Energy Education

It is vital that children begin to grasp the significance of environmental issues at an early stage in their education.
Saving energy and the potential threat of climate change are issues that must be understood by children and adults alike and we hope the "Kids4Energy" - teaching material helps to raise further awareness.

One of the main objectives of environmental education is to awaken and enhance students' environmental awareness by helping them consider their lifestyles.

To achieve this aim, the "Kids4Energy" - teaching material can be used in school education in various ways. The main target group are students in the age of 6 up to 10 years.

Students can identify with the imaginary roles and situations pictured on the cards and think about the consequences of the different ways of action. The game variations of the Kids4Energy - teaching material are a highly suitable background material for class discussions and can be used as stimulating material for group work.

The cards present four families, each with a different lifestyle. Lifestyles are characterised, e.g. by consumer behaviour or by hobbies and vehicle choices and by the way the family consumes water, energy and electricity.

Family "Wasteful"

This family wastes lots of energy and drinking water because of thoughtlessness, ignorance or laziness.

Family "High-Techs"

The most recent electronic devices take centre stage in the life of this family. This causes on the one hand a high electricity and energy consumption, on the other hand the family benefits from the better energy-efficiency of new and modern appliances.

Family "Energy savers"

This family is environmentally-conscious and acts energy-saving in order to protect environment and save money.

Family "Renewables"

The fourth family is very much dedicated to environment and climate protection. Energy-efficiency is an important topic for them and they try to substitute fossil energy by renewable energy sources.

The cards of the Kids4Energy - teaching material are numbered from 1 to 5 within each family. To distinguish the four families the numbers on the cards are coloured:

Red:	Family "Wasteful"
Yellow:	Family "High-Techs"
Blue:	Family "Energy Savers"
Green:	Family "Renewables"

The Kids4Energy - teaching material includes 20 pictures cards and one instruction booklet, where teachers can find information for the use of the "Kids4Energy" - teaching material. The cards can be used in many different ways, the descriptions in the instruction booklet are just suggestions.

Guidance to use the Kids4Energy - teaching material!

Depending on the age of the students it is necessary to explain the concepts of energy and energy efficiency before using the cards. To make this explanation more exciting "Game 1" can be played.

Game 1: What do you see?

Each student gets a card and describes his/her classmates the illustration on the card. He or she tries to find out (with the teacher's assistance) which activities or equipment illustrated on the cards waste energy and which are energy saving.

Game 2: Comparison with the own family

The class is separated into 4 groups. Each group gets all cards of one family. Each group tries to describe the behaviour of the family pictured on the cards. Perhaps they can identify the main characteristics of the illustrated lifestyle. Afterwards each group presents the life style of "their" family to the rest of the class.

After the group work each child in turn lifts a card. The player looks at the card he/she has lifted and compares his/her lifestyle (or the lifestyle of his/her family) with the lifestyle of the person on the card. He /She should try to find similarities or contrasts.

For example:

- My family could be the family "Energy Savers", because we have thermostatic valves on our radiators.
- I could not belong to family "Wasteful", because my TV-set is never in stand-by mode, it is always switched-off.

Game 3: Picture stories

Each student gets a card and invents a story related the picture on the his/her card.

- In this story children could describe which lifestyle the person(s) on the card are leading. They can point out how the family members are saving or wasting energy.

- Describe a typical day in the life of a member of the family "Wasteful", "Renewable",.....
- What happens next? Children can invent something exciting or surprising.

Game 4: Which person/card is missing?

This game needs a questioner and 2 –8 players. The aim of the game is to remember one or few missing cards or persons.

- The questioner spreads a few role cards on an even surface.
- The players look at the cards for a moment and then they look away from the cards.
- The questioner removes 1 –3 cards.
- The players try to remember which cards were removed and what kind of life the persons on the cards lead. If the players cannot remember who is missing, the questioner gives them hints by describing the lifestyle of the person in question. The winner of the game is the player who first remembers which card is missing.

Game 5: Try to remember!

- Take two decks of Kids4Energy - teaching materials.
- Shuffle the cards and put them on the table (face down).
- Each player in turn lifts two cards. If he/she found two identical cards he/she can keep them and he/she continues two lift two cards. If no pair is found, the next player gets his/her chance. The player who found the most pairs is the winner.

Game 6: To which family do I belong?

Use an adhesive tape to fix one card on each player's back. They players should not see their own cards. Each players asks the others questions about the person or the card on his/her back in order to find out which family or lifestyle is illustrated.

Game 7: Whose lifestyle is different?

- Put one family on the table (face up).
- Add a card from another family as visitor(s).
- The players should identify, which person or card is from a different family and how the lifestyles differ from each other.

Game 8: Find your family!

A random card is dealt to each player. The cards are not shown to others. Ask your class mates questions about their cards and compare the answers with your own card. Try to guess, who has a card belonging to the same family as yours. Pay attention to the lifestyles of the families. When you think that you have gathered a whole family, the colours of the numbers on the cards are compared. If the colours differ, you have ended up in a wrong group! Continue looking for your right family.

Game 9: Draw your own card

It is certainly great fun to draw a situation, which is representative for the children's own lifestyle.

Game 10: Role-plays

Type A

Groups of 3 or 4 present the lifestyle of one family in a short role-play. The following situation could be shown:

- How the family "High-Techs" celebrate Christmas
- How the "Energy Savers" spend their holidays
- How the family "Wasteful" start the day.
- What the "Renewables" do in their spare time.

Type B

One child pulls a card and acts the person or situation pictured on the card. The audience should guess to which family he/she belongs.

Type C

Each child assumes a role of a person on the cards. The players belonging to the same family or life-style try together to immerse themselves in the roles they have taken. Finally the players fill the role and spent their time accordingly. Students could visit the neighbourhood or go on an imaginary trip and act as if they were an "Energy Saver", an High-tech" and so on....

Afterwards, the family meets to create a summary of their experiences. It can be a play, a sketch, a story, drawings, photos, poems, a comic strip, a few pages of a diary, a letter, a shopping list...
These summaries are presented to the three other families.

Game 11: Discussion

The following issues can be considered within a discussion among the students:

- Which of the four lifestyles is most similar to your own life style?
- Which situations on the cards are "typically you"?
- How does our lifestyle influence our environment?
- Is your lifestyle strictly your own business? Justify!
- How are lifestyles adopted?
- How can I change my lifestyle?
- Search for alternatives for energy wasting equipment and behaviour illustrated on the cards.
- Can people's lifestyles be classified in the same way as on the cards?

Lots of success and fun with the "Kids4Energy" - teaching material!

Family "Wasteful"

On this card you can see that the family "Wasteful" does not care about energy saving or environmental protection when they are going shopping.

They use one-way plastic bags to pack the things they bought. The energy for the production and the disposal of the plastic bags can easily be saved by using shopping baskets or other re-useable bags instead.

The beverages the family chose are packed in plastic packings and aluminium cans. These packages should be replaced by recycle- or refillable (glass) bottles.

In addition the family buys exotic fruits and strawberries although it is winter. These products have to be transported for thousands of kilometres to Europe, which causes a high energy and fuel consumption. This energy can be saved and a lot of air pollution can be avoided if we buy fruits in season and prefer home-produced products in general.

Take a shower instead of a bath as it uses only about one third of the energy needed for a bath.

A dripping water tap (10 drops per minute) wastes around 170 l a month or 2,000 l a year

Look for the "energy label" whenever you buy electronic devices. ‘A’-rated products are the most energy efficient and ‘G’ rated products are the least efficient. In some European countries washing machines with an A^{+}-label and freezers and refrigerators with an A^{++}-label are already available. These devices have even a lower energy consumption than 'A'-rated appliances.

Family "Wasteful" chose a 'C'-labelled washing machine, which works with a low energy efficiency and causes a high electricity bill.

Family "Wasteful" washes their clothes at a very high temperature (90 °C). But a 60°C wash works just as well and costs half as much as the 90°C boil wash. A 40°C or a 30°C wash is even cheaper!

Everyone knows that an opened or tilted window when the heating is on wastes a lot of energy and money is thrown down the drain. Not sufficiently known is the fact that a curtain partly covering the radiator can increase the energy demand for heating by up to 40%.

The TV-set in the picture is in stand by mode, but electronic devices (e.g. televisions, VCRs, DVD players and stereo systems) consume a lot of energy when they in stand-by mode. One single TV-Set in stand-by mode can consume up to 190 kWh per year. To avoid this useless energy consumption always switch off electronic devices. A similar problem is the high energy consumption of a screen saver. It is better to switch off the monitor or set your computer to "sleep mode," which darkens the screen, when it is not actively used.

A short look at the rubbish bin shows us that family "Wasteful" does not pay attention to waste separation. Nevertheless waste paper, recovered glass and some plastics are valuable raw materials for industry, that should be separately disposed and recycled.

Pupils should walk to school, go by school bus or by bicycle whenever it is possible. Bringing the kids to school by car wastes fuel and has an negative impact on our environment, which easily could be avoided. In addition going to school by bus or going by bicycle – perhaps in a group – is most time much more fun than being driven in mother's car.

If it is inevitable to fetch your kids by car, do not leave your car running while you are waiting for them. When waiting for passengers or queuing because of rail crossings or heavy traffic, turn off the engine to avoid wasting fuel.

Examine your driving style. The following habits all waste fuel; frequent full-throttle acceleration; keeping the choke operative after the engine no longer needs it; frequent braking in traffic because of bad planning; cruising at high speed.

And last but not least: Pay attention to the fuel-efficiency when buying a new car. All-terrain vehicles – like in our picture – are an example for very high fuel consumption and low energy efficiency, especially when they are only used in town on asphaltic roads.

Looking at this picture it is easy to realise that "Wasteful" is the right name for this family:

- Cooking in pots without cover triples the energy consumption!
- Do not position the refrigerator next to the oven. The heat produced by the oven boosts the energy consumption of the refrigerator.
- Turn unnecessary lights off!
- According to researchers, a load of dishes cleaned in a dishwasher uses less water than washing dishes by hand! However, if you fill up one side of the sink with soapy water and the other side with rinse water - and if you **don't let the faucet run** - you'll use half as much water as a dishwasher does.
- Take a look at the coffee machine: Coffee is kept warm on the heating plate of the coffee machine. This is wasting of electricity. Use a thermos flask instead – and the coffee will still be warm **and** tasty after a few hours.
- Caulk your windows, install better weather-strips or replace the old leaky window by modern perfectly insulating windows. Although the window in the picture is closed, the curtains sway in the breeze. This window is very old and leaky. A lot of heat is lost to the outside.

Family "High-Techs"

Leisure activities can be very energy consuming or nature-orientated. The girl in our picture prefers to work with the computer and to play with a play-station or other electronic toys. This naturally consumes more electricity than playing a ball game, as the children outside do. Our health and the family budget could benefit, if we spend our spare time in the nature, at least when the weather is fine.

It is easily recognisable that this girl is a member of the "High-Techs"-family. She owes al lot of electronic devices, but these devices are at least modern and energy efficient, e.g. a flat screen requires half the power of a conventional monitor (cathode ray tube).

By using pocket calculators run by solar energy – like the calculator on the picture – batteries are avoided. Batteries (which are also needed for most electronic toys) contain heavy metals and other chemicals, are classed as hazardous wastes and it takes a lot of effort and energy to dispose them properly. The single life battery is a very inefficient system for the delivery of power. The amount of energy needed for the production of a non-rechargeable battery is 40 - 500 times higher than the energy provided by the battery in use. If you have to use batteries go for rechargeable ones. Portable appliances which have the facility to be plugged into the mains electricity supply should always be preferred.

Flying is today sometimes cheaper than going by train. But if you plan a journey you should take into consideration that air traffic causes negative effects on the environment. The fuel consumption of an aeroplane referring to passengers and km is comparable with the fuel consumption of an average car. In addition kerosene is 2 – 4 times more harmful for the environment than diesel or petrol.

Flying 3,000 km, driving 7,000 km with a medium-sized car or going 17,000 km by train creates the same amount of the greenhouse gas CO_2 (Carbon dioxide).

Another aspect visible in this picture are again electronic toys and portable CD player. They are mostly run by batteries, which have a negative effect on our environment and are inefficient (see "High-Techs" Card 1). It pays to find out how much electronic equipment lies about in our flats and if we could pass on some of these devices.

A tumble-dryer is a very helpful and time saving equipment, but it is a real "energy-eater". So if you want to act environmentally conscious, a clothesline is the most energy-saving (and money saving) way to dry your laundry! Sun energy is for free!

However, if you can not do without a tumble drier, you can still make a big difference by choosing a more energy-efficient model. Pay attention to the "energy label" and prefer 'B'-labelled dryers (as long as 'A'-labelled dryers are not available) to 'C'-labelled like in our picture.

The following tips can also help to save energy when using a tumble-dryer:

- Try to fit the maximum load in your tumble dryer every time.
- Don't put really wet clothes into your tumble dryer, spin-dry first with a high number of rotations per minutes (1,000 rotations/min or more).
- Clean the lint filter every time you use the machine. A blocked filter prevents the hot air from circulating freely, so clothes take longer to dry.

Apart from putting dripping wet clothes in the tumble-dryer on a sunny day, the family saves energy by using a highly energy-efficient washing machine ('A^{+}'-label) and choosing a low washing temperature (40°C).

The family "High-Techs" just uses the most recent appliances, this sometimes saves energy because of the high energy efficiency of modern products, but this lifestyle could also be energy wasting because of uncountable unnecessary electronic devices.

If you need to warm up or defrost small amounts of food, use a microwave instead of the stove to save energy. For large meals, however, the stove is usually more efficient.

Use an electric kettle to heat water. It's more energy efficient than using a cook top element or a microwave, but observe the following rules:

- It takes more energy to heat a calcified kettle. Regularly clean your electric kettle by boiling water and vinegar to remove mineral deposits.
- Don't overfill the kettle for just one cup of tea. Heat only the amount of water you need.

Do not leave your espresso machine in stand-by mode the whole day, when you drink just a few cups of coffee a day. When you buy a new one, chose a machine with an energy saving mode.

Looking at this picture a number of devices using electricity are visible: the TV-set, two lamps, the ventilator and the treadmill. The energy consumption of these appliances could easily have been be avoided if mother "High-Tech" had decided to go jogging in the nature. This example shows us that a critical consideration of our lifestyle could help us to save energy and money.

The heating control for this room shows a target temperature of 24 °C. That is a very high temperature. Adjust your thermostat down. Even just one degree can reduce the heating energy by up to 6%.

The following temperatures are recommended:

- Living room: 20-22°C
- Children's room: 20°C
- Bed room: 18°C
- Bath room: 24°C

Family "Energy Savers"

To avoid waste everyone should conform the three central principles of sustainable consumption - to consume less, to reuse and to recycle!

Waste paper, card boards, glass, sorted plastic and synthetics, corks, compact disks, used frying oil, clothes and shoes, discarded metal, cables, tyres,.... can be recycled or even re-used provided that the materials are sorted and delivered in a waste collection centre as in the picture above.

Some hazardous materials must not be disposed with domestic waste. Every citizen is obliged to bring the following a materials to waste collection centres or toxic waste disposal areas:

- Mineral oil residues
- Batteries / rechargeable batteries (including mobile phones)
- Freezers and refrigerators (cooling fluids, CFCs)
- Lacquers and paints
- Not completely emptied aerosols
- If you are not sure if a product is a hazardous waste, ask at a waste collection centre or read the text on the package carefully. It is likely that the approved way of disposal is described.

On this card you can see a member of the family "Energy Savers" buying food in a shop offering products grown by organic farming.

Organic farming favours renewable resources and recycling, returning to the soil the nutrients found in waste products. Where livestock is concerned, meat and poultry production is regulated with particular concern for animal welfare and by using natural foodstuffs. Organic farming respects the environment's own systems for controlling pests and disease in raising crops and livestock and avoids the use of synthetic pesticides, herbicides, chemical fertilisers, growth hormones, antibiotics or gene manipulation. Instead, organic farmers use a range of techniques that help sustain ecosystems and reduce pollution.

The family "Energy Savers" also prefers home produced products and buys fruits in season. Their usage of shopping avoids one-way plastic bags – another way to reduce the amount of waste, save energy (needed for the production and disposal of the bags) and protect the environment.

The family "Energy Savers" also pay attention to things that are often overlooked:

- An conventional electric bulb transforms 90 - 95% of the consumed electric energy into heat, just the small rest of 5 – 10% is converted into light. Hardly another electronic device shows just a bad energy efficiency. The family "Energy Savers" uses energy saving lamps. These lamps have a 5 times higher light output and a 8 times longer durability than light bulbs.
- Cooking with pressure cookers can save up to 50% of energy. Use the pressure cooker whenever you prepare food that needs a long cooking time.
- Using pots with cover minimises cooking energy.
- The thermostatic valve on the radiator attuned to 2.5 assures a room temperature of 20 - 22°C, which is recommendable for living room and kitchen. Thermostatic valves also account for heat arising from cooking and baking so the kitchen can not be overheated.
- The family prefers refillable bottles, that avoids waste and saves the energy for the production and disposal of one-way bottles or tins. In addition the amount of waste the family produces is reduced and they have to pay less for waste disposal.

Family "Energy Savers" avoids using a car as often as possible. The children go to school by bus, the father cycles and the mother walks to work.

Especially when your way to work is short you should sustain from using your car. On short distances the fuel consumption is extremely high, on the first kilometre between 20 and 40 l/km. Not until a distance of 4 km the fuel consumption decreases to normal values.

If you are living and working in town the bike or public transport may also be the fastest way to go to work, when you include the time needed for the search for parking space.

If you cannot avoid going by car, carpools are a good alternative to save money and energy. Most cars in the morning traffic jams are occupied by just one persons, although there is often enough space for at least 4 persons and passengers with an similar way to work are usually easy to find.

In this picture you can see the family going for a walking tour through the mountains. This is an energy saving and nature orientated leisure activity.

Because of their attitude to energy saving and climate protection the family "Energy Saver" chose the train for the journey to their destination.

The transport of 100 persons for 100 km by car in comparison with bus or train:

- 50 cars with 2 persons each need about 500 l petrol, that are 50 l per km.
- Two busses with 50 passengers each or a fully occupied railway carriage consume about 70 l diesel on 100 km. That is equivalent to 0.7 l per km.

And when driving your car obey the following tips to save fuel: Drive your car economically, observe speed limits, change to a higher gear in time, keep your tyres in good condition and at the right pressure, avoid roof racks, turn off the engine when you are waiting at railway crossings, drive off immediately after starting the engine (Idling causes pollution and excessive fuel consumption) and ensure your car is properly and regularly maintained.

Family "Renewables"

The mother of the family "Renewables" do not fuel normal diesel, but biodiesel. Biodiesel is not a fossil fuel, that means it is not made of petroleum, that is already running short. The raw material for biodiesel is rape seed oil or other vegetable oils. (Look at the field in the background of the picture: This yellow colour is typical for a blooming rape field in May.)

The usage of biodiesel reduces the emission of green house gases, since the same amount of carbon dioxide (one of the substances responsible for the green house effect) that is cause by the combustion of biodiesel was assimilated by the rape plant during the growth.

Biodiesel can be used in a lot of European diesel engines produced in recent years. But before fuelling your car with biodiesel ask your car dealer or your repair shop, if biodiesel can cause any damage in your car.

Unfortunately Biodiesel cannot be bought everywhere. But there are already several petrol stations that offer biodiesel. This alternative fuel is often a bit cheaper than normal diesel, because of a tax exemption in some European countries.

Grandmother "Renewable" collects used frying oil. This is advisable because of two reasons: On the one hand collecting the oil keeps sewer pipes clean. Oil can cause detrimental deposits and blockage of the drainage system. On the other hand used frying oil can be recycled. It is used as a cheap raw material for the production of biodiesel.

Family "Renewables" is living in a passive house. A passive house is a building in which a comfortable interior climate can be maintained (nearly) without active heating and cooling systems. That requires a number of measures to reduce demand of heating energy, like a very good insulation, windows with triple glazing, orientation to the south, a compact form and a controlled ventilation with heat-recovery. This ventilation system transfers most of the perceptible heat in the warm exhaust air to the incoming cold air. So the inhabitants are provided with fresh air without much loss of heating energy.

In our picture the air offtake of the controlled ventilation is visible. By the way a controlled ventilation makes window ventilation dispensable and opening a window in the heating period should be avoided.

In recent centuries electricity was mainly produced by the combustion of coal and petroleum or by nuclear energy.

But there are several other ways to produce "green electricity" without causing environmental pollution and green house effect. One of this clean ways to produce electricity is pictured on this card: wind turbines. Wind parks are applicable in windy regions and on the sea (off-shore wind parks).

Other examples for the environmentally friendly production of electricity are:

- Photovoltaics (usage of sun energy)
- Hydro power
- Biomass and biogas (e.g. wood is used as a fuel for power stations instead of coal and petroleum)
- Tidal power stations
- Geothermal energy

On the roof of the house of the "Renewables" a solar thermal installation is visible. In contrast to photovoltaic plants, that are used to produce electricity, thermal collectors are intended to produce hot water and/or heating energy in combination with an additional heating system. An installation with an area of 8 m^2 is sufficient to produce 70% of the demand for hot water of a household with 4 persons.

Sun energy is renewable and environmental friendly and it is free for everyone.

A conservatory on the South of a building helps the family to reduce their heating costs. This space has a dual purpose: providing an insulating effect as well as warming the air that passes through to the house. A conservatory is a way of passive usage of sun energy. But note that a conservatory only saves energy if the conservatory itself is not heated.

Family "Renewables" meets the low heating energy demand of the passive house with a heating system fuelled with wood pellets. Wood pellets are made from waste sawdust, compressed under extremely high pressure using no glues or other additives. Wood pellets are also a highly convenient form of fuel for end-users - they can be delivered by tanker trucks or in bags and are suitable for use in automatic feeding systems, making them as user-friendly and time-efficient as gas- or oil-fired boilers.

And last but not least wood pellets are CO_2-neutral, that means that the same amount of CO_2 that come to existence during the combustion of pellets was assimilated by the tree during the growth.