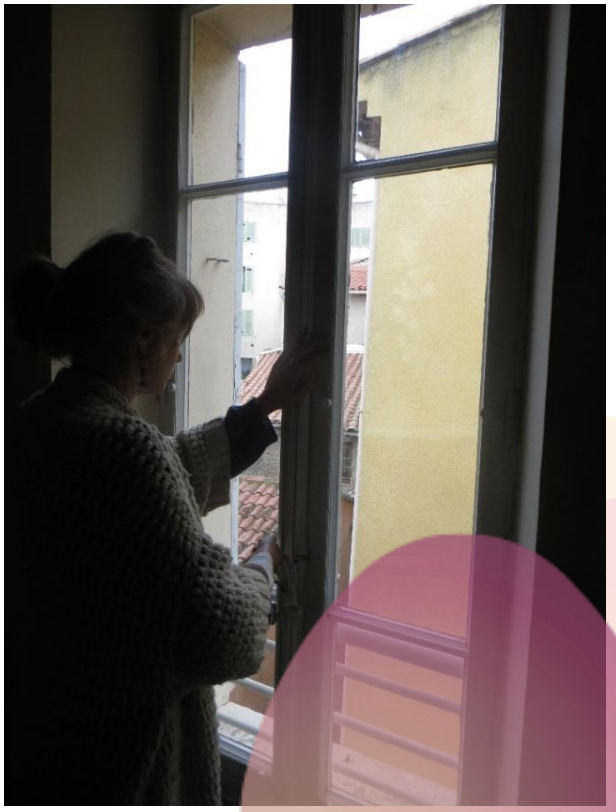
Heat transfer

Heat transfer can happen in several manners:

- Conduction
- Convection
- Thermal radiation



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Comfort factors in housing

Thermal comfort depends on the exchanges of heat between the human body and its environment. These exchanges depend on 6 factors that are classified into 2 families:

Environmental factors

- Air temperature
- Air speed
- Humidity
- Wall temperature

Individual factors

- One’s activity level
- Clothing’s thermal resistance

- Comfort and individual factors
- Comfort and temperature
- Comfort, humidity and ventilation
- Comfort and air speed
- Conduction
- Convection
- Thermal radiation

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Humidity I

Aggravating factors for humidity:

- Over use of water
- Inadequate heating
- Obstruction of entrances or airing
- Poor thermal resistance of walls (the temperature being low, air condenses more easily in contact with these walls)

Humidity in the air is measured in percentage. The ideal humidity should be between 40% and 60%.

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Humidity II

Consequences of low humidity (below 30 %)

- Increase of static electricity (small electric discharges in contact with metal objects)
- Increase of discomfort and irritation to tobacco smoke (odors are more noticeable)
- Increase of the concentration of dust in the air, which can bring bacteria and impact health (respiratory disease)

Consequences of excessive humidity (above 70 %)

- Effects in housing: water on windows, wall degradation, mould, cold walls, heat over-consumption, moral discomfort, visible damage…
- Effects on health: emergence of dust mites and cockroaches , fungi and molds cause allergies (eczema, rhinitis, asthma ...), babies and children vulnerable to respiratory problems

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Humidity III

Fight against humidity can be done in several ways:

- Ventilate the place to remove humidity excess
- Do not block air inlets and outlets, which must be regularly cleaned
- Do not dry your clothes inside the house
- Ventilate especially when cooking, bathing or other activities that release water vapor
- Heat properly: Heating a room allows to control humidity level, by limiting water condensation. The higher the temperature is, the lower the risk of condensation is, and therefore the lower the risk of mold growth is. Heating "dries" the air.

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Bulding envelope

- Insulation of walls
- Windows
- Example: three 100 m² houses, heated with fuel oil and with indoor temperature of 18° C

House 1	House 2	House 3
uninsulated single glazing	30 cm of insulation recent double glazing	3 cm of insulation old double glazing
Thermal loss: 32 kW Heating consumption: 355 kWh/m² Annual cost: 3400 €	Thermal loss: 10 kW Heating consumption: 147 kWh/m² Annual cost: 1 400 €	Thermal loss: 3 kW Heating consumption: 39 kWh/m² Annual cost: 375 €

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Heat loss

Main sources of heat losses in a not insulated building:

- The roof: accounts for 25 to 30% of heat loss
- Walls: responsible for 20 to 25% of heat loss
- Ventilation and air leakage: responsible for 20 to 25% of thermal loss
- The windows : account for 10 to 15% of thermal loss
- Soil: accounts for 7 to 10% of heat loss
- Thermal bridges: responsible for 5 to 10% of thermal loss

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Electricity bill

Electricity consumption is measured and calculated separately for each flat. Theoretically, it should then be possible to find the respective bill in each separate household. The electricity costs are divided into two cost components:

- the basic price and
- the consumption price.

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Changing the electricity supplier

- In the course of an advisory discussion the question frequently arises, which electricity supplier offers the lowest rates.
- The energy auditor should refer the customer to consumer information centres which can offer advice on this topic or to the Internet

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Water flow measurement

- Flow measuring cup: The flow measuring cup measures the water level in the cup and allows the read-out of the flow rate from a scale. The disadvantage is the relatively high purchase price of around 30 - 40 Euros.
- Measuring cup and stopwatch: Alternatively, you can use a simple household cup and a stopwatch. Measure the amount of water filled to the cup over a time interval of, for example, 15 seconds. Multiply this amount by four to determine the water flow per minute.

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Water bill and prices

The costs of water are divided into

- the fresh drinking water component,
- the drainage of waste water, and
- the basic price.

- The amount of water in cubic meters measured by the water meter represents the basis for the calculation of drinking water and waste water costs. Water prices can vary considerably according to region.
- The actual water consumption of a household cannot be determined unless there is a separate meter for each household. Costs are distributed over the individual flats according to a certain scale (e.g. per person or per m² living space).

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Heat

- Heating bill: amount of fuel consumed or by way of the ancillary costs (the bill does not allow reading out the amount of energy consumed)
- Allocation of heating costs: the heat energy consumption is measured by heat cost allocators on the radiators and the house owner or house manager bills the ancillary costs to the respective household.

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Lightning

- Luminous flux: the amount of light which a lamp produces; measured in lumens (lm). The higher the number of lumens produced by a lamp, the brighter the lamp.
- Illuminance: the amount of light falling on a surface; measured in lux (lx) = lumen per square metre
- The luminous colour: composition of the light emitted by a light source; expressed in Kelvin (K)

Warm White, Soft White The standard color of incandescent bulbs		**Cool White, Neutral, Bright White** Good for kitchens and work spaces		**Neutral or Daylight** Good for reading	
2700K	3000K	3500K	4100K	5000K	6500K

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Light types

INCANDESCENT

AVERAGE LIFESPAN: 1 YEAR

The traditional type you probably grew up with

Not energy efficient

Harder to find as they are being phased out

CFL (COMPACT FLUORESCENT)

AVERAGE LIFESPAN: 9 YEARS

These curvy, twisted bulbs have become more common in recent years

Energy efficient

More expensive than incandescent

Should be recycled since they contain mercury

FLUORESCENT TUBES

AVERAGE LIFESPAN: 9-10 YEARS

Less common in the home but frequently seen in commercial settings

Energy efficient

Must be recycled rather than thrown out

LED (LIGHT EMITTING DIODE)

AVERAGE LIFESPAN: 20 YEARS

These bulbs may soon overtake CFLs the way CFLs replaced incandescent

Highly energy efficient

More expensive than CFL

HALOGEN

AVERAGE LIFESPAN:1 YEAR

Used for outdoor or task-specific purposes rather than interior light

More efficient than incandescent

Less efficient than CFL and LED

HID (HIGH INTENSITY DISCHARGE)

AVERAGE LIFESPAN: VARIES

Primarily used in outdoor or commercial settings

Larger, heavier than other types

Uses sodium or mercury vapor to generate light

Generally last longer than incandescent

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Cost savings with energy-saving lamps

- Energy-saving lamp: 11 Watts x 10,000 h = 110,000 Wh = 110 kWh
- Incandescent lamp: 60 Watts x 10,000 h = 600,000 Wh = 600 kWh
- Assuming a price of 20 Euro-cents per kilowatt hour for electricity, the savings are: (600 kWh - 110 kWh) x 0.2 Euros / kWh = 98 Euros

The purchase price of the energy-saving lamp is 6.50 Eur and incandescent lamp 0,75 Eur. For a burning life of 10,000 hours it is necessary to purchase 10 incandescent lamps:

- Incandescent lamp: (10,000 h / 1,000 h) x 0.75 Euros = 7.50 Euros
- Energy-saving lamp: 6.50 Euros
- The cost savings over the entire lifetime with the energy-saving lamp are therefore: Savings: (7.50 Euros – 6.50 Euros) + 98 Euros = 99 Euros

Standby

- Standby: state of readiness for remote control operation, such as for televisions, video players and DVD players
- Pseudo-off: the devices require energy, although they appear to be switched off, for example low-voltage lamps with power supplies which are switched off from the low-voltage side but not unplugged from the mains
- Standby losses: visible, audible, possible to feel, possible to measure

Avoiding standby losses

- Completely unplugg
- Switchable multi-socket outlet
- Switchable remote control operated wireless sockets
- Standby interrupters
- Master-slave socket outlets

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Fridge measurements

Long-term measurement is a problem. Solutions can be:

- The customer reads out the data after a few days and informs the energy auditor by telephone. A second visit to the household is arranged to collect the measuring device.
- The customer brings the measuring device back personally.
- The customer sends the measuring device by post.
- During the analysis the energy auditor estimates the consumption.
- Record the data from the nameplate (usually inside, in the lower left corner), in particular the manufacturer, product name, year of manufacture and volume of the fresh food section and freezer compartment.
- Do not forget refrigerators and deep freeze cabinets in the cellar!

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Fridge issues

Reason for high power consumption	Cause
Poor thermal insulation	Old appliance
Inefficient heat exchanger	Old appliance
Unsealed door	Wear
High ambient temperature	Wrong location (sunlight, stove,...)
Cooling temperature too low	Incorrect setting
Poor heat dissipation	Insufficient ventilation, no ventilation slits
Refrigerator iced over	Insufficient maintenance

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Washing machine

Tips for purchasing a new appliance:

- Check the size (3 kg for a single person household, otherwise 5 kg filling capacity)
- Purchase only efficiency appliances in the category A+ with low water and electricity consumption
- Ensure a high spin speed when a drier is used.
- Purchase and use appliances for shared use.
- Washer-driers (combinations of washing machine and drier) consume far more electricity and should therefore not be purchased.
- If the appliance has standby consumption, dispense with automatic time control, etc.
- Ensure that the instructions are easy to read. The selector switch and the buttons must be easy to operate and reliable.

Laundry dryer

- Laundry driers are available in three basically different designs: ventilation driers, condensation driers, washer-drier

Tips for purchasing a new drier:

- No energy-saving appliances except for very expensive special models, such as gas-heated ventilation driers
- Choose capacities suitable for the washing machine.
- Condensation driers are more suitable for flats than ventilation driers
- Drying according to moisture has many advantages compared with drying according to time.
- Can the lint trap be easily cleaned? For condensation driers: Can the condensate be easily removed?

	Washer-drier	Ventilation drier (electric)	Condensation drier (without heat pump)	Clothes line
Inefficient appliance	750 €	660 €	675 €	0 €
New efficient appliance	380 €	400 €	510 €	0 €
Savings	370 €	250 €	165 €	0 €
Savings in electricity costs per year	75 €	50 €	30 €	0 €

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Dishwashers

Temperature	Description	Electricity consumption	Program time	Water consumption
35 degrees	"fast"	0.7 kWh	approx. 30 min.	10 l
40 degrees	"mild"	0.9 kWh	approx. 75 min.	15 l
50 degrees	"eco"	1.05 kWh	approx.140 min.	15 l
65 degrees	"normal"	1.6 kWh	approx.140 min.	19 l
70 degrees	"intensive"	1.7 kWh	approx.150 min.	20 l

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Water savings

	Savings of water	Savings of energy (fraction of hot water for overall water consumption)
Low-flow shower head	yes	yes (approx. 90% hot water)
Shower with flow limiter	yes	yes (approx. 90% hot water)
Water stream regulator on water tap	yes	yes (approx. one third hot water, depending upon tapping point)
WC flow limiter	yes	no

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Heating

- perception of warmth or cold is very different: older or sick persons and persons with low blood pressure are cold much faster than others
- reduce the temperature in rooms which are not used
- close the doors between the heated and unheated rooms
- during cold nights roller shutters should be lowered and window shutters closed
- heavy curtains and so-called draught excluders placed before doors and windows can help to reduce heat losses

	Recommended room temperature
Living rooms	20 °C
Kitchen	18° C
Bedrooms	16 °C
Hallways	15 °C

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THANK YOU !

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