



Grasping of climate

An inspirational guidebook for teachers



The Altener Programme
(The European Commission)



Teknikens Hus
SE-971 87 Luleå, Sweden
Tel + 46 (0)920 492201 • Fax + 46 (0)920 492202
info@teknikenshus.se • www.teknikenshus.se



NENET

NORRBOTTEN ENERGY NETWORK

Norrbottnens Energikontor AB
Västra Varvsgatan 11, SE-972 36 Luleå, Sweden
Tel + 46 (0)920-941 20 • Fax + 46 (0)920-941 25
info@nenet.se • www.nenet.se



THE NATIONAL ENERGY FOUNDATION

The National Energy Foundation
Davy Avenue, Knowlhill, Milton Keynes, MK5 8NG, England
Tel: + 44 (0)1908 665555 • Fax: + 44 (0)1908 665577
info@nef.org.uk • www.nef.org.uk



RhôneAlpÉnergie-Environnement
10 rue des Archers, 69002 Lyon, France
Tel: + 33 (0)4 78 37 29 14 • Fax: + 33 (0)4 78 37 64 91
raee@raee.org • www.raee.org

Editor and coordinator Tord Pettersson, Norrbottens energikontor AB

Graphics and layout Lena Ahlbäck

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Imagine the chance to work with such an important issue as climate change, and to be able to do that together with our most important target group, the children – our future! It was therefore with joy I received the message that our school project “Grasping of Climate” had been approved as an EU Altener programme. Today, almost three years later, I can look back on a fantastic time with lots of interesting meetings, activities and dialogues between children, youth and adults in three European countries. For myself, I have learned a lot about how I affect the climate by my way of living, for better and for worse. But through the project I have also come to understand that I can contribute to a change towards a sustainable society by making small changes in my everyday life. From other participants in the project I have understood that this insight is shared by many.

During the project we have met several engaged teachers in Sweden, England and France, and shared many ideas on how to work with climate change issues in school. In this book we have collected the best tips and ideas from all three countries, and it is our wish that this book may inspire other teachers as well, in their work to engage pupils in striving for a sustainable lifestyle.

I would also like to thank our partners, Norrbottens Energikontor (NENET), the National Energy Foundation (NEF) in Great Britain and Rhônealpiénergie-Environnement (RAEE) in France that have cooperated with Teknikens Hus in this project. I also greatly acknowledge all the financiers, sponsors, experts, teachers, pupils and all the others which made this project a success.

*Lena Embertsen
Director, Teknikens Hus
Co-ordinator for the project “Grasping of climate”*

GRASPING OF CLIMATE

An EU project

Concept The starting point was when the Swedish government presented a proposition in 2001, the aim of which was to assemble all the Swedish, EU and international climate-policy related measures in a single national climate strategy. According to the government, the objective was to bring about an active climate policy that would involve the entire society.

The proposition pointed to the climate issue as one of the largest global environmental problems. The necessity for individual efforts – not least among young people – was emphasised, as was the importance of international co-operation.

The emphasis on the role of youth and the importance of international co-operation was what induced the Norrbottens Energikontor AB, Norrbotten Energy Network (NENET), which is one of more than 250 local and regional energy-efficiency offices in the EU, to contact the region’s science centre, Teknikens Hus, in Luleå.

The idea was for NENET, with its expertise and international and national networks in the field of energy and environment, and Teknikens Hus, with its experience of public exhibitions and learning activities for children and adults, to combine their resources in a joint climate initiative.

Eventually, the ideas were formulated in a joint project application to the EU ALTENER programme. By then, two other partners – the National Energy Foundation (NEF) in the UK and Rhônealpiénergie-Environnement (RAEE) in France – had joined the project, which was given the name “Grasping of Climate” (in Swedish “Klimatgreppet”). Teknikens Hus assumed the role of project coordinator. In England, the project was conducted under the title “ACT” (Act on Climate Today!), while in France it went under the title “CLIMATTITUDE”.

Start-up Personnel at Teknikens Hus have regular contact with schools in the northernmost part of Sweden and are well acquaint-

ted with the situation of teachers and students. Like schools in many other regions of the EU, schools in the far north of Sweden face tight scheduling and restrictive budgeting. Often, there is neither time nor energy for overtime or labour-intensive and unconventional extracurricular activities. Therefore, it was established from the start that “Grasping of Climate” would be an inspirational project that would be based more on joy and delight in learning than on anxiety and compulsion. Quite simply, it should be fun for teachers and students to work with climate issues in school.

This attitude was reinforced during an inspirational day, which kicked off the Swedish part of the project in February 2003. On this particular day, one source of inspiration was the pianist and composer Carl Wahren, who initiated and chairs “21st Century Drama”, an organization that works to promote a holistic, cultural and interdisciplinary approach to social debate.

“Unfortunately, we’re looking for social systems in which the individual neither has to be good nor accept personal responsibility,” said Carl, who has many years of experience and has held numerous positions in organizations including the OECD, the UN and Sida (the Swedish International Development Agency).

Carl sees many similarities between the modern western way of living and the fall of the Roman Empire, and he contends that our society is suffering from what he refers to as verticalitis, a disease that is characterized by a dangerous and increasingly widespread deficiency of holistic thinking.

The inspirational day in Luleå culminated in the unanimous expression of a desire to create a project that would speak more to the heart than to the mind; a project in which information would not be confused with knowledge, and in which knowledge would not be confused with practical wisdom.

Read more about the project on page 68

Contents

Hrrmm....
Before you read any further there are a few things we would like you to know.

For starters we would like to point out that this is not a ready-made textbook that shows how teachers who want to include climate issues in their teaching should work. We have far too much respect for teachers' own competence and power of initiative to even come up with the idea of presenting pointers to you.

We are also well aware that there are many different ways to a successful teaching result. The only limits that exist are our own imagination.

Therefore we would like to emphasize that this material is first and foremost a guidebook that intends to give ideas and inspiration to teachers who are interested in tips on useful exercises, tools, facts, thoughts, exhibitions, drama, experiments etc linked to the climate issue and our current way of life. So, to you reading this we only wish to say:

This is how we did it!

Hopeful

When I think of all our possibilities and of how we can use them to reduce human impact on the climate while at the same time creating social and economic value here in Norrbotten, I feel extremely hopeful for the future.

From a speech by Norrbotten governor Per-Ola Eriksson at the official opening of the exhibition "Grasping of Climate – a sunny story" (April 2004)

Grasping of climate - a sunny story (exhibition)	6
Renewable Energy Kits (tools)	13
The Green Energy Machine (exhibition)	14
What will the world look like in 25 years from now? (exercise)	16
Susann promotes "small-drudging" (interview)	18
Werna and Surna (drama)	20
Who gives – who takes? (exercise)	24
Act like an eco-citizen (drama)	29
Everything we do matters! (exercise)	30
Becoming an energy-conscious consumer (drama)	32
Play Energingo (exercise)	33
Think the other way around (exercise)	34
Energetix (drama)	36
Car lounge 2025 (exercise)	39
Hot discussions (exercise)	39
Capture the sun's heat (exercise)	40
The house is heated with "poo-poo pellets" (pupils' work)	41
At the travel agency (drama)	42
At the youth recreation centre (drama)	44
"Children love challenges!" (interview)	46
Questions to elders (exercise)	48
Four simple experiments (exercise)	49
Exercise in statistics (exercise)	52
A weather bubble above Norrbotten (pupils' work)	53
Climattitude (exhibition)	57
Grasping of Climate (contd. project description)	68

GRASPING OF CLIMATE

- a "sunny story"

Teknikens Hus produced the exhibition "Grasping of climate - a sunny story" in close cooperation with Norrbottens Energikontor AB, NENET. The exhibition requires 250-squaremetres floor space and consists of three interconnected parts where one part composes a combined theatre and cinema.

The exhibition can be booked through Teknikens Hus. See some pictures from the exhibition with the exhibit texts on pages 6 - 12.

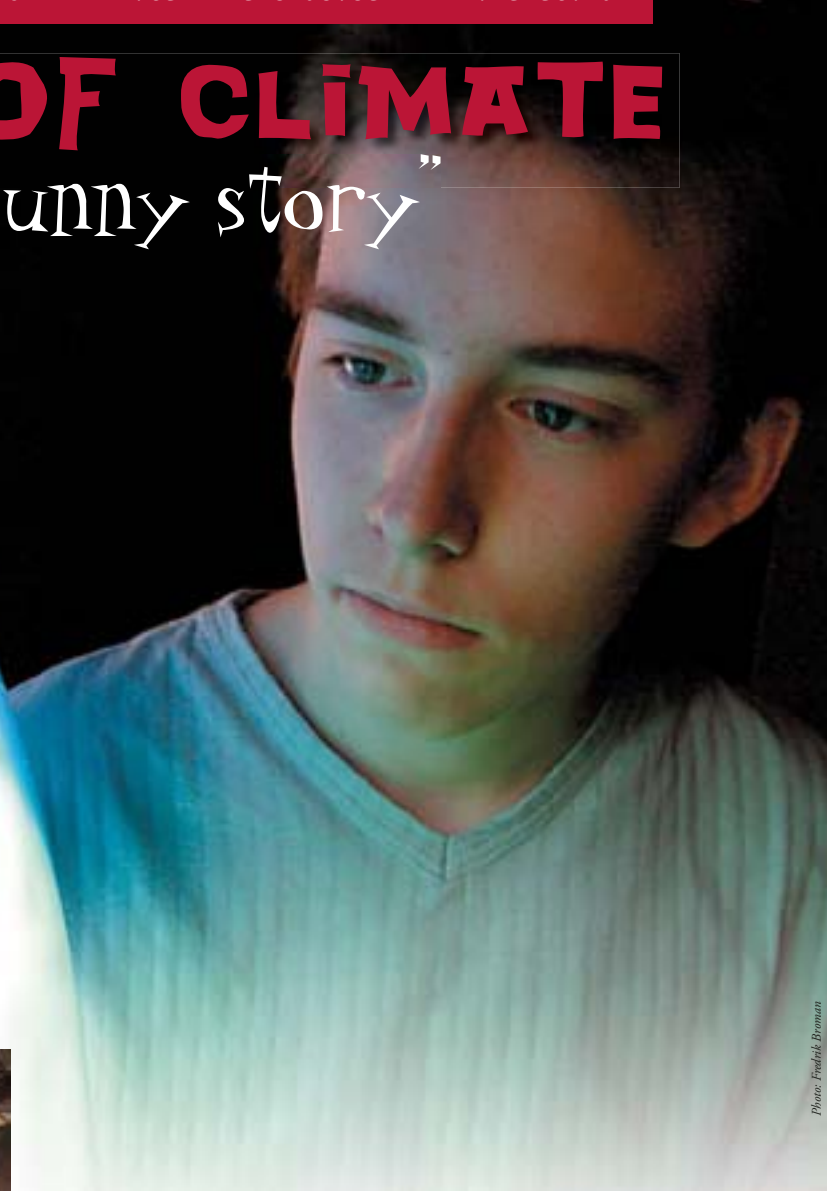


Photo: Fredrik Broman



Photo: Teknikens Hus

THE GREENHOUSE

If Earth had no atmosphere, the average temperature on the surface would be - 18° C. Brrr...

But green house gases, mainly water vapour and carbon dioxide, absorb heat radiation from the Earth's surface. Therefore, the average temperature is a comfortable + 14° C.

But the green house effect is getting stronger. When humans use fuels such as oil and coal, the concentration of green house gases in the atmosphere increases.

The average temperature on Earth is rising. By the year 2100, the average temperature is estimated to rise another 1 - 6° C.

What will the consequences of a rising temperature be? Nobody can tell for sure.

Can we afford to wait and see?



School is a greenhouse for knowledge, ideas, hope - for everything that can contribute to human progress.

The object of school's nurturing is the student; the as yet tender but incredibly vital young plant that will grow to one day take its place in the world.

All the nutrition, energy and care we give to these seedlings is beneficial, as long as we bear the individual plant's best interests in mind. Here, we cannot adopt a mass-production approach. Quality is our sole objective, and no single plant may be neglected in the process. → → → → →

THE ENERGY TRANSFORMER

Lift the weights by turning the crank. Then, let go and watch how energy is transformed.

When you turn the crank, the potential energy from your muscles is transformed into kinetic energy.

The movement of the falling weights turns kinetic energy into electrical energy via a generator. This electrical energy lights the lamp.

The electrical energy from the lamp becomes thermal energy, radiating out into the atmosphere and into space...

Energy principle: Energy can be neither created nor destroyed, it can only be transformed.



Photo: Teknikens Hus



Photo: Fredrik Boman



Photo: Fredrik Boman



Perhaps the best thing about this greenhouse is that the love and commitment invested in these young plants benefits the whole world and everyone in it - parents, grandparents, brothers and sisters, friends, strangers - even animals, plants and Nature. Everything is affected. In other words, the output exceeds the input by far more than 100%.

But if the individual is neglected in this process, the entire yield can be lost.



A WORKING LIFE CYCLE

The air tight jars in the exhibition represent models of the Earth. The jars contain everything necessary to make a natural life cycle work. All you need to add from the outside is energy from the Sun. The plants and other organisms in the jars arrange their own cycle of life.

There are expectations that man will be able to imitate the photosynthesis in the future. A large part of our need for energy could then be fulfilled. The big issue is to find a colour substance as efficient as the chlorophyll.



Take the train, the car, or the aeroplane from Luleå to Malmö. The red rods show the quantity of energy needed. Compare the different modes of transport! Here you can compare how far you get with the same amount of energy, using the train, the car or the aeroplane. Or you can go the whole way and compare the energy rods. The red rods show the energy quantity in kWh per person and per kilometer.

A NEW PERSPECTIVE ON TRANSPORTATION

How much greenhouse gas do the different modes of transportation emit?

Here is a comparison:

Mode of transportation	Carbon dioxide
Car	110
Car with catalytic convertor	110
Bus	15
Train	1
Aeroplane, domestic flight	171
Aeroplane, international flight	76

The figures show emissions in grams per person and kilometre

A few tips on how to become carbon dioxide smart:
Choose modes of transportation carefully. Carshare. Do not buy food that has been transported long distances.

Photo: Fredrik Broman



The greenhouse then becomes a storage shed - a place for the plants to be kept while life in the world outside goes on as usual; with increasing stress and materialism, with increasing pollution, with continued exploitation of people and natural resources, and with a steadfast belief that the only certain way to happiness is via ever-greater consumption. → → → → → → → → → →



Photo: Fredrik Broman

HYDRO-ELECTRIC POWER

Fill the tank with water. Crank it up and let the water flow through the turbine.

Water is stored in large reservoirs. At a hydro power station, the stored water is allowed to fall through a turbine. The turbine drives a generator which transforms the kinetic energy from the falling water into electric energy.

Hydro-electric power is renewable, but always makes a big impact on the environment



Photo: Teknikens Hus



Photo: Fredrik Broman

WHY ARE TREES A RENEWABLE FUEL?

Trees are fantastic solar panels! Energy from the sun stored in fire wood can be used for many things, building as well as for heating.

When the forest is still growing, it traps carbon dioxide through photosynthesis. Getting old and dying, the trapping of carbon dioxide decrease. The trees compost and the carbon dioxide goes back into the air again.

Trees become biofuel when we fell them for building or heating. After felling, it is important to make sure new forests will grow and continue to produce timber and trap carbon dioxide.



Photo: Teknikens Hus

BIOENERGY

Bio energy is made of living plants. Firewood, pellets made from paper industry residue and energy grass are all in this category. Pellets are mostly made from sawmill and lumber industry waste and are used most efficiently in district heating power plants, where 80 - 90 percent of the energy content is transformed into electricity and district heating.

PELLETS REPLACE OIL AND COAL

The energy concentration is high in wooden pellets.

Here you can see a working model of a pellet stove, next to the pellet press machine. These stoves are particularly useful in regions of the world where firewood is scarce and where there is a need to reduce the use of fossil fuels like oil and coal, fuels that create serious health- and environmental problems on a local level.



Photo: Teknikens Hus

A working model of a pellet stove that can replace coal-fired ovens and stoves in for example China.

ELECTRICITY DIRECTLY FROM THE SUN

The blue boards on the roof are solar panels. A solar panel can transform solar radiation into electricity. If not used directly the electricity can be stored in a battery or sold via the regular power grid. Solar panels are relatively expensive to produce, but can be used for a long time, at least 20 years.

Solar panels can be used where regular power cables cannot reach, for example in mountain areas or onboard ships.



Photo: Teknikens Hus

SOLAR PANEL HEATING

The black panels on the roof top are solar panels. They are dark in order to absorb as much heat from the sun as possible. Every year, the average family home in Norrbotten receives from the sun about five times the energy needed to heat the house.

The solar thermal panel is linked to a heat storage tank, where the solar heat can be stored. The storage can later on be connected to other heating systems, for example pellet heating. For short term heat storage in detached houses an accumulator tank is normally used. The storage connected to a biofuel system gives the home owner a convenient source of energy which can supply heat and hot water to his home during the whole summer season.



Photo: Fredrik Broman



Photo: Fredrik Broman

WINDPOWER

In a modern wind power plant, the kinetic energy from the wind is transformed via a generator into electrical energy. The towers are 50 - 80 metres high and the rotors' diameter is about the same.

Wind power is considered one of the most environmentally friendly energy sources there is, for production of electricity.



Photo: Teknikens Hus

WHAT IF...?

Locally produced

What if I...

... were to choose beverages produced locally instead of ones that have been transported a long way (more than 1500 km). Then, with every 100 litres I drink, I would reduce my carbon dioxide waste by 9 kg per year.

What if everyone in Sweden...

... were to choose beverages produced locally instead of ones that have been transported a long way (more than 1500 km). Then, with every 100 litres they drink, the Swedes would reduce their carbon dioxide waste by 80 000 kg per year.

What if everybody in the European Union...

... were to choose beverages produced locally instead of ones that have been transported a long way (more than 1500 km). Then, with every 100 litres they drink, the Europeans would reduce their carbon dioxide waste by 3,4 million tons per year.



Photo: Teknikens Hus

Visitors' promises. By placing little stones in tubes each visitor indicates which "What if...?" alternative they make a commitment to fulfil in their daily life.



Light bulbs

What if I...

... were to replace 9 regular light bulbs in my house with 9 good low energy bulbs. Then, my household would reduce its carbon dioxide emissions by 40 kg per year.

What if every household in Sweden...

... were to replace 9 regular light bulbs with 9 low energy bulbs. Then, the people of Sweden would reduce their carbon dioxide emissions by 160 000 tons per year.

What if every household in the EU...

... were to replace 9 regular light bulbs with 9 low energy bulbs. Then, the Europeans would reduce their carbon dioxide emissions by 6 million tons per year.

Standby appliances

What if I...

... were to turn off the TV, the video and the satellite receiver instead of leaving them on stand by. Then I would reduce my carbon dioxide waste by 42 kg per year.

What if every household in Sweden...

... were to turn off the TV, the video and the satellite receiver instead of leaving them on stand by when not in use. Then the Swedes would reduce their carbon dioxide waste by 168 000 tons per year.

What if everybody in the European Union...

... were to turn off the TV, the video and the satellite receiver instead of leaving them on stand by. Then Europe would reduce its waste of carbon dioxide by 6,3 million tons per year.

Meat/vegetables

What if I...

... were to replace 9,4 kg of meat, which is a fourth of my annual consumption of beef, pork or poultry with the same amount of leguminous plants (peas, beans and lentils). Then I would reduce my waste of carbon dioxide by 63 kg per year.

What if everyone in Sweden...

... were to replace 9,4 kg of meat, which is a fourth of the annual consumption per person of beef, pork or poultry with the same amount of leguminous plants (peas, beans and lentils). Then the Swedes would reduce their waste of carbon dioxide by 560 000 tons per year.

What if everybody in the European Union...

... were to replace 9,4 kg of meat, which is a fourth of the annual consumption per person of beef, pork or poultry with the same amount of leguminous plants (peas, beans and lentils). Then the people of Europe would reduce their waste of carbon dioxide by 24 million tons per year.

Bike or walk

What if I...

... were to walk or bike to the corner store (3 km) instead of going by car, once a week. Then, I would reduce my waste of carbon dioxide by 39 kg per year.

What if everyone in Sweden...

... were to walk or bike to the corner store (3 km) instead of going by car, once a week. Then, the Swedish people would reduce their waste of carbon dioxide by 230 000 tons per year.

What if everybody in the European Union...

... chose to walk or bike to the corner store (3 km) instead of going by car, once a week. Then, Europe would reduce its waste of carbon dioxide by 10 million tons per year.

What if... how were the figures calculated?

Today, Sweden emits 56 million tons of carbon dioxide emissions a year. The country has promised to reduce its emissions by 4 % by the year 2012.

The 15 first countries of the EU will reduce their waste by 8 %, which is 350 million tons of carbon dioxide, during the same period.

To come up with the numbers for the What if - texts, we performed the calculations using a population in Sweden of 8,9 million people and in the whole EU (15) of 380 million people.

In the bike example, we counted people aged from 10-59 years. In the examples about electricity, electricity from fossil fuel power plants is included. If you use BRA Miljöval electricity, (Eco choice) the carbon dioxide emission is 0.

RENEWABLE ENERGY KITS

Bring practical Renewable Energy into your classroom!

- Wind turbines, solar water heaters, and photovoltaic (PV) kits available
- Easy and fun to use - interactive experimentation
- Covers Key Stages 1-4: suitable for ages 5-16
- Includes ESD activities across the curriculum
- Durable

For further information about the tools contact The National Energy Foundation (NEF)

SOLAR WATER HEATER KIT

Experience the heating of water by the sun. Measure temperature increase with a digital thermometer (included)

Includes:

- 1.5V AA battery
- Digital thermometer (range 0-50°C)
- Aluminium solar clip fin
- Copper heating tube
- Robust insulated storage case
- Comprehensive lesson plans



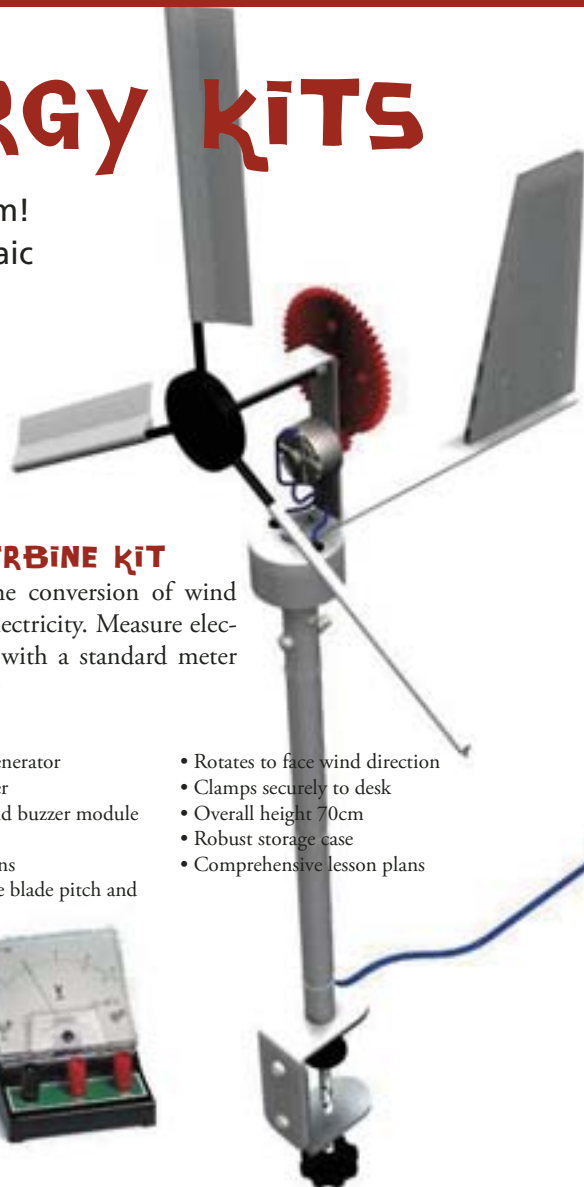
WIND TURBINE KIT

Experience the conversion of wind energy into electricity. Measure electrical output with a standard meter or data logger

Includes:

- 1.5-6V wind generator
- Bench voltmeter
- Motor, LED and buzzer module boxes
- 5 gearing options
- Variable turbine blade pitch and number

- Rotates to face wind direction
- Clamps securely to desk
- Overall height 70cm
- Robust storage case
- Comprehensive lesson plans

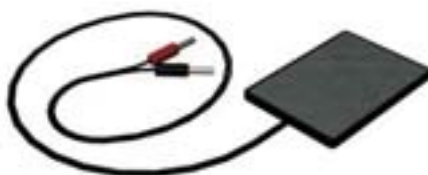


PHOTOVOLTAIC (PV) KIT

Experience electricity generation from the sun. Measure electrical output with a standard meter or data logger.

Includes:

- Motor, LED and buzzer module boxes
- High quality 3V 80mA solar panel
- Stackable 4mm leads (70cm)
- Robust storage case
- Comprehensive lesson plans



While the world today is living under the threat of an exaggerated greenhouse effect, the schools are facing the threat of weaknesses that are due to cutbacks.

Our anxiety over the impact of an exaggerated greenhouse effect has to do with something that has consequences for the entire planet, its inhabitants and environments, and the solar-driven processes and eco-cycles upon which they depend. The scale of this threat makes the situation so very serious and at the same time so very difficult for us, as individuals, to comprehend; not least since we ourselves seem to have caused the whole thing. The blame, of course, is mainly on a way of living that has been dominated for well over a century by the burning of fossil fuels.

THE GREEN ENERGY MACHINE



A mobile exhibition - The Green Energy Machine (GEM) is the National Energy Foundation's renewable energy demonstration vehicle, which is used to promote renewable energy and sustainable living at events throughout United Kingdom. GEM visits both public and school events.



Surface Display for Solar Water Heating

- in use at Kennet School in Berkshire, for their Theme Day - "Waste Not Want Not". Thermometers show how the temperature of the panel is affected by the colour and level of insulation.

The four surfaces are as follows, starting with the coolest temperature:

- White surface
- Black surface
- Black glazed surface
- Black glazed flat plate collector





The Human Powered Generator

The red pedal bicycle, demonstrates how difficult it is to generate electricity at the rate of 100W (the rate required to power a 100W light bulb). The energy generated can be used to help charge the main batteries on the green energy machine or to power a fountain.



The Carbon Game in use at a community event in Bedford

The aim of the game is to raise awareness about the impacts of individuals' daily energy consumption, particularly about the amount of CO₂ that is released into the atmosphere.

Players answer a number of questions about how much energy they use and, depending on whether this has a positive or detrimental impact on the environment, pump air into or out of a balloon that represents the earth. If too many damaging activities are carried out without being counterbalanced, the balloon will over inflate and burst.

● Crib sheet - For calculating emissions of carbon dioxide

● Rule of thumb 1

● **1 kWh electricity = 1 kg CO₂**

● If the family uses green electricity from for example wind power the emission of carbon dioxide is 0 kilogram per kWh. The emission of 1 kilogram per kWh derives from the coal- and oil-fired power plants that are connected to the Nordic and European electricity network.

● Rule of thumb 2

● **1 litre of oil = 2.5 kilogram CO₂**

● Used when calculating heating and hot water.

● Rule of thumb 3

● **1 litre of petrol/diesel = 2.5 kilogram CO₂**

● Used when calculating emissions from transportation by car.

● Rule of thumb 4

● **Reducing the indoor temperature by 1 degree Celsius = 5 % energy saving.**

● From the climate textbook "Coola ner jorden", Municipality of Växjö (www.murbrackan.nu)

Doing nothing is not an option

Ignoring climate change will be the most costly of all possible choices, for us and our children. Doing nothing is not an option. You may doubt some of the predictions and their likely impacts, but I suggest that a sensible analysis of the risks does not allow us to sit back and wait.

Quotation by Peter Ewins, Chief Executive, British Meteorological Office



It is said that the human brain is not equipped to deal with long-term threats that creep up on us a little at a time. We don't seem to be able to put two and two together and react to small but nonetheless recurring signs that something is slowly but surely going badly wrong. We are so easily distracted. Especially if it is a case of something threatening and incomprehensible that, with a little luck, might not even affect us - at least not personally or within the foreseeable future.

Maybe someone else will solve the problem for us...

So why worry?



What will the world look like in 25 years from now?

Four future visions

The only thing we with certainty can say about the future is that however we expect it to be, it will turn out differently. In the famous children's book "Alice in Wonderland", Alice expresses this in the following way: "...if we don't know where we want to go, we will surely get lost..." One thing that we can do is to choose the direction desired for our journey towards the future. Therefore it is important that we pay attention to our visions. How do we think the future will look like and how do we wish it to be?

Let us make a mind experiment and transport ourselves one generation ahead in time (approximately 25 years). In this exercise you will find four different visions of the future. They should be seen as present descriptions made by someone alive in 2025.

- Study the four visions below. Estimate whether you find them "improbable" or "probable" by indicating the appropriate number. In the same way estimate whether you find the visions of the future "desirable" or "non-desirable".
- Thereafter underline the headline of the alternative that you consider to be most likely.
- Repeat the same procedure with the alternative that you find most desirable.

1. The threats are exaggerated

The big climate threats that were described at the turn of the century did not occur, luckily enough. With the help of modern technique the carbon dioxide emitted from the coal-fired power plants could be dissolved in sea water and therefore the emissions did not increase in the same way as they did in the 20th century.

Fossil fuels could thereby become the source of energy that constituted the transition to modern technique. By means of solar energy large quantities of hydrogen are produced and transformed into electricity in fuel cells. This is how the majority of our cars are run. The fusion energy is the latest technical advance in the field of energy. Hydrogen atoms, made from water by electrolysis, are fused into heavier helium atoms and by doing so large amounts of energy are produced at every fusion.

Thanks to this technology the era of energy shortage came to a halt. Energy is no longer a scarce resource.

Improbable
1 2 3 4 5 6 Probable

Non-desirable
1 2 3 4 5 6 Desirable

2. It will have to do

By the end of the 20th century scientist warned that there was a risk that the climate would change if we did not decrease our emissions of carbon dioxide. Today, the use of

coal and oil has if anything increased rather than decreased. The countries of the world were more concerned about protecting their own interests than in saving the world. The industry was guided by short-sighted profit interests. There was a slight possibility that all the prophecies could be wrong!

The climate changes became more dramatic than the scientists had imagined. Drought, flooding and severe thunderstorms affected areas that had never before experienced extreme weather events. It affected the production of provisions. Starvation catastrophes have in the latest years affected areas that earlier were relatively well-fed. The global economy is at crisis. Large parts of the Swedish stock market are knocked out. The least you can say is that our society is rocking to its foundations. The news casts on TV are dominated by the entire crisis on earth.

Improbable
1 2 3 4 5 6 Probable

Non-desirable
1 2 3 4 5 6 Desirable

3. We in the Northern Hemisphere surely will manage

Our world is in crisis. Drought, flooding and severe thunderstorms have caused enormous damage in several countries. The reason to the catastrophes is the same as in the previous alternative - increased use of fossil fuels. Draught led to mass evacuation of people from the affected areas, something that put the international solidarity to difficult tests.

The world economy is rocking. In a global comparison we have managed relatively well. In fact the climate changes have been beneficial for us. A few degrees increase of the average temperature have resulted in a more auspicious climate for farming. The northern part of Norrland is nowadays known as Sweden's barley shed.

Improbable
1 2 3 4 5 6 Probable

Non-desirable
1 2 3 4 5 6 Desirable

4. Piece of cake

Every doomsday prophet turned out to be false. The emissions of carbon dioxide decreased significantly, more than the government demanded by the turn of the century. This was mainly because the industry considered sustainable development as a competitive advantage.

By means of energy smart technology the use of energy decreased significantly. There was a technological breakthrough for solar energy and it is still the dominating source



of energy. Oil is nowadays only a primary product for certain kinds of plastic that have not yet been replaced with polymer material from the vegetable kingdom. People are beginning to live according to their ideals. The political arena is dominated by political parties with other thoughts and visions about the future than the old ones had. With new priorities the consumption of natural resources diminished to only a fraction of what it used to be.



- Make a clarification of values exercise called Four Corners. Four Corners engages people in a semi-structured dialogue around a set of statements intended to provoke critical thinking and sharing. The problem is presented with at least three possible and realistic suggestions to a solution, and often one alternative of one's own. All four statements are positioned in each corner. Ask the pupils to go the corner which best corresponds to their opinion on the issue. You can clarify the alternatives by putting notes in the corners with names on the different solutions. A question about the fastest way to decrease the use of fossil fuels could in such an exercise be answered with the following alternatives; "Buy petrol mixed with ethanol", "Organise car pools and car-sharing", "Decrease shopping journeys to discount warehouses etc" and "Own suggestion..."
- Choose the corner which best corresponds to your choices regarding probability. Form small groups in each corner where the participants explain why they went to the corner they did.
- Request that each group selects one person to keep notes and report back on behalf of the entire group after the discussion. Discuss/dialogue with the rest of the group.
- Work in the same way with "the desirable".

Exercise from climate textbook "Coola ner jorden" (Cool down the earth), part of Murbräckan (www.murbrackan.nu), a project financed by the Swedish Environmental Protection Agency in order to reduce the emissions of carbon dioxide in the municipality of Växjö.

16 steps to a better life for all

- Carl Wahren, who initiated 21st Century Drama, asks himself what happens to the wisdom we are losing at the altar of knowledge, and to the knowledge we are losing at the information altar.
- This is his 16-point recipe for a better life on Earth for all.
 1. Start with the simple things (success breeds success).
 2. Focus on possibilities rather than problems.
 3. Seek, adapt and apply existing knowledge.
 4. Don't confuse the issue.
 5. Don't make "best" the enemy of "good".
 6. Work preferably within existing organizations and structures that have a high degree of credibility and expertise.
 7. It's better to rediscover the wheel than to reinvent it.
 8. Do not confuse information with knowledge, nor knowledge with practical wisdom.
 9. Use culture (dance, music, etc), which has an emotive influence, to communicate important messages.
 10. Consider, in every situation, the central role women play in development.
 11. Be unreservedly curious and impatient within reason.
 12. Beware of single-issue solutions.
 13. Prevent instrumental behaviour from becoming ritual.
 14. Use the practical wisdom of elders.
 15. Do not change things that work.
 16. Make work as fun as possible.

Presented during an inspirational day at Teknikens Hus in Luleå, Sweden, February 2003.

Our house is burning

Our house is burning, and we are looking elsewhere.

Quotation of The French President Jacques Chirac in Johannesburg (sept 2002)



It seems that the threats we are able to handle are immediate, concern us directly and can be dealt with by acting unequivocally, for example, by fleeing, defending ourselves or going to attack. → → → → → → →

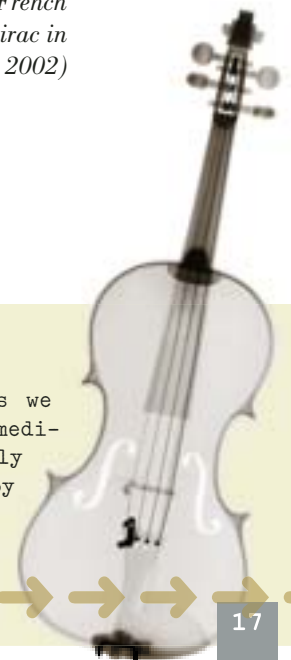




Photo: Fredrik Brannan

Technology can be defined as “everything that is between man and nature”. In other words, it is a large and complex subject with overt connections to economy, psychology and sociology.

- The technology we use today says a lot about ourselves and our values, says Susann Johansson, project leader and pedagogue at Teknikens Hus in Luleå.

Susann Johansson, Teknikens Hus

Susann promotes a “step-by-step” approach

Susann Johansson has worked at Teknikens Hus since 1993. She has been chiefly responsible for the EU-project “Grasping of Climate”. Not only has she been leader of the project she has also actively participated in the pedagogic work and several of the other activities within the Swedish part of the project.

- The climate issue is probably the most complex subject I worked with at Teknikens Hus.

She says that the experience among the staff at Teknikens Hus in building and working with pedagogic activities and educations in technology has been very useful for her. Just as the climate issue, technology is a subject with many entries to almost all subject fields and sectors of society.

- In both cases we are dealing with subjects and questions at issue that, apart from containing a certain amount of “construction” also have entries to politics, global justice, equality, our social and cultural heritage etc.

“Truths”

This means that a certain level of basic knowledge and comprehension on the part of each individual is pertinent. Otherwise it is impossible to see the questions in a larger context. And according to Susann Johansson anybody that makes a serious effort to get to know more about these issues will soon face “truths” that seem so right from one perspective, but yet so completely wrong from another.

Take for example a small and apparently simple question as whether it is right to replace high wattage bulbs with low consumption light bulbs in your household.

- If you live in a house with electric central heating, which is common in Sweden, you can take advantage of the warmth that comes from the bulbs to heat the house. At least during the cold period.

- So, in that case, perhaps changing to low consumption bulbs is not such a wise measure as in houses with other heating systems.

Frightening problems

The response from the pedagogues who have participated in the project has been very positive. Some teachers have said that they even consider focusing solely on the climate issue in their teaching since it is such an important and pressing issue. Most teachers who participated in the project have experienced that their pupils have realised the seriousness with the ongoing climate changes after participating in the workshops at Teknikens Hus. But the project has also gathered point of views directly from the pupils. According to Susann Johansson these views as a whole confirm the conclusions made by the teachers, even if the image is somewhat fragmented.

- There are also pupils who think the problems are very intimidating. They fear that the climate changes eventually can mean the end of mankind.

Others again refuse to admit the gravity of the situation. They choose – as well as many adults – to focus their interest on something else instead, like for instance what they are going to do during the weekend or which mobile phone is the coolest.

Susann Johansson thinks that the variation of the pupils reactions to a large extent reflect the level of awareness on climate issues before they came in contact with the project. The more they knew before hand, the easier it has been to accept the positive message that the problems can be solved, and that everybody can do something to be a part of that solution.

- Many pupils have contributed with their own suggestions on how we should become more energy efficient.

Small important steps

The large quantity of personal commitments made within the project by the students show that many pupils have accepted the positive message. Often these commitments have been about driving less by car, always switching off lamps when leaving a room, switching off computers and standby functions when the devices are not used or eating more locally produced foods.

Something that Susann Johansson has discovered along the way is that the big challenge for each individual is not to understand the large contexts and the complexity of the climate issue, but to realise that the little things matter and that small steps are crucial if we want to achieve a true change.

- There is simply no magnificent, grand solution that will solve the problem for us.

She thinks that it is very typical for our time, to try to find super solutions for everything.

- There is always so much focus on the awesome while the important "small steps" way is considered to be of no interest.

Our values

Susann Johansson is convinced that the large and complex problems in our world are linked to ourselves - who we are and our values. Therefore she does not believe that it will be possible to achieve permanent changes if we only focus on external conditions. True changes come from within.

- But we shouldn't be too hard on ourselves. It is better to be happy about the good things we actually do, than to grieve over all the things we don't manage to do.

- The whole project has in fact been about focusing on the important "small steps" way. We can't change everything at once, but hopefully we have made everybody that participated in the project feel that they can do something to prevent the climate changes.

→ The capacity to respond quickly to direct, obvious threats to ourselves and those dear to us has certainly been necessary for the survival of our species. The adrenalin starts flowing and we are motivated to act. In situations like that, we seem to be more willing to listen to and follow strong, determined and authoritative leaders - regardless of whether we really believe, deep down, in their message or their inner qualities.



It sometime seems as if the more daunting and difficult the problem we face, the more likely we are to accept a quick and apparently simple solution. This, too, can be a sort of defence mechanism. Perhaps it helps us to quell our fear and prevents us from losing hope.

● The Red Cross reports: Natural disasters claimed three times as many lives in 2003 as in the previous year

● In 2003, 76,806 people died as a result of famine, floods, storms and other natural disasters. The earthquake in Bam, Iran claimed more than 30,000 lives. In Europe, a summer heat wave took tens of thousands of lives.

● About 255 million people were affected by disasters in 2003. The number of weather-related disasters has increased by more than 60 percent in ten years. People in poor countries are eleven times more exposed to disaster events than are people in the rich world.

● The report was compiled by the International Red Cross and its International Red Crescent Federation.

● From Swedish Television's website (www.svt.se)
28 October 2004 (about two months before the tsunami devastated Southeast Asia, Christmas 2004)

MEET



Rachel, Eco School Committee member

What have you done to decrease your own schools impact in global warming?

"We formed a school eco-school committee and carried out an energy survey. We gave this information to the school caretaker, Mr Oxborrow. He made lots of

alterations to the heating system that saved energy and money!

We also started a cycle to school campaign and built new bike sheds to keep our bikes safe. Now there are less cars coming to and going from school."

Werna and Surna

In this drama we want the participating children to learn about greenhouse effect and the enhanced greenhouse effect, and which consequences global warming might have. The participating children should also learn how they can act to avoid contributing to the enhanced greenhouse effect.

Cast list:

One teacher playing the role of the calm and collected environmental protector Werna (*the name Werna is in Swedish a play on the word defend*).

One teacher playing the role of the unruly environmental destructor Surna (*the Swedish name denotes acidification*).

Props for play:

- A small stage with 10 – 20 seat or cushions for the spectators.
- A large, round green rug or similar.
- A beach ball representing the Earth.
- A TV with a remote control.
- An armchair.
- A bag of crisps and a soft drink.
- A skipping-rope.
- A locally cultivated apple.
- A “travel sick” apple.

An interactive drama for pupils aged from 10 to 12



A far-reaching challenge

What is now plain is that the emission of greenhouse gases, associated with industrialisation and strong economic growth from a world population that has increased sixfold in 200 years, is causing global warming at a rate that began as significant, has become alarming and is simply unsustainable in the long-term. And by long-term I do not mean centuries ahead. I mean within the lifetime of my children certainly; and possibly within my own. And by unsustainable, I do not mean a phenomenon causing problems of adjustment. I mean a challenge so far-reaching in its impact and irreversible in its destructive power, that it alters radically human existence.

Quotation by the British Prime Minister Tony Blair, September 2004



Photo: Fredrik Broman

Surna meets the children and asks them to enter the climate bungalow. The children sit down. Surna tells them that she and her cousin Werna live here, and that Werna is coming any minute. Surna also tells them that she plays with the skipping-rope every morning.

Surna: It's really good to play with the skipping-rope every day. But first of all I have a proper breakfast in order to cope with my exercise. Before I started exercise I hardly managed anything at all. But you know, since I started exercise I have a lot more energy, I'm able to do a lot these days. Have you had a proper breakfast?

It is a bit dull that I'm the only one who plays with the skipping-rope, don't you think? But I know let's all play with the skipping-rope, let's make a long skipping-rope. Have you all tried that? All right, I need someone who can help me to spin the rope (*asks if anyone would like to help her. Together they draw out an invisible rope and agree that they are holding a long skipping rope.*) All right, let's count to three and then you can jump one at a time. Very good, now you can sit down. Do you feel warm now? Good.

But you know, I exercise at the gym as well, every other day. I use my gorgeous car to get there. A black Toyota Celica, newly waxed, is there anything better than riding smoothly along in your freshly polished car?

Werna: Oh, hello, sorry I'm a little late, I went to buy some apples.

Surna: Did you go by bus, or?

Werna: No, I took a walk, it was such a nice weather..

Surna: Why didn't you borrow my car, it would have been much quicker.

Werna: You know how I feel about unnecessarily using the car.

Surna: (*turns to the audience*) We disagree a bit whether one should use the car or not. I have a gorgeous sports car that Werna can borrow if she wants. But Werna doesn't think it's environmentally friendly to use cars.

Werna: It's because of the emissions of carbon dioxide.

Surna: (*turns to the audience*). She says that it's not good to drive a car, and especially not if you are alone in the car. But do you know what, in that case I have an idea, if I'm out driving my car and I see a hitchhiker, then I can pick her

or him up. And then I want to be alone in the car anymore, right?

Werna: Well, it's better than riding alone. But you know that I'm concerned about the green house effect, we need to reduce the emissions of carbon dioxide.

Surna: Carbon dioxide, that's real good for the plants, we need that.

Werna: Yes, sure, it is necessary for the plants to grow, but it's not good if it's too much. Wait, I'll show you, come and give me a hand, Surna. (*Werna and Surna places the green, round carpet in the middle of the floor, takes the beach ball representing the Earth, and puts it in the centre.*)

Look here, Surna. This is the atmosphere that surrounds us. What do you think is in the atmosphere? (*for example nitrogen, oxygen etc*). Let me borrow your beach ball, Surna. I'll put it here in the middle of the carpet with the atmosphere surrounding it. But oh, you're really hot, Surna!

Surna: I am?

Werna: Yes, you're warm as a sun, you can be the sun's rays that hit the earth and then immediately are re-emitted into space. (*Surna does as Werna says, walks towards the earth and back again.*) If it were like this, the Earth would have an average temperature of minus 18 degrees Celsius, and no life would be possible. But if we add some carbon dioxide to the atmosphere we'll see what happens (*Werna encourages some of the pupils to play the role of carbon dioxide molecules in the atmosphere by placing them in a ring around the earth*). Now, Surna, you'll beam towards the earth again, and you will see what happens (*Werna instructs the carbon dioxides to trap the ray of sun = Surna*). You return several times towards earth before you finally are transmitted back into space. This is the normal greenhouse effect and it provides us with an average temperature of 15 degrees Celsius. But let's imagine that we drive many cars (*puts more pupils – carbon dioxide in the ring*), we use oil to heat our houses (*more pupils in the ring*). Now you see, Surna, that there's quite a lot carbon dioxide in the atmosphere. Now we need more sunrays (*the remaining pupils play rays of sun*). Now when you hit the earth, do you see what happens? It becomes difficult for the sun's rays to leave the atmosphere and then it becomes rather warm on Earth (*the carbon dioxide molecules trap the sun's rays and push them back towards the earth again*). You see, it becomes warmer and warmer and it's hard for the heat to disappear back to space again. This is the so called enhanced greenhouse effect. (*To the pupils*) Thank you, you



can sit down again. Do you understand now, Surna?

Surna: You said that it's called the greenhouse effect? We have a small greenhouse on the balcony, does that function in the same way?

Werna: Yes, almost, but imagine your greenhouse – if it was terribly warm in the greenhouse and there was hardly any water, what would happen? It would become too dry and it would be difficult for the plants to survive.

Surna: So you are saying that it's becoming warmer everywhere? (*Werna nods agreeing*) Even here in Luleå? Imagine January, the coldest period of the year when we have 25 degrees below zero and everybody is cold. Then we might have like plus 25 degrees instead. That would be wonderful! (*Surna grabs the beach ball symbolising the globe and pulls the rug towards the wall*). Now imagine a beautiful sandy beach (*points at the green rug and lays herself on it*). It's plus 25 degrees Celsius in January in Luleå, I'm on the beach with my beach ball, an ice-cold soft-drink, enjoying myself! We won't have to be cold anymore, not plod through the snow. We really ought to speed up the carbon dioxide emissions, don't you think? (*Surna totally enjoys the moment with her eyes closed*)

(*Werna has picked up a water-pistol and shows it to the audience, she has a cunning look. She sprays water on Surna.*)

Surna: Help, what are you doing?

Werna: (*laughs*). It's not sure that it gets warmer, it might as well become rainy (*sprays water on the audience*). Or even worse – it might get colder.

What happens if the ice melts here? (*points at the North and South pole*). The level of the oceans will rise which means that several cities would disappear under the water. When the snow and ice melt to water, condense is created in the atmosphere, and then what happens? Exactly – more rain. Do you see these areas that already today are very warm, what would happen if they become drier? Well, it won't be possible to grow anything there and people might have to leave their homes. So you see – the greenhouse effect is no guaranty for a warmer and better climate.

Surna: Oh, that sounds terrible. But we ordinary people can't do anything to prevent it from getting worse, can we?

Werna: Oh yes, we can become energy smart (*points at the lamps in the ceiling*). You see all these lamps, they are very useful when we are in this room. But when we leave the room, we might turn them off, don't you think? Do you see that little lamp over there? (*points at the stand-by lamp on the TV*) That means that the television is using electricity although no one is using it.

But hang on, everybody who has a television at home, raise your hand. If you have a computer, raise the other hand. Okay, and those of you with a stereo, stand over there.

And if you have them on stand-by, raise your leg. Do you see Surna, how many machines that are on stand-by function every day?

Surna: Yes, and do you know what else I discovered? It is really good exercise to stand like this, bend your knees and you'll feel it (*remains standing with bended knees*). No, wait, sit down. Werna, I don't think that anyone would like to



Photo: Fredrik Broman

be without the remote control? Imagine that it's Friday and there's a really good movie on the television. You slip down in the sofa with a bowl of crisps in one hand and the remote control in the other hand, right? Your main interest is to do as little as possible. One light push on the control and "voilà", the film begins. And when the commercials begin, you want to zap between the channels. It's absolutely wonderful! Who would not want to have it like this?

Werna: You surprise me a little, Surna. With your interest in exercise, what if you would get up to switch channel. Can't you try switching channel?

Surna: Do you mean that I should get up and switch channel instead of using the remote control?

Werna: Yeah, why don't you try it?

Surna: Okay (*sits up*). Oh, I felt that in my stomach. Already when sitting up I can feel it in my muscles.

Werna: Yes, I know. Now get up and switch channel.

Surna: All right (*she stands up*). Wow, it's incredible. Try to stand up, you can feel it in your thighs and in your backside. Okay, then I'll walk to the TV to switch channel. Well, and then I can exercise on the way between the sofa and the television (*walks with high knees*). This is super! (*walks several times between the sofa and the TV*). Then, when I don't want to watch telly anymore, I turn it off, but not with the remote control. You are incredibly smart, Werna. (*takes an apple and begins to eat it*).

Werna: Thank you, but now what are you doing?

Surna: I became so hungry that I decided to have an apple.

Werna: Oh yeah, and where do you think that apple's from? (*takes the apple from Surna*)

Surna: I think it's from Brazil.

Werna: Okay, let's take your apple from Brazil and mine from Holland. Which one of these two apples is the most energy smart? (*turns to the audience?*). That's right! The apple from Holland is the most energy smart. I prefer to buy apples from Sweden, but you don't find Swedish apples all the year around, but then you can choose apples from

countries as close as possible to Sweden.

But if we look at the globe and see where Brazil is situated, and then compare to where Holland is. The distance from Holland to Sweden is much shorter.

So in order to be energy smart, buy locally grown products.

Surna: Yes, that means for example buying crisps made of potatoes cultivated in the North of Sweden.

Werna: Absolutely.

Surna: But you can't buy eco-labelled bananas from a country close to Sweden.

Werna: No, that's true. But you can still buy eco-labelled bananas. Eco-labelling is a different issue. It concerns the way in which the products have been produced.

Surna: But now we must repeat what we have talked about.

We can help to prevent the enhanced greenhouse effect by ... How? (*turns to the audience*).

That's right, by turning of the lamps when we leave the room, by turning of the stand-by function, by buying locally produced food. Hey, Werna, maybe I should sell my car?

Werna: No, I don't think so. But you could try to use it only when you really need to. And next time you buy a car, buy an electric or bio-fuelled car. Or perhaps a fuel cell car.

Surna: Yes, and in the mean time I can use my car when we do our weekly grocery shopping.

Werna: (*Facing the audience*) I hope you are interested in continuing to work with these questions? Because in that case, I have something for you (*hands over a bag with questions linked to the climate. At Teknikens Hus, the questions related to the exhibition "Grasping the climate"*).

Now you may all go and have a look at our climate exhibition.

Surna and Werna: Thank you for coming!

Who gives - who takes?

The purpose is to give the pupils a better understanding of energy concept and principles. Furthermore the pupils are expected to understand how to use the flows of energy and transform them into electricity.



(a metal construction for candles used especially at Christmas. It consists of a round metal plate with place for four candles, above which four angels hang down from a mobile. When the candles are lightened and the warm air hits the angels, they begin to move)

HAND OUT ANGEL CHIMES with belonging candles and ask the pupils whether they can find some form of energy in them. Establish that in order to move the Angel Chimes, energy is required. That energy might for example be provided by blowing on the Angel Chimes, spinning it with your hand or lightening the candles.

Hand out matches to all the pupils (one box of matches per group).

Discuss the chemical energy stored in the candles, the matches and the striking surface of the matchbox.

The stored energy is not enough to make the Angel Chimes move. Only the pupils themselves can light the matches by using their muscular power. In that way the pupils provide kinetic energy. The energy used by the pupils to light the match and the candles comes from the food they have eaten. Food contains plenty of energy, both from the vegetable as well as from the animal kingdom. All the energy that is in the food we eat originally derives from the sun.

Once the candles have been lit the stored chemical energy is set free. And from the thermal energy created by the flame, an upward stream of warm air is made which finally sets the Angel Chimes in motion.

All the energy that is necessary for human beings to be able to live on Earth comes from the Sun. The sun is an important part of the photo synthesis, without which there would be no green plants for us human beings to eat and enjoy. The solar energy stored in the food we eat gives us, among other things, power to our muscles so that we can manage to provide the kinetic energy necessary to light a match (filled with chemical energy). When the candle is lit a flow of upward air is created by the heat from the flame. It is this flow of air that sets the Angel Chimes in motion.

Time required: Approximately one hour

Group size: Maximum 16 pupils

Introduction: Brainstorm the following question: What is energy? Write down the pupils' answers so that everyone can see them.



Examples on energy forms in this exercise:

- chemical energy
- kinetic energy
- thermal energy
- radiant energy

As long as the candles burn and energy is provided, we have thermal energy. When the candles have burned down the Angel Chimes will stop moving, but not immediately. The heat from the candles remains a short while afterwards and makes the Angel Chimes spin a couple more turns.

Turn off the light. How could anyone tell that we just had an Angel Chimes in motion in the room? Is there anything left of the energy?

The thermal energy remains in the room a while before it disappears into the air.

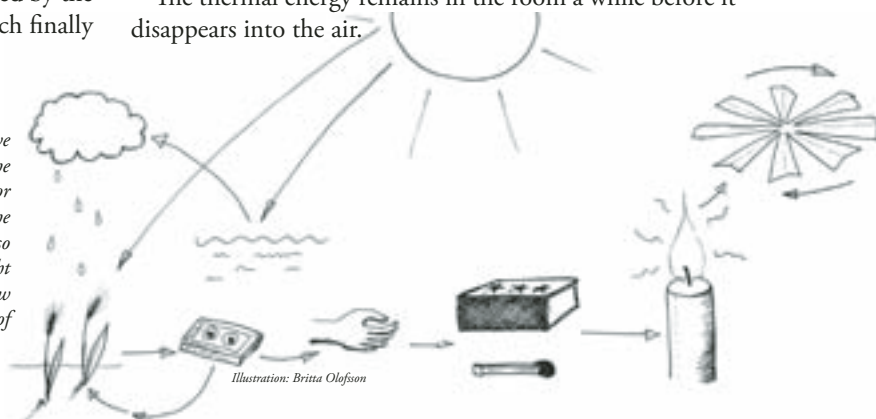


Illustration: Britta Olofsson



COLLECT IN THE ANGEL CHIMES and hand out: Mechanical toys (like “jumping frog”, “the rolling car” etc)

Let the children wind the springs that make the toys move. After the children have played with the mechanical toys, a conversation is initiated regarding which forms of energy they have managed to define in the jumping and rolling toys. Draw parallels to the Angel Chimes. Have any new forms of energy been added? Remove the “lid” from one of the mechanical toys so that the pupils can clearly see the spring that is tightened when the handle is wound.

Examples of energy forms in this exercise:

- kinetic energy
- elastic energy (in the winded spring)
- thermal energy (as soon as there is friction)
- radiant energy (if there is heat there is also radiation)

Mechanical toys can store energy and transport it to a different place. All you have to do is to “lock” the spring tight in some way, for example by taping the handle. Then you can send your energy to someone else, who only has to loosen the tape to set the stored energy free. Another energy form that is being stored is chemical energy.



→ Frightened people, people without hope, can be dangerous - both to themselves and to those around them.

Frightened people often see war and other aggressive acts as a solution to their problems. The same can be said about people living under great stress. Then, the reptilian brain is activated and empathy is lost. → → → → → → → → → →

Dynamo lamps



TURN OFF THE LIGHTS in the classroom and let the pupils play with the dynamo lamps for a while.

Examples of energy forms in this exercise:

- kinetic energy
- electrical energy (by using a generator)
- thermal energy
- radiant energy

Connect to earlier experiments. Compare different energy forms. The dynamo lamp cannot store energy. The more kinetic energy added the more electrical energy is produced. In that way it is possible to adjust the intensity of the light.

Water power

In Sweden nearly half of the electricity supply derives from waterpower. Water power does not emit any climate-impacting gases, as for instance carbon dioxide. If the people in Sweden waste electricity we must import so called dirty electricity from countries where large amounts of electrical

energy is produced in fossil fuel power stations (for example coal). These plants emit large quantities of carbon dioxide. Furthermore, the fossil energy sources like oil, fossil gas and coal will one day be exhausted.

Show the pupils the water power technology. Explain that the movement of the water makes the turbine spin. Now the pupils have tried dynamo lamps and understand that by adding some kinetic energy a lot of electric energy can be provided. The position of the water determines the amount of electrical energy that can be obtained. Draw a waterfall and describe how the water can fall from different positions. A low position gives a smaller movement that in turn only makes the turbine spin a little. But if the water falls from a higher height, the turbine gets more movement, and spins more.

Draw a waterfall with a turbine and hold the dynamo lamp to the waterfall to illustrate the generator and the electric energy that it generates. The movement in the dynamo lamp is compared to the movement in the water that flows through the turbine.

LET THE PUPILS let go of one ball to see what happens. Also let them experiment by letting go of two or three balls at the same time – or by letting go of balls from both ways at the same time. Discuss what happens.

Examples of energy forms in this exercise

- potential energy
- kinetic energy
- thermal energy

Through the movement (when withdrawing the ball) the position of the ball is altered. The higher position the ball has from the beginning, the more thermal energy can be obtained. Finally the balls stop and the energy has been transformed ...to what?

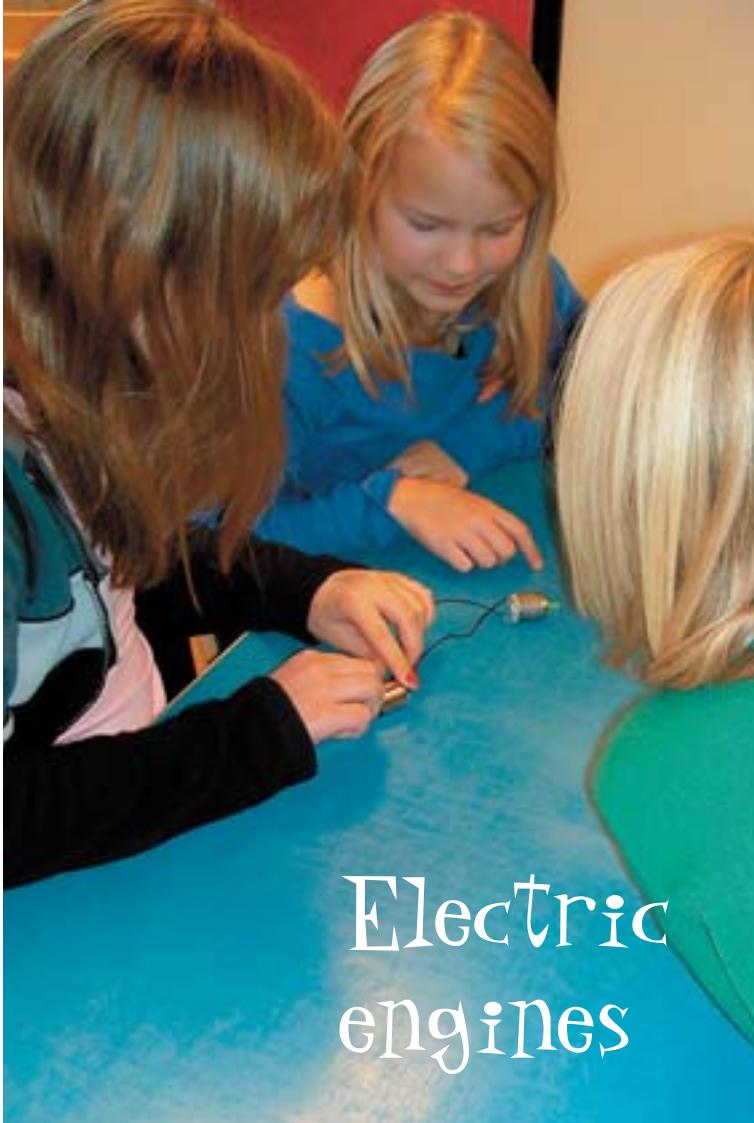
At this moment you can begin to talk about the energy principle. Energy does not disappear when we use it, it is only transformed into different forms. We cannot see the energy, but sometimes we can see when it is being transformed.



A bouncing ball can replace Newton's cradle. The same forms of energy are exemplified. The potential energy accelerates with the position of the ball (if the ball is high above the floor it will bounce more and vice versa)

Newton's cradle





Electric engines

DIVIDE THE PUPILS in groups of two. Hand out two electric engines, two batteries (4,5 volt) and two wires per group.

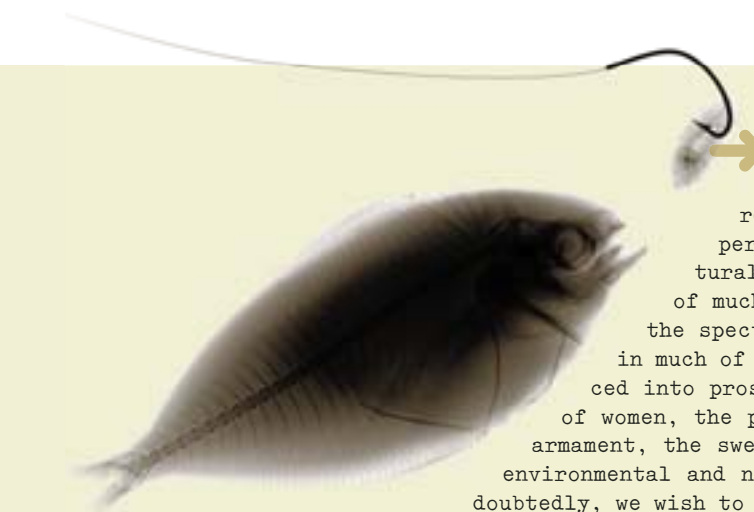
Let each pupil test his or her engine by connecting the engine to the battery. Each engine is driven by electricity. But the question is whether it is possible to get electricity from an electric engine only by spinning the axle of the engine fast enough with manual power. Let the pupils investigate!

Then let the pupils continue to work in pairs connecting two engines with each other via the wires. Let one of the pupils spin the axle of his or her engine while the other pupil carefully checks if the axle on the other engine is moving (in case it is difficult to see you might have to draw a line on the axle so that it is easier to determine whether it moves)

Then change so that everyone gets to try. Now each pair have created a generator (a transformer of kinetic energy to electric energy)

If there's time left...the teacher can explain the principles of an electric engine (for example by showing two broken engines without surrounding capsules). Inside each engine there are two permanent magnets (with constant effect). Hand out permanent magnets to the pupils. Let the pupils examine how they can make a permanent magnet move by doing a circular movement above the magnet with another permanent magnet.

In the engine there is also an electromagnet that looks like a spool. It only turns magnetic when electricity is conducted through it and then the engine begins to rotate.



But when the threat comes slowly creeping and the first clear signals begin to reach us that something wrong is happening, perhaps in another part of the world, our natural defence mechanisms no longer seem to be of much help. Unquestionably, we are appalled by the spectre of AIDS, the growing shortage of water in much of the world, the fact that children are forced into prostitution and child labour, the oppression of women, the persecution of dissidents, ongoing nuclear armament, the swelling numbers of refugees in areas hit by environmental and natural disasters, war and pestilence. Undoubtedly, we wish to do something about the situation. So, perhaps we donate money to a worthy cause. But what then? → → → → → →

Sparkler

HAND OUT SPARKLERS to the pupils. Help them light the sparklers, for example by using a burning candle. Talk about what happens.

Examples of energy forms in this exercise

- light energy
- thermal energy
- radiation energy
- chemical energy (in the sparkler as well as in the candle and the striking surface, and the match used to light the sparkler)

Repeat some energy forms that the children by now ought to recognise and discuss them.



Conclusion

Return to the initial brainstorming on “What’s energy?”

No one really knows. We can only see the energy when it is being transformed, as it cannot be destroyed or formed. All energy forms we have spoken about originate from the sun. The exception is nuclear energy where uranium atoms are split. Uranium has existed in the crust of the Earth ever since the creation and is therefore a finite and non-renewable natural resource.

→ One such gradually encroaching threat, an exaggerated greenhouse effect, is altering the global climate. The first indications were occasional observations of unusual occurrences in other parts of the world. Then, we began to receive alarming reports from scientists and environmental organizations. Eventually, a few politicians started to take notice. Perhaps this will result in international agreements on measures for combating this “evil”. These measures, however, will have a noticeable impact on our way of living.

When these alarming reports finally become so loud and frequent that they merge to form a deafening lamentation, there is a very great risk that we will switch off our senses in an effort to shield ourselves from the cacophony. Unfortunately, when that happens, it is often necessary for a truly devastating event to occur, something very close to us, before we begin to listen, see and feel again.



Act like an eco-citizen

Role play game

Concept designer: AGEDEN – Espace Info Energie de l'Isère

Educational goal: To understand 'why' and 'how' we should change our energy consumption habits.

Target audience and quantity: 4th or 5th class, primary school: children aged from 10 to 11. Average class size of 30 pupils.

How to play: The children are split into groups of 5 or 6. The activity leader gets them to select a particular theme:

Transport	at home
Electricity	in school
Heating	the city the country

They must then think as citizens or policy-makers and devise 3 or 4 actions and explain how to implement them.

During the exercise (which last about 20 minutes on average), the activity leader goes from group to group to stimulate discussion where necessary.

After that, the groups pool all their ideas and hold a vote to elect one action per theme. The chosen actions are then noted on an "Energy ambassador" certificate.

As "energy ambassadors" the children commit to act responsibly as individuals but also to share what they have learned with those around them.

This certificate is awarded to the class and will be displayed in the class room. Everyone is invited to consult it on a regular basis.

The purpose is not to draw up an exhaustive list of actions that could be implemented but rather to raise children's awareness of their role as protagonists and eco-citizens.

Duration: 1 hour

Implementation site: The classroom

Equipment required: Just the "energy ambassador" certificates

Activity leader: An activity leader or teacher. In most cases, both take part in order to stimulate group discussions.

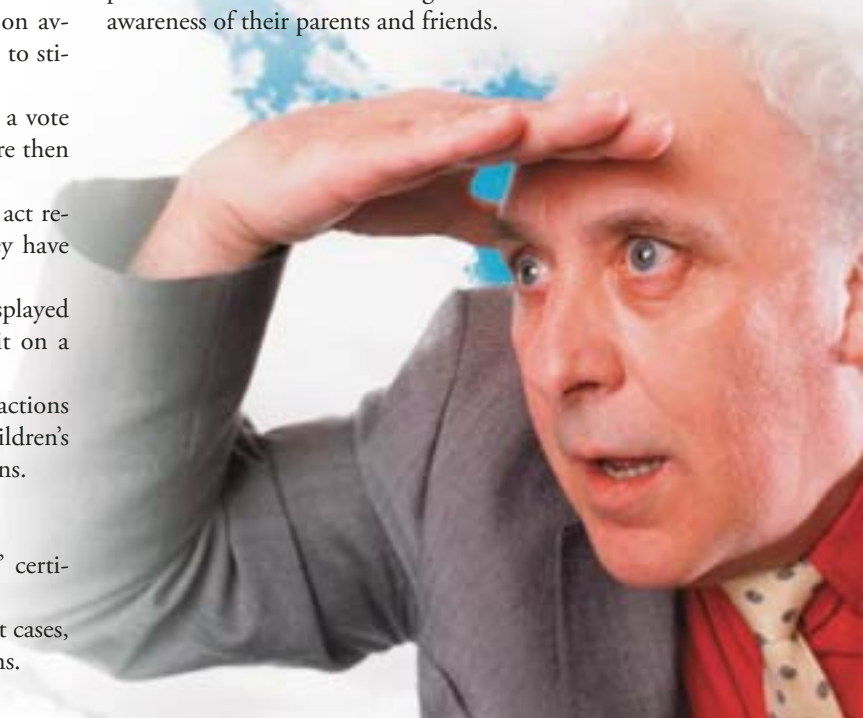
Preparation: This role play game is played at the end of an educational exercise that is conducted in two phases:

The children will first of all have followed an initial activity to introduce them to energy, how it is used, its benefits and hazards, and how it can be saved.

A second element looks at the consequences of our energy consumption (the children are given a questionnaire on the topic and are asked to complete it at home between the two other exercises).

The role play game is played at the end of the second exercise and completes the cycle. It is used to summarise what has been taught and to check how much the children have retained.

Teachers' opinion: This is the bit that children and teachers enjoy the most because it provides an opportunity for exchanges and discussions and children go away with the personal commitment to change their habits and raise the awareness of their parents and friends.



● Action on Climate Change post 2012

● The EU's Contribution to Shaping the Future Global Climate Change Regime

● The Kyoto Protocol is only a first step to address the serious global threat of climate change. Major studies, including the Intergovernmental Panel on Climate Change's Second and Third Assessment Reports, call for significant cuts in global emissions to well below 1990 levels. Only significant cuts in global emissions will allow greenhouse gas concentrations in the atmosphere to stabilise at a level that would prevent dangerous anthropogenic interference with the climate system, as required by Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC).

● The Kyoto Protocol to the UNFCCC requires the international community to initiate the discussion on the global response to climate change after the end of the Protocol's 'first commitment period' (2008 to 2012) by the end of 2005 at the latest. In anticipation of the international debate on the future of the global climate change regime, the European Council, at its meeting on 25 and 26 March 2004, announced that it will consider "medium and longer term emission reduction strategies, including targets" at its meeting in spring 2005.

● The European Council's discussion comes in recognition of a growing awareness of the threat that climate change poses to our planet and the need to find responses that are environmentally effective while preserving and enhancing Europe's competitiveness. The European Council's discussion also seeks to create a stable and predictable policy environment concerning the EU's response to climate change, providing all sectors of the European economy with clear indications of how EU policy in this area is likely to evolve. The conclusions resulting from the spring meeting will provide an important input into the international discussions on global climate change policy after the end of the Kyoto Protocol's first commitment period (2008-2012).

● From "Europa" – Gateway to the European Union (<http://europa.eu.int/>), December 2004

Everything we do matters!

It is important to try to convey the idea that everybody is important and that everything that we do matters, even little things. It can be very simple things, such as switching off the TV instead of leaving it on standby, or choosing bread from a local bakery instead of bread that has been transported a long way in lorries. Here are a number of activities that can be carried out in your own school.

SAVE AND WASTE WEEKS

Examine which things in the classroom that need electricity?

Which things need electricity at home?

Begin with a waste-week when you don't switch off lamps, computers etc in the classroom. How much energy is used? The following week is a save-week. Be careful to switch off computers and other equipment that uses electricity. Measure and compare the results from the save- and waste weeks.

Do you have any other ideas on how your class can be energy smart?

To be able to measure the amount of electricity computers or other machines use you will need a simple electricity meter. You'll find them in good DIY stores or electronic shops.

INTERVIEW SEVERAL GENERATIONS - COMPARE SOCIETY NOW AND THEN

What do you think has happened in society during the last 80 – 100 years? The pupils interview adults; parents, grandparents and other adults who can tell them about life when they were young.

Things to compare:

- Travelling
- Food
- Washing of clothes
- Material standards

Make your own questionnaire for example. Let the pupils ask various persons from different generations on how life was when they were 10 years old.

CHALLENGE EACH OTHER TO SAVE ENERGY

How much money is it possible to earn by saving energy at your school?

Contact the caretaker and the principal. Try to make an agreement where the pupils get to keep some of the money that can be saved by energy efficient measures. Perhaps the money can be used to do something nice together.

Not only should the economic profits be emphasized. The environment is also a winner when we save energy.

SURVEY WHERE THE FOODS COME FROM

Have your foods travelled a long way, or are they produced somewhere nearby where you live? What's the difference between buying locally produced food and food that has travelled a long way? Is there food that cannot be produced locally and therefore has to be transported long distances? Is it possible to replace that kind of food with a locally produced alternative?

Talk to those in charge of the school lunches. Where do the foods served in the school come from? Is there anything that could be replaced for locally produced crops? Let the pupils survey their breakfast and answer questions such as: How far has the breakfast travelled? Give suggestions on alternatives to the products that have travelled long distances.

Or let the pupils go to a grocery store and compare the distance different products of different brands have been transported.

NEWS COVERAGE ON CLIMATE ISSUES

Enter deeply in one of the subject areas involved in the climate issue, for example food distribution, transportation, greenhouse effect, wind power, atmosphere, solar energy, electricity consumption, lifestyle, hydro-electric power, cycle ways, wave power, public transport, heating or something else that you find interesting. Gather information. Make your own interviews. Make your presentation as a news programme. Consider how and to whom you want to show the news. How will the news be received? Discuss.

You can make a live presentation of your news programme to other classes in the school. Don't forget the video camera!

MAKE A NEWSPAPER, OR A BROCHURE ON CLIMATE ISSUES

Study a newspaper to find out how it is structured – head lines, introduction etc.

Make a printed matter, as you would like it to be in order to arouse commitment for the struggle against the global warming. What is it that can get us to act? Intimidation, encouragement or both?



MAKE A YOUNG CLIMATE PROMISE!

It might for example be about:

- Replace nine high wattage bulbs with low consumption light bulbs. That avoids 250 kg CO₂.
- Switch off the computer instead of leaving it on standby. 12 hours every day for one year means avoiding 7 kg CO₂.
- Switch off TV, video and parabolic aerial instead of leaving them on standby. Avoid 35 kg CO₂ per year.
- Travel by train on domestic journeys. By replacing 2 hours journey by aeroplane with train, you will avoid 200 kg CO₂ per year.
- Shorten your daily shower with 5 minutes and you will avoid 68 kg CO₂ in one year.
- Exchange 1 kg of rice for the equivalent proportion of potatoes per year and avoid 6 kg CO₂. To the average Swede 1 kg of rice corresponds to one quarter of the total consumption in one year.
- Exchange 4.5 kg imported apples for the same amount of Swedish apples per year and avoid 1 kg CO₂. To the average Swede 4.5 kg of apples correspond to half of the total consumption of imported apples in one year.
- Exchange 9.4 kg of meat (beef, pork and poultry) for the equivalent amount of leguminous plants (beans, peas and lentils). The average Swede would avoid 63 kg CO₂ per year. The average Swede eats a mixture of meat that mainly consists of beef (29%), pork (40%) and poultry (31%). The amount 9.4 kg corresponds to one quarter of the total consumption in one year of beef, pork and poultry.

Source: Swedish Society for Nature Conservation, <http://skaru.snf.se/klimatloftet/> (November 2004)

ON YOUR BIKE ACROSS THE WORLD

Walk or go by bike to school instead of going by car with your parents. How many kilometres do you walk/cycle in one day? How many kilometres do your entire class walk/cycle in one day? How much carbon dioxide have you avoided by not going by car to school? Use a map to see how far you will come in one week when you count the distance walked or cycled to and from the school. Find out more about the places you "visit" on your journey.

Climate Change

Climate change is one of the greatest environmental, social and economic threats facing the planet.

During the last century, the Earth's average surface temperature rose by around 0.6°C. Evidence is getting stronger that most of the global warming that has occurred over the last 50 years is attributable to human activities. In its Third Assessment Report, published in 2001, the Intergovernmental Panel on Climate Change (IPCC) projects that global average surface temperatures will rise by a further 1.4 to 5.8°C by the end of this century. This global temperature increase is likely to trigger serious consequences for humanity and other life forms alike, including a rise in sea levels of an estimated 9 to 88 centimeter by the end of this century, which will endanger coastal areas and small islands, and a greater frequency and severity of extreme weather events.

Human activities that contribute to climate change include in particular the burning of fossil fuels and deforestation, both of which cause emissions of carbon dioxide (CO₂), the main gas responsible for climate change, as well as other "greenhouse" gases. In order to bring climate change to a halt, global greenhouse gas emissions must be reduced significantly.

The European Union (EU) is at the forefront of international efforts to combat climate change and has played a key role in the development of the two major treaties addressing the issue, the United Nations Framework Convention on Climate Change and its Kyoto Protocol.

The EU is also taking serious steps to address its own greenhouse gas emissions. In March 2000 the Commission launched the European Climate Change Programme (ECCP). The ECCP led to the adoption of a range of new policies and measures, among which the EU's emissions trading scheme, which will start its operation on 1 January 2005, will play a key role. As a result of the EU's and individual Member States actions, the latest monitoring data indicates that the European Union has delivered on its long-standing commitment to stabilise emissions of CO₂ at the level of 1990 in the year 2000. The EU-15 is committed to deliver the collective 8 percent cut in emissions by 2008-2012 to which it signed up under the Kyoto Protocol. Equally the New Member States are determined to meet their individual targets under the Kyoto Protocol.

The Kyoto Protocol is only a first step to address the serious threat of climate change. Further action must be taken after 2012, the end of the Kyoto Protocol's 'first commitment period'. In order to prepare for the EU's input in the further development of the global climate change regime 'post 2012', the Commission has started a stakeholder dialogue, inviting stakeholder participation in preparing the EU's contribution to the shaping the future global climate change regime.

From "Europa" – Gateway to the European Union (<http://europa.eu.int/>, December 2004)

MEET

Ingela Jonsson, teacher in natural sciences and home economics, Pitholmsskolan, Piteå

What have you done to decrease your school's impact on climate change?

"We have encouraged everybody to turn off the lights when leaving a classroom. In home economics we make compost which we use when cultivating our own vegetables. That provides us with nutritious food that isn't "travelsick"."

What have you done to decrease your own impact on climate change?

"Little things like turning off the lights and only use the car when it's really necessary. I try to buy locally produced foods and I also grow some myself. We are planning to exchange our oil-fired boiler and instead use wood to complement the electricity for heating."

Which are the best measures to decrease the human impact on climate change?

"Reduce the car journeys. It is much better to go by bike or travel by public transport. And we need more cars run on alternative fuels at a competitive price."



Becoming an energy-conscious consumer

Role play game

Concept designer: Energies Environnement 74 – Espace Info Energie de Haute-Savoie

Educational goal: Learn to make consumption choices in favour of sustainable development

Target audience: 12-15 year olds. Group of 20 people.

How to play: The game works well with a small group of 5 to 6 people. The scene is a supermarket aisle.

An activity leader hands a mission card to each of two players. One is a customer and the other the shopkeeper. Each mission card bears an instruction. The mission cards deal with: energy stickers, water saving appliances, lighting and petrol heaters.

The rest of the group observes the exchanges between the buyer and the shopkeeper. When the actors have finished their exchange the game stops and the players, activity leader and audience engage in a discussion, with the activity leader taking the opportunity to explain why it is important to better consume to preserve the planet.

Duration: 10 minutes for each “role play” followed by 10 minutes of discussion (or more where necessary).

Implementation site: Indoors or outside, depending on the situation.

Equipment required: Supermarket décor: either the activity leader could wear the uniform of a supermarket worker, or perhaps the décor could feature stacks of packages for household appliances, etc.

Petrol heaters, energy-saving light bulbs, enlarged energy-saving stickers, water-saving shower heads, etc.

Activity leader: An activity leader or teacher is required.

Preparation: Just the time required to inform the activity leader of his or her mission.

Opinion: The game has been designed to appeal on young teenagers and encourage them to apply their critical faculties to modes of consumption and their impact on the planet.

WATER

Shopkeeper’s mission card

You have to sell water-saving appliances ...

Sales considerations

Firstly, advise the buyer and raise his or her awareness:

Remember to check watertight seals to ensure they are in order; take showers rather than baths! Do not leave the water running while brushing your teeth,, etc.

Then try to make the sale:

- The double-flow flushing system (small and big flow)
- filter on tap head (divide water consumption by 2)
- Shower stop (stops water flow – and keeps the water hot – while you are applying soap)

Customer mission card

You have just received a high water bill and want to get advice on how to save water ...

THE ENERGY STICKERS AND HOW TO CHOOSE A HOUSEHOLD ELECTRICAL APPLIANCE:

Shopkeeper’s mission card

You have to sell a class A washing machine...

Sales considerations

Look at the energy sticker:

- This shows how much electricity the appliance consumes: (Green – low consumption red – high consumption)
- This shows how much water the appliance consumes
- Their purchase price is higher, but these appliances cut electricity bills
- Class A uses three times less electricity than class F

Customer mission card

You want to buy an inexpensive washing machine

LIGHTING

Shopkeeper’s mission card

You have to sell an energy-saving light bulb...

Sales considerations

- Its uses 5 times less energy than an ordinary bulb
- It lasts 8 times longer
- It does not heat up
- They should only be fitted in rooms that are lit for a long time
- They are quite costly (50 F)

Customer mission card

You want to buy an ordinary light bulb ...

KEROSENE HEATERS (PETROL HEATERS)

Shopkeeper’s mission card

You have to convince the buyer that using a kerosene heater is not a good way to heat...

Sales considerations

- It is just as expensive as electrical heating
- It can only be used to heat up one room for a few hours
- It’s not good for your health (because it emits carbon dioxide)
- It damages the room (because it emits humidity)
- It would be better to buy an electric oil-filled radiator on wheels

Customer mission card

You live in an old home with old electrical radiators that do not give out much heat.

You want to buy a kerosene heater to replace these radiators because you think that would be more economic and more comfortable ...

Think the other way around

Workshop on climate

Target group: pupils aged from 13 to 15 and from 16 to 18.

Educational goal: The participants will get facts about the climate problems and time to work on these facts in discussions. The idea is also to give them a positive experience.

Values clarification

In this exercise the students express their opinion by placing themselves in different areas in the room marked with yes, no or don't know. Examples of questions:

1. I would like to win a million pounds (test question)
2. The environmental threats are considerably exaggerated?
3. The world will improve?
4. I want to eat good and healthy food?
5. Carbon dioxide is good?
6. I am affected by climate changes?

The purpose with this exercise is that the participants should think for themselves, take a personal position and clarify where they stand on specific environmental and social issues. It will also give them an opportunity to listen to the opinions of their school mates and thereby get a better understanding that there is not always a simple, correct answer and that everybody is free to have their opinions. In value clarification exercises it is very important that everybody is allowed to express their opinion and everybody should have the opportunity to change positions if they alter their mind on something.

Four corners

The effects of the climate changes are getting worse and worse, according to the scientists. We must change our way of life, they say. Which is your role in this complex problem? Establish four alternative answers, one in each corner of the room and let the pupils choose corner. First ask them to discuss in each corner-group what made them choose that specific corner, and then tell the rest of the group why they chose that answer. Examples on four different alternative answers:

1. I can't affect what's happening
2. I don't care what's happening.
3. I want to be active and prevent the negative development.
4. Open corner (where the pupils can give other answers)

See also Four corner-exercise page 17.

This is how the natural greenhouse effect is enhanced

Material: A beach ball representing the globe.

The teacher (pedagogue) explains and discusses the natural and the enhanced greenhouse effect.

1. The natural greenhouse effect

Some pupils symbolize the carbon dioxide molecules in

the atmosphere, which surround the globe like a ring. The teacher represents the sun's radiation and shows how the rays easily reach the earth. But it is not as easily for them to go back out in space again, because the carbon dioxide does not let the rays back out immediately. The heat from the radiation stays a little longer in the atmosphere, something that we should be very grateful for. Without the natural greenhouse effect life would not be possible on Earth and the average temperature would be -18 degrees Celsius.

2. The enhanced greenhouse effect

Now some more pupils take place in the ring surrounding the "globe". The addition of pupils symbolizes the carbon dioxide generated from the combustion of fossil fuels.

First some pupils are added and they represent the carbon dioxide molecules derived from the oil, coal and fossil gas used to heat our houses. Then some more pupils are added symbolizing the fossil fuels used to produce electricity in large and environmentally damaging power plants. And finally further pupils are added to symbolize the oil used to produce gasoline and other fossil fuels for our cars and aeroplanes.

The teacher now asks some pupils to represent the radiation from the sun. Just as before, it is easy for this radiation to reach the Earth, but then it stays very long time in the atmosphere because of all the carbon dioxide there. All the huffing and buffing that arise when the radiation tries to get past the carbon dioxide and back out in space, additionally raises the temperature among the "actors". This heating symbolizes the enhanced greenhouse effect which causes the temperature on earth to increase. And it will continue to increase – unless we do something to stop the course of events.

See also the drama "Werna and Surna", page 20 – 23.

What can we do?

What can we do to reduce our negative impact on the climate?

Really there are only two ways to go: to save energy (and natural resources) and use only renewable sources of energy.

Discuss the difference between renewable and non-renewable energy. Review how we can be more energy smart by:

1. Switch off lamps.
2. Turn off the standby function (Check if the pupils have computers, television, stereo etc at home and if these are on standby when not used).
3. Eat locally produced foods. Compare for instance a travel-sick apple that has been transported from the other side of the globe with an apple that is

produced within the country, or in a neighbouring country. Why might it be desirable to use locally produced foods? Discuss.

What is renewable energy?

Exemplify – discuss. Renewable energy sources are re-created in the same pace as they are used. What energy sources meet these demands? Which does not?

Think the other way around

The purpose of the exercise is to enable pupils to think ahead (with a strong individual connection).

Step 1. Begin in small groups (three pupils in each group) and ask them to describe what a really bad life would be like. They get three sheets of paper to write down their thoughts. Each group only presents two of the sheets to the others. The group explains their thoughts to the others and pin their sheets on the wall (preferably at the back end of the room). When all groups are finished the teacher (pedagogue) asks: Is this how we want it to be? No! If any of the pupils answer yes, confront him or her and start a discussion to clarify what the pupil really means. The other pupils will surely also take part in the discussion. And those who answered yes usually admit that they do not want it like that.

Then everybody should turn their backs on how they don't want it to be and focus on how we would like it to be instead.

Step 2. The same method is used again, with the same group size. The groups are to discuss what the good life means to them. The presentations are performed in the same way, which usually give rise to good discussions. Symbolically it is important to turn the backs on what you do not want to have and instead pin the new notes on the opposite wall (preferably far ahead in the room).

Step 3. Conclusion. The result of the work is a good starting point to formulate a vision for the future. A vision is always POSITIVE and DESIRABLE, and should not contain horror scenarios.

The exercise could end with following question: Who is responsible to ensure that everybody's lives becomes as good as possible?

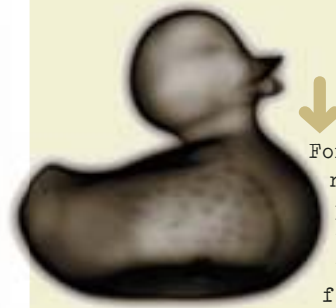
When the group has twisted and turned the question for a while they will eventually reach the individual level and the pupils usually discover that it is not enough to say that the politicians, the large companies, the UN or something similar outside themselves are responsible – but that it eventually comes down to the choices I make on a day-to-day basis in my life.

Connect

In case the earlier discussions have not already involved the connection between the good life we wish for everybody to have and the existing climate change, and our use of energy, it is time to do that now. Discuss and share ideas.

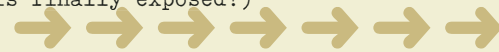
Repeat four corners

Repeat four corners on the enhanced greenhouse effect. Has anyone changed corners? If that is so- discuss the reason for them doing that.



For our self-esteem, nothing is more important than feeling that we are important and that we are fine just as we are.

As soon as that feeling is missing, we risk falling victim to the siren songs of commercialism and other strong forces telling us that money can buy self-esteem or that it can be gained by “being seen in the right places”. (How many people will have to be sacrificed at the altar of fame before the myth of the good life in the limelight is finally exposed?)



• A more contented lifestyle

- A more contented, “material-efficient” lifestyle among the affluent and high-consumption middle and upper classes
- of both industrialized and developing countries would facilitate an economic and social equalization, and thereby
- promote the necessary “downward” movement towards radically reduced emissions of climate-impacting gases.



From Stefan Edman's book *The Earth has a Fever – Can we Stop Climate Change?* (2003).

MEET



Neil Morgan
Saxmundham
Middle School, Suffolk

What have you done to decrease your schools impact in global warming?

“We involved all the staff and pupils in a whole school audit of our environmental impact as part of our work towards the Eco School Green flag award that we were awarded last year. We now have a pa-

per recycling bank, cartridge recycling and other schemes to reduce consumption and waste and to reuse and recycle. Our Big Green House Project also teaches the need for local food production and supply. We have been particularly careful to reduce energy consumption.”

What have you done to decrease your own impact on global warming?

“Personally I like to re-use materials and use second-hand materials wherever I can and try to reduce energy usage at home. I also now live much closer to the school where I work and share transport - saves a lot of money and energy resources.”

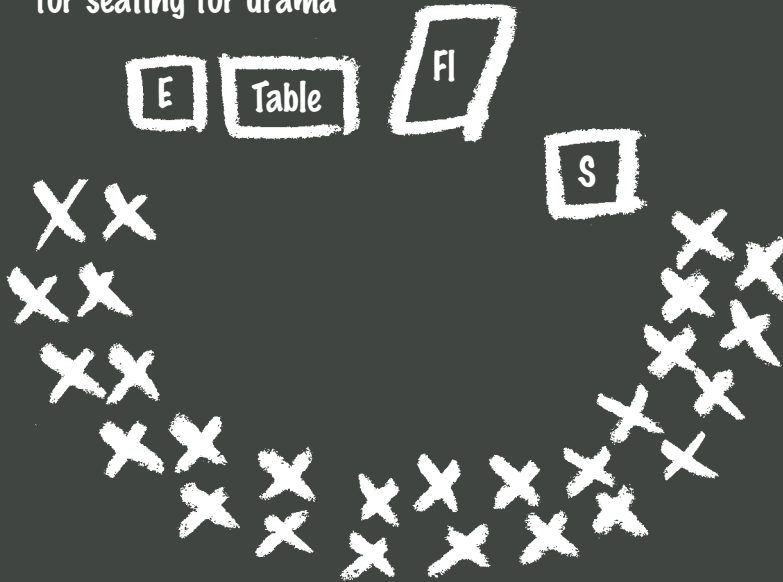
Which are the best measures to decrease the human impact on global warming?

“The key to reducing global warming is to reduce consumption. We need to consider if never ending economic growth is sustainable - I very much doubt if it is.”

ENERGETIX

A energy and renewable energy drama

Possible arrangements for seating for drama



On table: E – Professor Energy
S – Professor Solar
Fl – Flipchart and Flipchart pens (optional)

Characters:

Professor Energy, the energy expert
Professor Solar, the renewable energy expert

Props for play:

Lab coats
Carbon dioxide blanket
Globe
Sun picture
Sun streamers – sunbeams/light energy/photons
“Electricity” – 2 lightning bolts for children to hold
Wind picture
Water streamers
Picture for climate change eg icebergs breaking up (optional)
Energy Saving light bulb
No Cost Energy Saving tips (optional)
Goggles and flippers (if a child needs to swim for his life
– global warming sea level rising scenario)

SCENE 1 - introduction to the world's energy problem

Prof S (*introduces herself*): Hello! I'm Professor Solar, and know lots about all types of clean and renewable energy sources, that's nothing to do with tomato ketchup you understand, a source here means something that we can get energy from, such as the sunANDwhen we say RE-NEW-ABLE (*emphasises word*) we mean something that never runs out – like the sun you know..

Oh dear, ----- I'm expecting a visitor today. He's – an expert on coal and other things that have to be dug out from mines and deep holes under the ground – and he's late – again. He's the worrying type, you know – worry, worry, worry. Well you can understand why – coal will run out one day. It's not going to last for ever.

(*Prof E enters looking flustered and dishevelled.*)

Professor Energy: Why hello there. Sorry I'm a bit late. It took a long time to get here

Prof Solar: You're looking very dirty. Where have you been? We ought to have a big think about the problems with all those dirty energy sources that you're always messing around with.

Professor Energy: Well I can't help that!! You'd look grubby if you'd spent all day down a dusty coal mine. Well what with getting up to the surface from the coal pit, and then cleaning up.

(OPTION FOR OLDER JUNIOR CHILDREN with experience of imaginative drama – and who have already researched RENEWABLE and NON RENEWABLE ENERGY – Children act in role of an expert)

Prof Solar: (*addresses audience*) Well a lot of you good people look very knowledgeable – Do we have a couple of people who think they could be energy experts – for clean renewable energy OR for dirty energy that's not renewable ---- we call it NON RE – NEW – ABLE ENERGY.

Do we have 2 (or more) experts to help us??

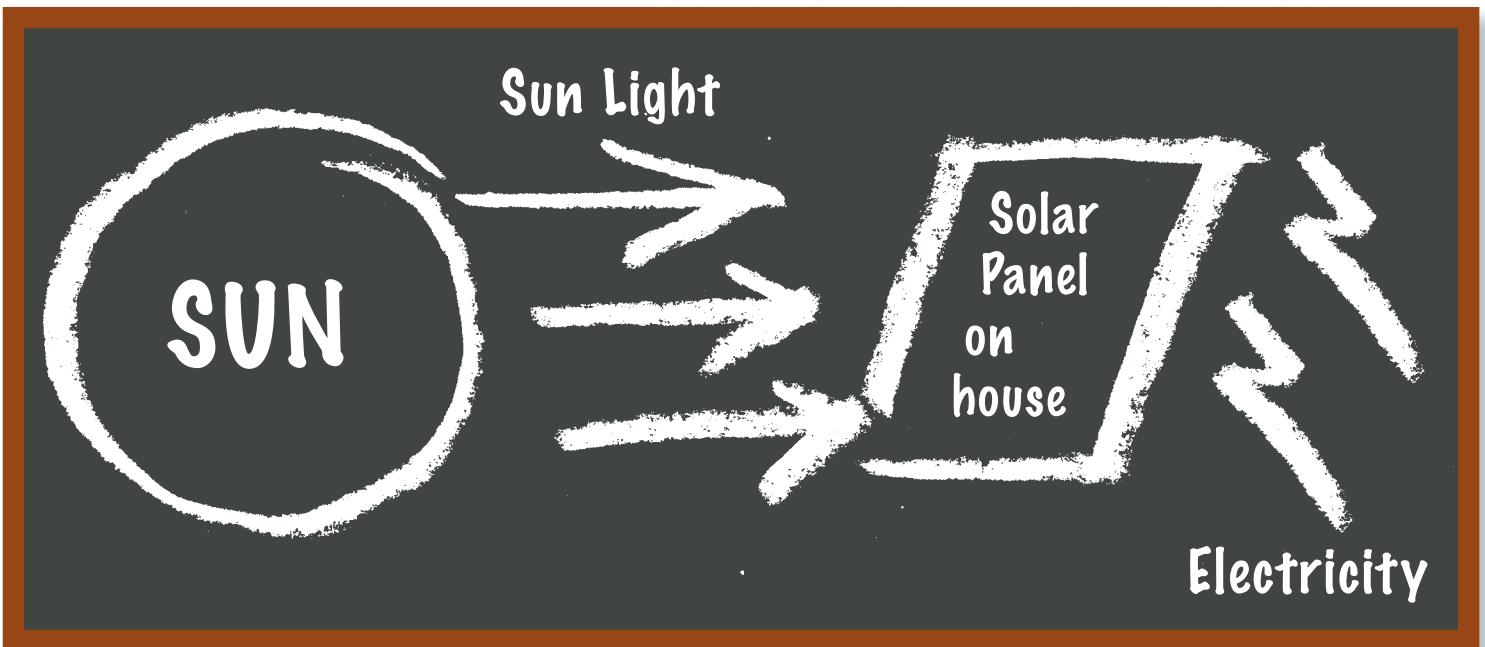
(*Invite participants ...Have an argument with a non-renewable energy supporters group assisted by Professor Energy talking with a renewable energy supporters group assisted by Professor Solar*)

Prof S: SO (*addressing pupil assistants*) Can you help us all to understand where all our energy, the electricity we use at home and at school, comes from! . . . Where does it all come from?

WHERE'S IT MADE? (Use box/bin of flash cards/pictures – possibly have a “washing line” and pegs for the children to peg up the order of what happens ie: [COAL, OIL, GAS, FOSSIL FUELS ----- POWER STATION (CHILDREN COULD BE THE POWER STATION. ----- POLLUTION, CARBON DIOXIDE/ CO₂])

Prof E: (*walks to front of group with a very worried expression on his face*) Oh dear, oh dear what are we going to do. People keep on telling us about what is happening to our world! There's a big problem with GLOBAL WARMING. What can we do?

Prof S: I'm not really worried! (*Still looks worried, scratches head.*) So what can we do? We're told that that the earth's getting too warm, so the oceans are warmer and the climate is changing? So what can we do?



(EXAMPLE OF CHANT OR RAP – children could make a different one for their own drama!)

(All: (chanting.....) (emphasise words in bold)

Yes! What **can** we do to find more energy! It **mustn't** be dirty!
It must be **clean!** It **must be green!**)

SCENE 2 - so what's global warming?

Prof E: (Sticks power station picture on fuzzy board. Gets 2 people from audience to assist with holding up – (Prof)- COAL, OIL and GAS labels, and 2 CO₂ blanket (flimsy light material) holders) to be ready to hold a blanket of carbon dioxide over the earth, and 1 globe holder to hold the globe - with maybe a sad face stuck on it.) We call this gas, carbon dioxide, CO₂ for short. CO₂ rises up (waves hands in upward floating motion above power station picture) out of the chimneys at the power stations when we burn (points to children who hold up labels in turn.) – COAL, OIL, and GAS!

Prof S: (-encourages the CO₂ people to float their CO₂ blanket over the earth. She encourages Globe person to fan himself vigorously and look very unhappy!) So you see, the blanket of Carbon Dioxide traps in the Sun's heat a little bit. Not all of the heat that gets through to the earth can escape so easily!! This is called The Increased Greenhouse Effect, and it can increase the amount of global warming!

Prof E: Now let's see if we can slow this down a bit by SAVING SOME ENERGY other wise the earth'll get too warm AND there'll be no coal, oil and gas left at all!!

SCENE 3 - let's save it! (No cost energy saving tips!)

Prof S: (Puts HOUSE PICTURE on fuzzy board – or a child can draw a house.) Right then, Professor Energy is the Energy Saving person but she(he) might need another expert!

We need 2 people. (Prof S prepares to choose 3 people.) Let's have you to hold this (energy saving light bulb) when Professor Energy says, and you TWO to read out some important TIPS in a loud voice.

Prof E: Right I've got the Energy Saving Tips here and these won't cost you anything!! (Prof E sticks the Energy Saving Tips to the fuzzy board and helps everyone to read them out carefully and loudly whilst pointing at the words with a stick!)

(Prof Solar points to the house on the fuzzy board/flipchart and its "roof" with her pointer as appropriate!!)

(The above is a starter idea only. The No Cost Energy Saving Tips can be used by teachers as a resource for drama ideas – in groups or as a class production) Use a QUIZ at the end to reinforce the message – if time allows! – The children could make up their own to ask the audience.)

SCENE 4 - solar

Professor Solar places SUN picture on the fuzzy board, and SOLAR ENERGY label.

(Prof ENERGY (encourages 1 person to hold the SUN and 2 people to hold a solar panel saying – you're the house with a solar panel on the roof)- and 1 person to hold the lightning bolts saying –)

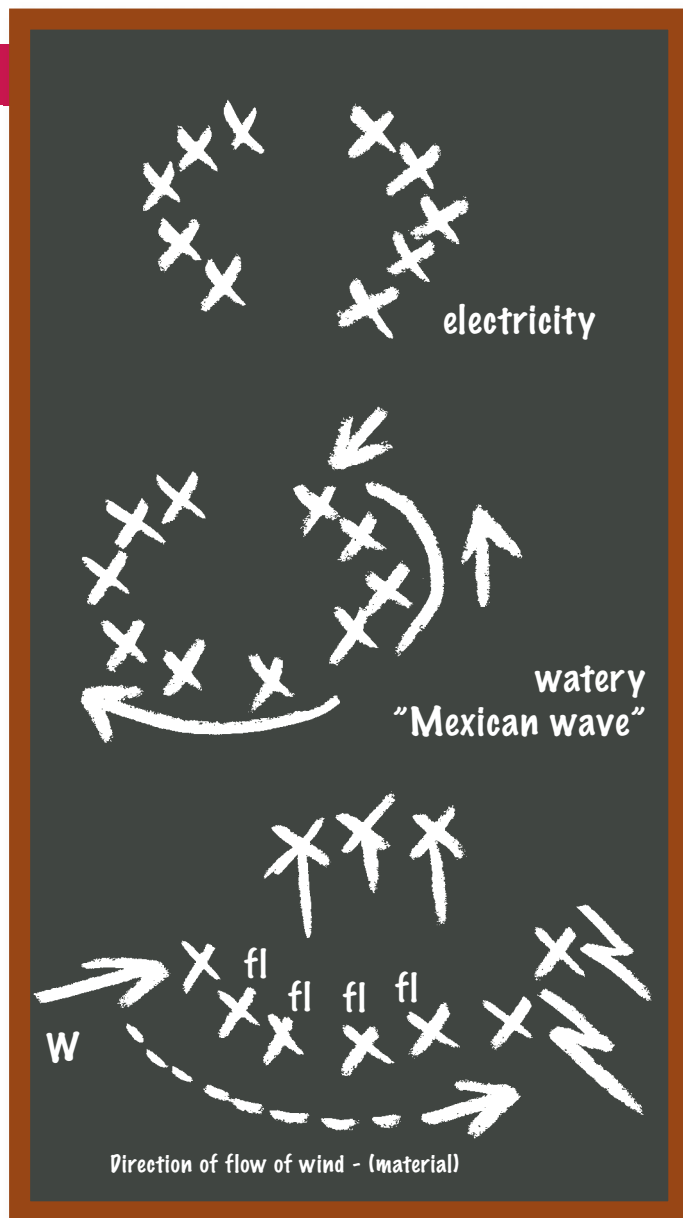
Prof S: (quietly, to chosen people) This stands for the electricity that's made. You have to jig about energetically when the sunlight reaches the panel!! (2 people are given the LIGHT STREAMERS and told to dance between the SUN and the SOLAR POWERED HOUSE.)

Prof S: (dramatically, waving arms about....) So..... the sunlight shines brightly from the SUN to the solar panel on the house roof, as soon as the LIGHT gets to the..... SOLAR PANEL..thenELECTRICITY is made!!

HOORAY! This is so exciting!!

AND did you know this amazing fact?.....that the sun is where all our energy comes from – so let's use it, it's free energy!





SCENE 5 - falling water = energy

(Prof Energy instructs audience to sit in a circle on the floor/grass.)

(Professor Solar puts hydro power/waterfall/wave pictures on the fuzzy board.)

Prof S: (dramatically..... as ever!) - Now you see that falling water has tremendous power (gestures frantically with hands) and we can use this energy to make electricity. Let's see if we can demonstrate this.....

(Professor Energy gives out water streamers.)

(Professor Solar instructs falling water half of audience to stand up and be ready to perform falling water movements with splashy-splashy noises. - following which the electricity half of the audience will perform a sparky-bouncy dance!!!)

Prof S: Brilliant! (claps hands excitedly) This is just what happens at a hydro-electric power station high up in the hills in Wales and Scotland.

Now let's look at what happens at the seaside. The waves are full of energy (demonstrates with arms) Let's see if we can make some wave power happen!!

Prof S: Now we can have fun with a watery Mexican wave!! When I point to this person (identifies one person in circle) stand up and sit down and wave your water streamer. The first time - slowly, next, a bit quicker, and the last very energetically.

SCENE 6 - our windy islands!

Prof S: We're nearly at the end of our important work, looking for new and RENEWABLE energy to use in the future to help

sort out the world's energy problems RENEWABLE means it will never run out like coal and oil and gas, and can be used over and over again.

Prof S: Now, let's make a wind farm!! We can use the power of the wind to make electricity too! (Chooses 3 people to be wind turbines.)

(Prof Energy puts wind turbine pic on fuzzy board. Prof E chooses a person (W) to hold the windy face picture on a stick., also a person to hold the electricity (lightning bolt) that's being made.)

(Professor Solar encourages the remaining people in the group (fl) stand and hold the light floaty material which she encourages them to waft in anticlockwise direction to simulate the wind. As the wind blows the wind turbines turn round windmilling their arms, then the electricity is made - sparky bouncing!!!)

Professor Solar and Professor Energy (together, looking immensely pleased and smiling broadly): Fantastic!

Conclusion:

Prof S: Now do you see what amazing magic we've managed to work for our world! Our planet is happy again!!

Prof E: Well done everyone! Now we must make sure that we tell everyone about saving energy and using clean, green and renewable energy!!

Let's give ourselves a clap for all this hard thinking we've been doing.

Many elements of this core drama for primary age children can be adapted as required. The ideas above can be used as a starter, for further dramas eg modelling ideas dramatically, role-play, hot seating etc. Many ideas can be found on the Internet for these drama strategies.

CAR LOUNGE 2025

How do you think we will travel in the year 2025? Which means of transport will we use? Which energy sources are common for transports? Do we still have enough oil?

Happy Lotto winners

It is the year 2025 and you have just won 25 000 EUR (euro) on the lottery and you also have a decent and well paid job. You have decided to buy a car and you want to go for something new and fresh. Therefore you go to a big, international car show to see their latest models. The price of petrol is approximately 3 EUR per litre, while the so-called green fuels cost approximately 1,3-2 EUR per litre. The latter are not as efficient but the cost per 10 kilometres is still 10-20 percent lower compared to petrol.

What do you think would be most important when buying a car in 2025? Rank your alternatives - 1 for the most important, 2 for the second most important etc.

- _____ Performance (maximum speed, acceleration)
- _____ Type of fuel
- _____ Fuel consumption
- _____ Appearance
- _____ Safety
- _____ Price
- _____ Environmental stress (emissions)
- _____ Other

- Form groups and compare your rankings.
- Present your results for the rest of the class.
- Repeat the exercise one more time and consider whether you would choose differently if those who use a car which runs on renewable fuel would be offered free parking and lower congestion fees in all cities and population centres.

Exercise from climate textbook "Coola ner jorden" www.murbrackan.nu. The exercise is also described in "The Climate Journey" a material for schools produced by the Swedish Society for Nature Conservation.



→ It has been said before, but it is worth saying again. Every life is a wonder, and together, we can work wonders. This applies to our efforts to reverse the ongoing trend towards climate change as well as to our efforts to stamp out other world threats. If we only exercise a little forethought – and use what knowledge we already have – perhaps we can avert several threats in a single stroke. → → → → → →

Hot discussions

MARK THE NUMBER THAT BEST CORRESPONDS TO YOUR OPINION IN THE FOLLOWING STATEMENTS. 1 MEANS NO AND 6 MEANS YES.

Go through the statements one at a time. Position yourselves on the number that corresponds to your choice (the numbers are written on notes on the floor). First discuss with those who are standing on the same number as you are. Present the reasons for making the choice you did to the rest of the group.

Exercise from climate textbook "Coola ner jorden" www.murbrackan.nu. The exercise is also described in "The Climate Journey" a material for schools produced by the Swedish Society for Nature Conservation.

We need cheap electricity in order to develop our standard of life

1 2 3 4 5 6

Since nuclear power might lead to accidents it ought to be forbidden

1 2 3 4 5 6

Solely renewable energy sources based on sun, wind, bio fuels and water should be used

1 2 3 4 5 6

By means of energy smart technology we will solve the climate threats.

1 2 3 4 5 6

Capture The sun's heat

Materials: • One decilitre water per group
• Thermometers

Other materials that can be used to capture the heat from the sun's rays are for example:

- Black paper or fabric
- Bits of polystyrene
- Paper strips
- Insulation material, for example rockwool
- Woodwool
- Aluminium foil
- Milk cartons
- Balloons
- Sellotape
- Rubber bands

Time: approximately 1 - 1 1/2 hours

Purpose: To try to build a solar collector by means of simple materials, showing the transformation of sunlight into heat, and in this way to learn how a solar collector works. OBS! The exercise must be performed on a sunny day.

Preparations: Fill a bucket with water-enough for all the groups. This is so everybody can begin with water that has the same temperature.

Performance: Pour out one decilitre water for each group, preferably into paper mugs.

All groups measure the temperature of their water.

The assignment for the groups is to heat the water as much as possible by letting the sun shine on it for 20 minutes. Each group has the possibility to build something that captures the heat from the sun by means of the materials available. Building time: 20 – 30 minutes.

After the groups have concluded their constructions they should concurrently position their "creations" outdoors. They may choose the spot themselves, and leave it there for 20 minutes.

During these 20 minutes the pupils should describe what they have done, for example by using a digital camera. They should also write down what materials they have used, why they specifically chose those materials and why they chose to place their creation in that particular spot.

After 20 minutes it is time for the groups to collect the water and measure the temperature once again.

The teacher writes the temperatures of each group's water on the blackboard (the pupils may possibly do this themselves).

Discuss the results and the outcome. Let each group give an account of how they thought and what they have learned from the exercise. Think together what you could have done differently for an even better result.

Things that can matter:

- Did the group build something that reflects the heat instead of capturing it? (aluminium foil or white material instead of black material on the outside)
- How do you get the sun's heat into the water and how does the heat remain there?

Try again (if there is time): Let the groups try their newly achieved skills in a new 20 minutes experiment according to above mentioned procedure.



The inventors of the new and energy-smart houses, that among other things are heated with poo pellets, are (from the left) Anna Andersson, Tove Rådelius and Ludvig Svartholm. They are upper secondary students at Luleå Gymnasieskola.

Here is the future toilet that separates urine from faeces. The excrement is passed on to a factory for pelletising. Since comfort is the be-all and end-all the toilet is ergonomically designed. It is also provided with a "house doctor-function" that analyses the excrement and then reports the result in terms of temperature, value of nourishment, possible diseases, pregnancies etc on the enclosed display. This function is also available with loudspeakers.



The house is heated with "poo pellets"

It is the year 2024. The city is Luleå. A completely new concept for energy supplying of houses has been born.

The new houses are completely self-supporting in electricity and heating. The special construction of the roof creates optimal circumstances for using the solar cell panels to produce electricity. In order to endure long periods with little sun radiation the house has been provided with electricity accumulators for long-time storage of electricity as well as supplementary sources of electricity such as small but efficient windmills and hydroelectric power stations that take advantage of the fall height of the water that is collected in the lower angles of the roof construction.

The heating supply itself is managed by district heating based on renewable excrement pellets, which possibly can contain other available bio fuels. The excrement is gathered in the municipal sewage treatment works before it is send on to a factory for pelletising.

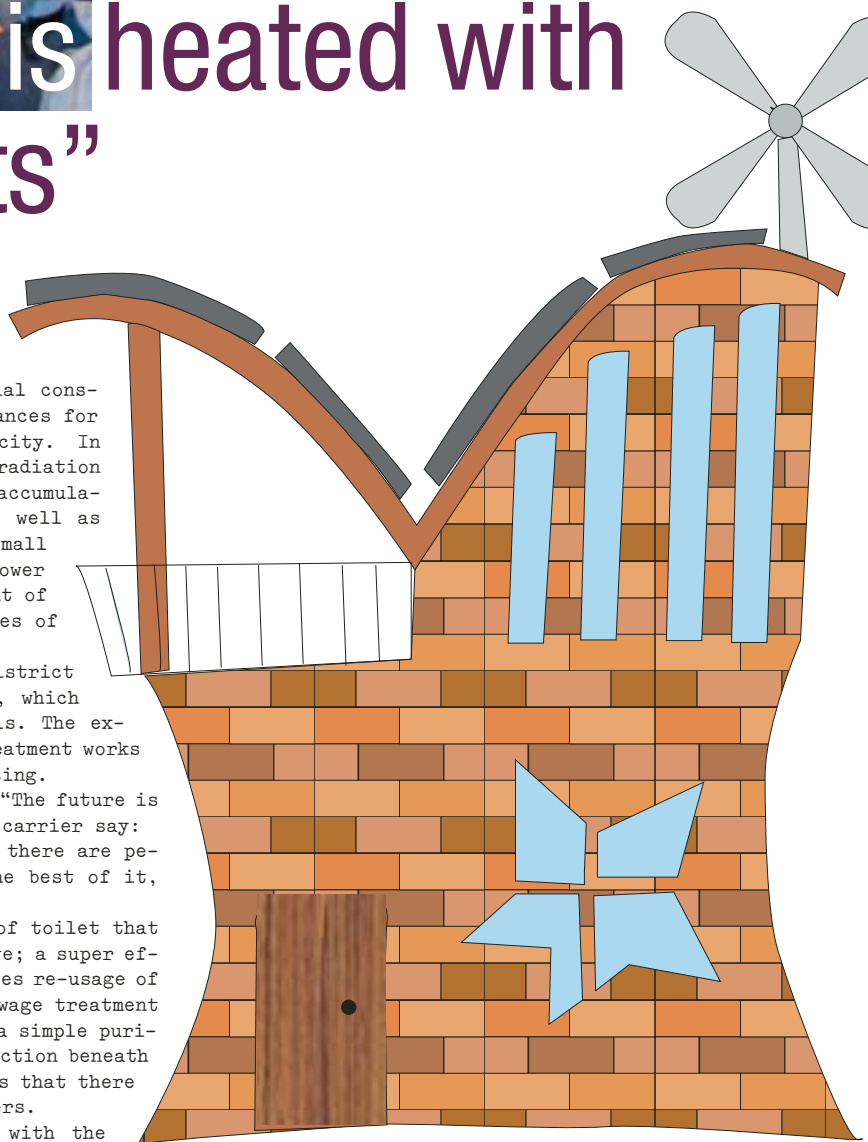
These pellets are being sold under the motto "The future is shit", or as the inventors of this new energy carrier say:

- What is it that will never end as long as there are people? Supply of excrement. So why not make the best of it, and use it in the smartest possible way?

The new houses also contain a special kind of toilet that makes the collecting of excrement more effective; a super efficient solution for water supply, which involves re-usage of water before it is send on to the municipal sewage treatment works. The re-usage of the water is enabled via simple purification methods that are included in a construction beneath the house. Another novelty with these houses is that there are no space demanding refrigerators or freezers.

- No, we developed a new kind of package with the capacity to cool, or freeze the food, and then heat it to desired temperature. You could say that the package has a multi-function as a combined refrigerator/freezer and microwave oven.

The houses heated with poo pellets are one of the results of the collaboration that Teknikens Hus has had with upper-secondary school pupils within the framework for the two projects "Unga spekulerar" and "Grasping of Climate".



The future house presented by the group is self-supporting in electricity and other energy, partly via poo pellets. The construction of the roof makes the sun's rays "bump" between the roof walls so that the solar energy can be maximally used. Beneath the house there is a sewage treatment works where the used water can be purified and reused.

At the travel agency

Sketch for upper secondary school pupils



A short sketch made by Teknikens Hus to illustrate some of the problems regarding the effects of climate changes that we might come across in the future. The sketch is played by 3-4 persons.

Person 1: Elder person (lady) comes rushing in to the travel agency from horrible rain weather.

Person 2: Travel agency official.

Person 3: Person travelling through.

Person 4: Person on a virtual journey.

Play props:

Person 1: Wellington boots, coat, umbrella, scarf around the head, hand bag, possibly glasses.

Person 2: Jacket, mobile phone (or similar), two rolls of toilet paper covered in aluminium foil and a "crazy" hat in aluminium foil.

Person 3: (stands behind a hanging) holding two rolls of toilet paper covered in aluminium foil and is wearing a "crazy" hat in aluminium foil.

Person 4: same as person 3.

P1: *(comes rushing in, somewhere at the back of the room)(shouts) I can't understand why it's always raining nowadays. How could anyone have imagined that climate change would lead to this... (folds the umbrella while walking down the room).*

(P1 approaches the travel agency - in the front part of the room - and stops.)

P1: What if one was to order a trip, sun-bathe...I think I'll visit the travel agency.

(P1 opens a door and enters the travel agency.)

P2: Welcome! How can I help you?

P1: Well, I would like to travel to a place where it is warm and sunny. Do you think you could help me with that?

P2: Well, let's see...Do you want to go somewhere where it's really warm? Mallorca, for example?

P1: Oh, no, it's far too hot there nowadays...

P2: Well, then maybe the south coast of Skåne would be suitable, it's the same climate there as it was in the Mediterranean in the beginning of the 21st century. That trip costs 20 000 euro.

P1: Yes, that sounds good. I'll take it!

P2: Very well, then all we have to do is to identify you.

(P1 reaches forward her forearm and P2 puts the mobile phone against her arm.)

P2: I'm sorry to inform you that you've already filled your emission quota. It is only allowed to travel this far two times a year per person. You do know that, don't you?

P1: Yes, but maybe that can be solved in some way?

P2: Let's see now. You could of course buy an extra emission right from ...Yes, now I know. The people living at Nissans industrial area can't afford to travel themselves so they would be glad to sell their quotas. In that case the trip to Skåne would cost you 30 000 euro.

P1: Yes, that sounds good. Only it would be far too expensive for me. Isn't there any other way?

P2: Well, in that case we could offer you a virtual trip. Could that be of interest?

P1: Yes, that sounds exciting.

P2: Nowadays we can also offer you travel company if you don't have anyone to travel with. Do you?

P1: Well, I have Pär of course, but he snores terribly. No, I can't bring him. I would like to have a travelling companion.

P2: Would you like to have a standard model or would you like to design your own?

P1: I'd prefer to design my own, if I may.

P2: Can you describe what he/she should look like?

P1: I would like a man. He should be tall, handsome, have a six-pack, 25 years and willing.

P2: Did you say willing?

P1: No, I meant of course thrilling. He should be thrilling, cultivated and intelligent. Brown hair and brown eyes...Is that enough?

P2: Yes, that will do. Where would you like to go?

P1: Can we go anywhere we want to?

P2: Yes.

P1: Then I'll choose that place Ibiza...

P2: You mean Ibiza.

P1: Yeah, that's right. It used to be such a popular resort...

P2: Would you like the climate of 2004? In those days the climate was very pleasant on Ibiza.

P1: That'll be good.

P2: Then you can come with me.

(P2 puts P1 behind the hanging, together with the two others - P3 and P4, whom have already taken off on a virtual trip.)

P2: Then I'll let you out in two weeks time...

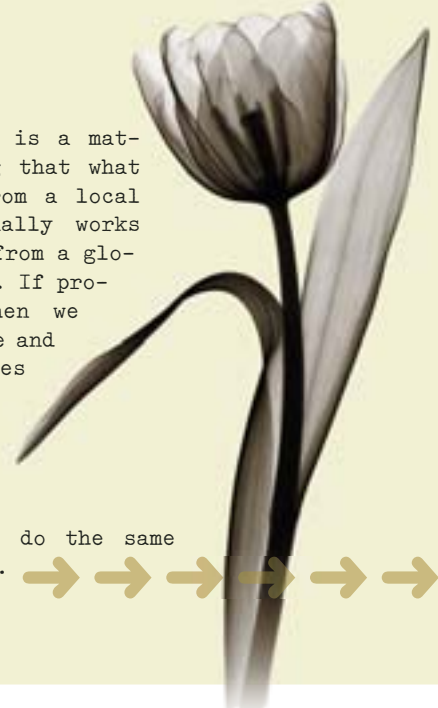
(P1 closes the hanging and leaves.)

THE END

The sketch can be part of, or end with, a discussion or debate on what sustainable development means for each person.



Essentially, it is a matter of learning that what works poorly from a local perspective usually works just as poorly from a global perspective. If problems arise when we mismanage people and natural resources in our own local environment, problems are likely to arise if we do the same thing elsewhere.



● It's a matter of the good life

● The UN's strategy for ecologically, economically and socially sustainable development, adopted at the Earth Summit in Rio de Janeiro in 1992, has guided the actions of more and more nations as well as many companies. It has become something of a political mantra.

● With this reasoning, the social dimension must take precedence. It's a matter of the Good Life – for everyone and for generations to come. The other two dimensions of sustainability necessarily follow: namely; how can economics serve to promote the good life, and can this be accomplished without destroying nature, land, air, water and biological diversity?

● This is the core of the climate issue. To be able to check global warming, we must hasten to build a more equitable world order.

● This is the only way we can establish a climate of consensus and willingness to change that is the foundation for ensuring a physical climate that is acceptable for all people.

● From Stefan Edman's book *The Earth has a Fever – Can we Stop Climate Change?* (2003).

MEET

Simon, 5th grade, Vidselskolan, Älvsbyn

What have you done to decrease your own impact on climate change?

"Well, I try not to drive my moped at home so much"

Which are the best measures to decrease the human impact on climate change?

"I think you ought to decrease the emissions of carbon dioxide and make everything environmentally friendly. Why not construct a machine that eats the carbon dioxide and transforms it to clean air?"



AT THE YOUTH RECREATION CENTRE

Role play

Target group: pupils 13 - 15 and 16 - 18 years.

The youth recreation centre in question has received strict orders from the municipal executive board that they must cut down on their expenses. The municipal economy department has looked into the costs and how the youth centre handles their everyday cores and purchases. The review revealed that the energy consumption is very high and the refuse collection far too expensive in proportion to the size of the youth centre. If this were to function better, the total cost for the youth centre could be reduced by at least 30 percent.

If no action is taken the youth centre will have to shut down. That would mean that the youths would have nowhere to go in the evenings. The recreation leader has called the youths to a crisis meeting to ask for their help. A decision has to be made the very same evening. All youths have to agree to the decision to decrease the use of energy and improve the refuse collection; otherwise the centre will close within six weeks.

Decisions that have to be made are:

- Everybody must improve their waste sorting.
- No electric appliances can be left on stand-by function when they are not used.
- Everybody must turn off the lights when leaving a room, if no one else is in the room.
- No one must use the oven if it's not necessary (it has been left on during entire nights sometimes).

To the teacher:

In role play the purpose is that the pupils should try to play different roles and face questions at issue that are very complex

- The teacher reads the story aloud.
- The pupils work in groups of, maximum, eight people per group (if there are not enough persons you can eliminate the parts of Tom and/or Alexandra). Each group goes to a room, where they will find the necessary play props.
- Cast the parts, everybody gets a note with a description of his/her role.
- Each one reads the note with instructions properly (they should not show the note to anyone else).
- The group should rearrange the room in the way they want it to be.

- Each individual makes his/her own interpretation of the part and must not be criticised by someone else.
- Allow the play to last for a maximum 25 minutes. Appoint someone to keep an eye on the time.
- When all plays are ready everybody is gathered in the same room as at the beginning.
- The total time up to this point should not exceed 40 minutes.

What is required?

- A recreation leader (the teacher or another educator. The recreation leader can choose to leave the room for a while and let the youths discuss without an adult present).
- Several rooms for the groups to work in (a class may need three room).
- Clothes to use in the role play.
- Pedagogue/pedagogues that provide help and support if necessary.

Parts:

Mary/Martin	Recreation leader		
Charlie/Caroline	16 years	Felix/Frida	16 years
Ann/Andrew	16 years	Nancy/Nicholas	15 years
Sandra/Sam	15 years	Tom/Tina	16 years
Eric/Emma	17 years		

Role description

Recreation leader Mary/Martin:

You love your job and have been working at the youth centre for three years. The thought of losing your job and the contact with the youths makes you upset. Now you have taken the matter in your own hands and called to a meeting with the youths. You believe that together you will be able to solve the problems. You know that lamps and computers are never turned off. Even the oven is left on; the TV and stereo are always on standby. Everybody was really good at waste sorting in the beginning, but now no one cares. Everything is turned into the combustible fraction and the waste costs have risen by 25 %. If everybody makes a joint effort the youth centre will not have to shut down. You have decided to let the youths be part of that decision.

Charlie/Caroline:

You are 16 years old and enormously happy and lively. You think that the youth centre is one of the best things in the whole world. You are prepared to do whatever it takes to prevent the centre from closing.

Ann/Andrew:

You are 16 years old and don't give a shit about the environment. You don't even think that the earth will continue to exist when you are an adult. You find it a little amusing that people are so upset and are happy to present silly suggestions, just so that the meeting won't reach any solution.

Sandra/Sam:

You are 15 years old and very committed to environmental issues. Waste sorting and turning off lamps represent an easy solution for you to keep the youth club. With a sense of irritation you try to make the others realize that this is important.

Eric/Emma:

You are 17 years old and you like it at the centre. Your dream is to become a recreation leader and now realize that you have an opportunity to win on points. You try to take over the leadership from the recreation leader, but you do it in a quite unpleasant way. You run the environmental- and economy issue in an aggressive way. By threats and coercion you try to make everybody realize that they have to stand by the decision.

Felix/Frida:

You are 16 years old and you think that the recreation leader is wrong. Why should YOU have to sacrifice your comfort at the youth centre only because some old politicians say so? The way you see it is that once again the youths have to retreat because of adults' idiocies and sick ideas. Because of that you refuse to agree to any suggestions that you think prove that the municipality and the adults don't respect your needs at the centre.

Nancy/Nicholas:

You are 15 years old and for the first time in your life you feel that you can influence something. You are on fire for keeping the centre - at any cost!

Tom/Tina:

You are 16 years old and came to the meeting only to see how and if you can solve this. You can't understand that it is possible to save enough money to keep the youth centre just by waste sorting and turning off the odd lamp. You listen with interest to what everyone says. But you have your doubts whether anything you do will actually matter.

After the role play:

The entire group ask themselves:

- What happened?
- Did the groups manage to reach unanimous decisions?
- Could this happen in reality?
- Other thoughts and questions?



Sooner or later, the consequences of all this mismanagement will become apparent to those responsible, their families, successors, neighbours and many others, regardless of how far away they are from the people and environments that are most directly affected. It is a question of delayed effects, which, unfortunately, often entail consequences that have a habit of snowballing and affecting so many more people than would have been affected had the encroachment and ensuing problems been restricted to the perpetrator's own local environment.

Here, we have a lot to learn from primitive peoples, who often have great respect for the environments in which they live and upon which they are dependent. To a degree, this reverence is also displayed by many "modern people" who in one way or another have acquired an insight into the importance of living in harmony with each other and with nature.



The point of no return

A child born in a wealthy country is likely to consume, waste, and pollute more in his lifetime than 50 children born in developing nations. Our energy-burning lifestyles are pushing our planet to the point of no return. It is dawning on us at last that the life of our world is as vulnerable as the children we raise.

Quotation by George Carey, Former Archbishop of Canterbury, United Kingdom

● Four conditions for sustainable development

● Karl-Henrik Robèrt and John Holmberg, from the international organization "The Natural Step" have formulated four important principles for sustainability which have been further developed within an international network of leading scientists and other stakeholders. The four principles are known as the four System Conditions for a sustainable society.

● In the sustainable society, nature is not subject to systematically increasing:

- 1. ...concentrations of substances extracted from the Earth's crust
- 2. ...concentrations of substances produced by society
- 3. ...degradation by physical means
- And
- 4. ...human needs are met worldwide.



Photo: Fredrik Broman



“Children love challenges!”

The pupils sometime know just as much about the existing climate changes as the teachers do, says Lisbeth Lindmark. She is the principal at Norrbyskolan in Piteå.

- It's a highly topical issue that involves young people of today.

She has noted that many teachers lack support if they want to integrate the climate issue in their teaching. Therefore she would like to see further training and textbooks on the subject.

Lisbeth Lindmark has worked as a teacher and pedagogue for more than 30 years. Mainly at intermediate level, teaching mathematics, science subjects and technology. Since the autumn of 2004 she works as a principal at Norrbyskolan in Piteå.

She is one of more than 50 teachers in Norrbotten who participated in “Climate, energy and future” a teacher-training programme carried out by Teknikens Hus within the framework for “Grasping of climate” an EU-project in the autumn of 2003. Apart from participating in three one-day seminars and just as many evening lectures the training programme also involved the task of “grasping climate” together with the pupils in her school.

Special carrots

The school where she was teaching at that time was one of four schools in Norrbotten that was allotted “special carrots” by the Swedish project team for their ways of “grasping climate”. She tells us that she and her colleagues mainly work with pupils in the ages of 10-12 years.

- At first we spend one week examining how we use energy at home and in studying the unequal distribution of resources in the world. One thing we discussed is the huge waste of energy among human beings in the Northern Hemisphere.

- We also discuss what would happen in our houses if the electricity all of a sudden was turned off? What would we do?

After reviewing the households' supply of electricity, heating and combustion, where a significant part of the energy used still come from fossil fuels (oil for example), the pupils were asked: What energy sources can we depend on in the future?

Questions to elders

During this week the pupils also carried out interviews with three adults, one person aged 35-40 years (for example a parent), one person aged 50-60 years and one person aged 70 years. The questions asked involved, for instance, how many electric households' machines the person interviewed had at home, how their house was heated etc, when they were ten years old.



Lisbeth Lindmark, principal at Norrbyskolan, Piteå

- The interviews gave a good picture of the tremendous speed with which development – or whatever we should call it - has gone on. (See also "Special carrots", page 48.)

- It also made them conscious of our present way of life by asking questions such as: How often do we change computers at home? Where do they end up?

The pupils also carried out an exercise where five students per class each got a balloon that was blown up. The balloons symbolized the amount of energy on earth that is accessible today. The five pupils symbolized the population on earth. Then, when one of the pupils took four of the balloons, and the remaining four got to share one, it became obvious to the class how unequal the present distribution of energy resources is.

After they had worked with climate- and energy issues for one week the pupils had the opportunity to test their knowledge during a theme day.

- Since we are in Norrbotten, and annually export large quantities of renewable energy from water power, we focused on hydroelectric power.

Lisbeth Lindmark describes how more than hundred pupils devoted the theme day to:

- Constructing their own water-wheels, later used to carry out various experiments with.
- Drawing diagrams monitoring the results from the interviews made with parents, grandparents etc.
- Calculating the costs for using computers, TV-games etc as often as children do today.
- Making their own postcards with useful tips on how we can save energy.

- Later on the postcards were pinned on the walls outside the schools dining room so that everybody could read the tip-offs.

Excellent subject

She thinks that the climate issue is an excellent subject to work with in school at present. It is highly topical. The pupils read about it and see news about it on television nearly every day.

- Actually my opinion is that the children quite often are aware of the increasing problems with the enhanced greenhouse effect, even if they don't know the exact underlying causes.

But she certainly does not want schools to worry about the future, but wishes for an education in climate problems built on a strong and positive belief in the future.

- If we present the climate issue in a too fatal way, the children will not become involved. If the climate problems instead are presented as a challenge it is a completely different story. Children love challenges. They are dying to contribute with their own solutions.

According to Lisbeth Lindmark, the climate issue is furthermore an issue that involves all subjects in school, which makes it extra exciting and interesting for the teachers to work with.

- Unfortunately many teachers seem to have difficulties in grasping the problems, in spite of all the information you can find about the climate issue. They simply don't feel secure in the area. Luckily – that can be changed.

MEET



Lars Thomsen, teacher in maths and natural sciences, 6-9th grade, Östra skolan, Jokkmokk

What have you done to decrease your school's impact on climate change?

"Nothing in particular. But I took part in the environmental commitment that we made at our school in 1996/1997."

What have you done to decrease your own impact on climate change?

"Everything I possibly can. I always go by bike on short journeys instead of going by car. I preferably buy locally produced food or products that are eco- and fair trade labelled. I avoid unnecessary packages. Furthermore I am active in the local Swedish Society for Nature Conservation and the Environmental Party in Jokkmokk."

Which are the best measures to decrease the human impact on climate change?

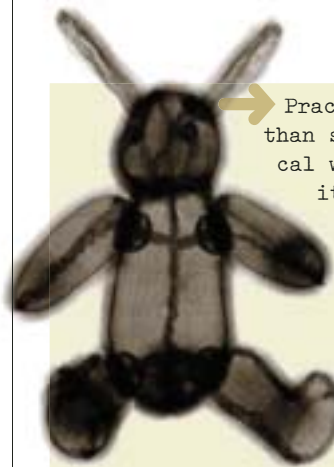
"First of all we have to stop using oil for heating buildings. Then we must find an alternative to oil at the petrol stations."

Tackling global warming

Renewable energy's time has arrived. Allied with sustainable energy use in homes, it promises to deliver an environment which tackles the major problems of the 21st century: warm homes and the recognition of the need to tackle global warming now.

Quotation by Dr. Ian Gibson MP, Norwich North, Chairman of the Government's Science and Technology Select Com-

mittee



Practical wisdom is more than simply knowledge. Practical wisdom is wisdom's twin; it is wisdom mirrored in our actions. Someone once said that wisdom is what remains if you take away all the facts, figures and footnotes. Practical wisdom quietly steps aside, leaving room for our inner voice, intuition.

Practical wisdom is also our ability to learn from our experience as well as from the experience of others, and to apply, in our daily lives, the new insights gained thereby. Practical wisdom poses no opposition between head and heart. It is the two, working together. → → → →



“Special carrots”

In the autumn of 2003 Teknikens Hus carried out a teacher-training programme in climate and lifestyle issues within the frames for the Swedish part of the project “Grasping of Climate”. A task where the teachers were expected to “grasp the climate” in their own schools formed part of the course. As a “carrot” to the teachers special prizes were offered to those who presented the “best” grasps. All and all four special “carrots” were handed out. A jury consisting of representatives from the reference group appointed the prizewinners.

QUESTIONS TO ELDER

The questionnaire was developed by a group of teachers at Rosviksskolan (Municipality of Piteå). They were designated a special carrot because they managed to involve many of the pupils in their “grasping of climate”. They also involved parents, grandparents and other adults. In their work they demonstrate how the climate issue can be integrated across all lessons and subjects. More than one hundred pupils between the ages of 10 – 12 years interviewed adults in varying ages and thereby received a good picture of what the technological development in the last 50 years has been like. The pupils then made diagrams of the development based on the results from the interviews.

The person interviewed is...

- older than 70 years
- between 50-60 years
- between 30-45 years

1. When you were about ten years old, how...

a) many motor vehicles did your family own?

- none
- one
- two or more

b) was the house/apartment where you lived heated?

- with wood
- with oil
- with electricity
- other source of energy _____

c) many times a week did you have a shower/a bath?

- none or once
- twice
- three times
- four times or more

2. Which of these devices did you have at home when you were ten years old?

- TV
- “mobile phone”
- microwave oven
- electric cooker
- electric mixer
- computer
- hair dryer
- radio

• The climate system is never in equilibrium

- The sun, of course, is what drives the Earth’s climate system.
- Since different parts of the planet are heated to varying degrees by the sunlight, large temperature differences occur from place to place. The climate system is always trying to even out these differences by transferring warm air and warm seawater to cooler areas. This is what gives rise to winds, ocean currents and high-pressure and low-pressure systems, which in turn determine the distribution of cloud, precipitation and other weather phenomena.

- Because the Earth rotates on its axis and orbits around the sun, the supply of solar energy to any given part of the Earth’s surface is constantly changing. The temperature on the ground and in the lower strata of the atmosphere react within the course of hours or days to the variation in sunlight, but other parts of the climate system – not least deep-sea areas – may need decades or centuries to adapt to changes of this nature.

- The climate system is very complex; it is exposed to varying influences to which it reacts on widely differing time scales. Such a system is never in perfect equilibrium, and its changes can never be predicted with absolute certainty.

From A Warmer World – the Greenhouse Effect and Climate, Naturvårdsverket, Swedish Environmental Protection Agency (2003).



Practical wisdom acts according to what it already knows – which is often more than enough. Practical wisdom banishes irresponsible wishful thinking. It does not place its hope in new technologies and systems, or in coming generations, to solve the problems that we ourselves have created. It acts solely according to the maxim that no individual or group has the right, now or in the future, to destroy the possibility for others to live a good life in a safe and healthy environment.

→ → → → → → → → → →

MEET

Judy Tree, Colby School, Norfolk:



What have you done to decrease your own impact on global warming?

“Personally – I buy energy efficient goods and low energy light bulbs. I also use my bike more frequently.”

Which are the best measures to decrease the human impact on global warming?

“The best way to reduce our impact on climate change is by using sustainable technologies and educating children to raise awareness of energy efficiency and to understand their role in mitigating the effects of global warming.”

Four simple experiments

THE WINDMILL

By: CEDER (+33(0)4-75-26-22-53), Nyons, France

Description: the windmill is a small Aeolian which uses the wind's strength to function. It has a propeller and a tiller, and it pivots in order to stay facing the wind and to go on turning.

Materials:

- One sheet of drawing paper (25cm x 25cm)
- One thin round stick (about 50cm long)
- One thin square stick (about 50cm long)
- One CD (a free one, perhaps)
- One piece of cardboard (12cm x 18cm)
- Three beads
- Two nails (2.7mm in diameter and 5.5cm long)
- Scissors
- Felt tips
- Ruler
- Pencil
- Hammer
- Drill
- Jig-saw

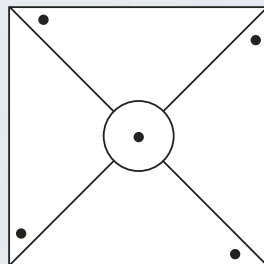
To assemble:

The sticks can be prepared before the assembly in class. In this way, the pupils will not handle the drill or jig-saw. Prepare as follows:

- Cut the two sticks to the right length
- Make a slit of 5cm in the round stick to put the tiller in later
- Make a 3mm hole in the middle of the round stick (the hole should be in line with the slit).

The following stages can be completed in class:

- Draw a trapezium on the cardboard 15cm high, and 10 and 5cm wide
- Cut out the trapezium
- Decorate it (with felt tips or by sticking on some silver paper...)
- On the sheet of drawing paper, draw a square 25cm by 25cm
- Cut out the square



- Draw in the diagonal lines in this square
- Decorate the two sides of the square (use coloured pencils because felt tips make the paper too damp)
- Draw a circle 5cm in diameter whose centre is at the intersection of the diagonals
- Cut along the diagonal lines starting from the corners and stopping at the circle (so that the centre of the square is not cut out)
- Mark five points (see diagram) which will be pierced with a nail
- Pierce the holes with the nail
- Put the paper on the ground
- Put the CD in the centre of the paper
- Thread a bead onto a nail
- Fold back a corner with a hole in it and put the nail through
- Fold back the next corner (with a hole) and put the nail through
- Fold back the third then the fourth corner with a hole, putting the nail through
- Put the nail into the middle of the CD then in the central hole of the paper (which becomes a propeller)
- Thread the second bead onto the nail
- Fix the propeller on the round stick (at the opposite end from the slit)
- Insert the tiller into the slit of the round stick
- Place a nail in the hole in the round stick
- Then thread on the last bead
- Fix this nail to the top of the square stick

Operation: the windmill is a spectacular project. It begins to move with no help from the pupil. Whether it is planted in a pot of flowers or fixed to a fence, it will teach us about the direction and movement of the wind, as well as its power. By moving it, it will be possible to work out the influence of the relief on the flow of the wind: a hill increases wind speed at its summit and a narrowing between two obstacles can also have an effect of speeding it up. But the relief generally will have a negative effect on wind speed. Finally, the windmill will show that the wind is a local resource, which it would be a shame not to use...

THE SOLAR OVEN

By: HESPUL, Villeurbanne, France

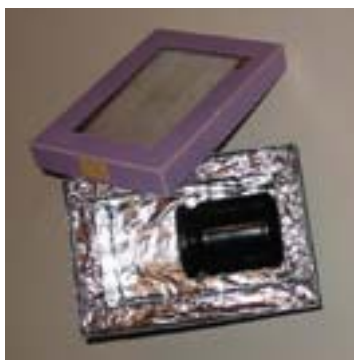
Description: This simple project allows, among other things, the study of the “greenhouse effect”, “black body effect” and “reflection” phenomena...

Materials:

- One shoe box
- One jam jar (which goes into the box)
- Paintbrush
- Ruler
- Scissors
- One roll of sellotape
- Poster paint
- One roll of aluminium foil
- Black paint for jam jars
- 1 cm thick polystyrene
- Transparent rigid plastic
- Copies of solar cooking recipes

To assemble:

- Paint the jar black and leave to dry



- Draw an outline on the lid of the box 2 cm from each edge
- Cut out the interior of the lid along the lines you have drawn
- Glue a piece of polystyrene on each interior side of the box
- Glue a sheet of foil on each interior side of the polystyrene
- Sellotape or glue the piece of transparent rigid plastic onto the inside of the lid
- Put the jar in the box and close the lid

Operation: the solar oven is a very useful project! It will allow you to concoct dishes without giving out any greenhouse gases! You will only need the power of the sun to cook your food. You need only position the oven correctly in the direction of the sun to obtain sufficient heat for cooking. Here are a few examples of recipes and a useful internet site. Cooking times depend on light intensity, but be careful not to burn your food! In winter, when it is sunny, one trick is to position the oven inside the house behind a window facing the sun.

For more information - visit the internet site: www.solarcooking.org

Recipes for the solar oven:

- Rice
Pour half a glass of rice and a glass of water into the jar. Add a slice of tomato and pieces of pepper. Add salt. Add a teaspoon of olive oil.
- Lentils
Pour in half a glass of lentils and a glass of water. Add 1/4 of a stock cube.
- Hard boiled egg
Put in an egg with a soup spoon of water. It cooks in the steam in about an hour.
- Stewed apple
Cut an apple into small pieces. Add two soup spoons of water. Add a soup spoon of sugar. Add a little cinnamon.

SOLAR WATER HEATER

By: CEDER (+33(0)4-75-26-22-53), Nyons, France

Description: Model showing the transformation of sunlight into heat. It allows water, chocolate and coffee to be heated using just the sun's energy! This simple project enables us to study, among other things the “greenhouse effect”, “black body effect” and “reflection” phenomena...

Materials:

- One shoe box
- One bottle of mineral water (1,5l)
- Paintbrush
- Ruler and pencils
- Scissors (Stanley knife or knife for an adult)

- Roll of sellotape
- Roll of aluminium foil
- Black paint for the plastic
- 1 cm thick polystyrene (optional)
- Roll of plastic kitchen film
- Glue stick

To assemble:

- Paint the bottle black and leave to dry
- Draw an outline on the lid of the box 2 cm from each edge
- Cut the inside of the lid along the line you have drawn
- If the bottle is taller than the box, draw the outline of

THE SOLAR CAROUSEL

By: Hespul (+33(0)4 37 47 80 90), Villeurbanne, France

Description: the solar carousel is an electric model which is propelled by a solar cell. It shows how sunlight can be transformed into electricity. The carousel turns when the roof of the cabin is exposed to the sun. The carousel can be decorated and arranged by the children using their imagination. For example, cutting out little figures, making an advert or constructing an amusement park...

The carousel is composed of a photovoltaic cell linked to a small electric motor.

Materials:

- Used cardboard boxes
- One wooden camembert box
- Old pieces of hardboard
- A cardboard toilet roll centre
- Solar cell
- Solar motor
- Cogwheels for motor axles
- Stripped electric wires
- Wood glue
- Two Stanley knives (one each for the leader and the teacher)
- 6 lids to pour the glue
- 2 small screws
- The lamp (for trials)

To assemble:

Preparation

- Cut one piece of hardboard per pupil 15 cm x 25 cm
- Make two holes in the support for the house and carousel base
- Cut two electric wires per pupil 20 cm long and strip each end to a minimum length of 1cm
- Make a hole in the centre of the camembert box of the same diameter as the cogwheel.

To make up in class

- Show how the carousel is to be made up and how it will work
- Show on the blackboard the two rectangles which are the walls of the house: 7cm x 6cm and 7cm x 9cm, then show the cut-out for the cogwheel 6 cm from the floor
- Cut two rectangles for the roof 6 cm x 9 cm
- The children draw and cut out each rectangle with

scissors or the leader with a Stanley knife

- Glue together the parts of the house except the roof
- Produce the cell and electric wire
- Cut out a rectangle 2 cm x 3.5cm in a roof
- Connect and tighten the electric wires on the cell. Tighten the nut with scissors and glue the cell onto the roof, then the roof onto the house
- Cut out cardboard feet for the hardboard support + a cardboard base for the motor
- Take the motor, cogwheel and camembert box
- Make the connections and isolate them with sellotape. Glue the motor then put the camembert box onto the motor axle
- Take the cardboard toilet roll centre and glue it onto the camembert box
- Check that the carousel works



Operation: the solar carousel is a “magic” project. It begins to move with no input from the pupil. On a window ledge or in the playground, the speed with which it turns will depend on the intensity of the light, the slope of the roof, and where it is placed in relation to the sun’s position. By counting the number of turns per minute, it will be possible to determine the influence of these parameters on the functioning of the carousel. We shall confirm that the solar cell is a wonderful tool for the production of electricity without creating greenhouse gases...

the stopper on the top of the box (this isn’t necessary if the bottle fits into the box); cut out, following this line

- Glue a piece of polystyrene on each interior side of the box (optional)
- Glue a sheet of foil onto each interior side of the box
- Sellotape a sheet of plastic cellophane onto the lid (it is better to sellotape the cellophane onto the inside of the lid, otherwise it can tear after being opened many times)
- Put the bottle into the box and close the lid

Operation: the solar water heater is a very useful project! With it you can warm up liquids such as water, coffee and

chocolate, and without giving out any greenhouse gases!

We can also measure the differences in temperature of the liquid during the course of the day. You just need to buy a thermometer: but take care, the temperatures can go as high as 70°C!

It is also possible to make water heaters with or without insulating material, with or without glass, with or without foil, with a bottle painted black or another colour... It will then be very interesting to compare the temperatures in each of the water heaters and to assess the usefulness of each unit. In winter when it’s sunny, one trick is to place the water heater inside the house behind a window facing the sun.

“Special carrots”

EXERCISE IN STATISTICS

(performed with pupils 13-14 years old)

Teachers from Tunaskolan in Luleå were assigned a “special carrot” for giving an example of a “grasp of climate” that is clearly linked to the everyday life of the pupils. First the pupils received some homework where they should register how many hours they used different electrical appliances at home; per day and per week. Then they made a bar chart and/or line diagram of electricity consumption. Thereafter they calculated how:

- much it cost to use the electrical appliances during one week
- much electricity the different appliances used in one year, and how much that cost.

The calculations show among other things that in most cases the computers and TV/video were the most energy demanding machines in the households (many computers were never turned off and in some households there were several computers).

Register how many hours different electrical appliances are used in your household during one week

Appliances	Per day	Per week
Electric cooker		
Oven		
Microwave oven		
Dish washer		
Toaster		
Hoover		
Iron		
Electric razor		
Computers		
TV		
Video		
Stereo		
Light bulbs in your room		

MEET



Discussing cleaner greener transport at Colby Primary School, Norwich.

Children, 5 to 11 years from Colby School, Norfolk

What have you done to decrease your own school's impact on global warming?

"In our school we set up an Energy club through the Carbon Reduction Project – (CRed) from The University of East Anglia. Electricity meters are read weekly and reported to the school council about how the school can be more efficient. We have installed photovoltaic cells in our own Field Study Centre and erected a small wind turbine to produce extra light in our chicken run.

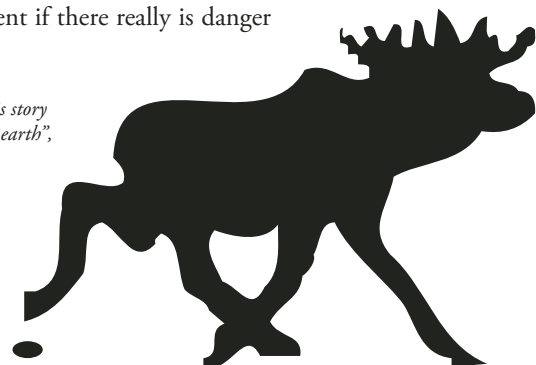
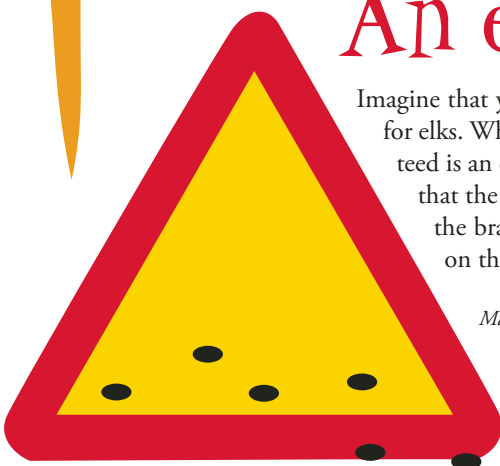
We have also created an Eco Committee to deal with environmental issues across the school.

A travel action plan has been organised to cut down on cars being used for car runs, by car sharing and by using the school bus."

An elk behind the brow

Imagine that you are driving in your car on a main road and you see a warning sign for elks. What is your reaction? Do you demand secure evidence that there guaranteed is an elk behind the next curve before you slow down? Most of us would say that the warning sign is enough to make us at least slow down a little. If we hit the brakes on time the braking will not be so violent if there really is danger on the road.

Material to start a discussion about the likeliness between this story and climate work from climate text book "Cool down the earth", municipality of Växjö, (www.murbrackan.nu)





The inventors of the future news "The Weather Bubble" are (from the left): Sara Stark, Elvira Öberg, Jesper Lindström, Emma Samuelsson Öhberg and Maja Quvarnström. (not present Micaela Nordström). They are upper secondary students in Luleå gymnasieskola.



A weather bubble above Norrbotten

One piece of news in an ordinary transmission of Swenews in the year 2034 is about a unique invention, a "weather bubble" which is to be tested in a pilot project in Norrbotten. "The weather bubble" is designed by a team of scientists led by Truls Artak, professor in climate technology at Luleå University of Technology.

- The bubble itself is created by so called climate plastic, it's major component is the recently discovered element Tjetaru, says professor Artak.

The invention has two important functions. Firstly the "weather bubble" will replace the already destroyed atmosphere around the planet Earth. Secondly the invention will make it possible to control the climate in specific places so that it will be possible to get the most desired weather.

Therefore, it will be possible in the future to control the climate in Norrbotten so that the beaches will have maximum hours of sun at the same time as the ski slopes will offer the perfect conditions for skiers.

- In order to avoid the risk that a dictator or lunatic makes incorrect use of the unique possibility to control the local climate, we have made sure that the climate in the bubble is distributed after consultation with international weather and environmental expertise, says Truls Artak.

He thinks that the "weather bubble" will become very appreciated by the residents in Norrbotten.

- Mostly it will facilitate their planning since every resident in Norrbotten will get a calendar which clearly says when it is going to rain or snow, and which gives similar information about the weather for each city.

"The weather bubble is one of the results of collaboration that Teknikens Hus has had with upper secondary school pupils within the framework for the two projects "Unga spekulerar" and "Grasping of Climate".

The weather bubble works as follows: the artificial atmosphere of environmentally adapted plastic above the experimental area Norrbotten receives and stores different forms of energy from outer space. The energy is divided in specially designed tubes and then placed in different compartments. Each city has its own weather stored in a special compartment.



● Both Man and Nature have changed the climate

● That climate models must include greenhouse-gas emissions
● if the calculations are to account for the rapid warming that
● began in the 1970s is a strong indication that human inter-
● vention has had an impact on global climate, at least since
● then. This conclusion is supported by an increasingly appar-
● ent deviation from the climate trend that prevailed in pre-in-
● dustrial times. Evidently, this deviation would have been even
● greater had it not been for the fact that increased quantities of
● aerosols in the atmosphere have dampened the greenhouse
● effect.

● Those who still reject the theory of human impact on the cli-
● mate claim that, despite all the indications, it has still not been
● verified. In fact, we will never be able to present any real
● evidence to either prove or disprove that man has had an im-
● pact on the climate, regardless of how the climate changes in
● future. Scientific proof, in the strict sense, only has a place in
● abstract and theoretical disciplines such as mathematics and
● logic. Out in the complicated and difficult-to-grasp reality that
● surrounds us, it is impossible to arrive at absolute certainty as
● to cause and effect; instead, we have to be content with ap-
● proximations of the probability of one inference or another. If
● there is a very great probability that a certain theory is true, it
● is reasonable for us to accept it, at least for the time being.

● *From A Warmer World – the Greenhouse Effect
● and Climate, Naturvårdsverket, Swedish Environmental
● Protection Agency (2003).*

The green welfare state

The green welfare state will be built. This is a vision of an ecologically sustainable Sweden in which health, environment and welfare are protected at the same time as we improve our contribution to increased solidarity and a more equitable distribution of resources in the world.

The will to reorganize and modernize society towards greater resource efficiency will release a wave of technical innovations and investments that will generate economic growth. The Government's policy for sustainable development will be strengthened and broadened.

A coherent climate and energy policy is being formulated. Vattenfall [the Swedish state energy group] will assume a leading role in the transition to renewable energy. Energy-intensive industries participating in energy-efficiency improvement programmes will be eligible for tax rebates. State subsidies for municipal climate initiatives will be strengthened. Land and sea areas suitable for development of wind-power production will be identified by 2006. Public-sector activities will set an example. Investments that make schools, hospitals, libraries and other public buildings more energy efficient will be encouraged. Trade in emissions rights will be a powerful instrument for reducing carbon dioxide emissions in Sweden and the EU. Conditions will be improved for consumers in the markets for electricity, natural gas and district heating.

The transportation system will be modernized. Sweden's climate goals will be reached. Taxes on petrol and diesel will be increased, as will motor vehicle taxes on cars and light-duty trucks. The infrastructure for sales of alternative fuels will be improved. Biofuels and other renewable fuels will continue to be tax exempt. At least 25 percent of all state-owned vehicles purchased in 2005 will be environmentally friendly. Sweden will work actively in the EU to support a differentiated kilometre tax rate on heavy vehicle traffic.

*Extract from Swedish prime minister Göran Persson's
throne speech, September 2004*

Not a sustainable consumption

Today the consequences for climate and health of greenhouse gases are well known and nobody can contest them: global warming, rising of sea level, natural catastrophes, climate deregulation, breathing sickness... Let's say it frankly : our actual model of consumption is not sustainable. History brings us in front of two paths: respect for the environment or energy explosion. Time for choice has come. This issue is certainly the most important and the most urgent of all the ones we have to face! Our collective responsibility is engaged.

*Quotation of Nicole Fontaine,
French Minister of Industry (24 may 2003)*

MEET

Emilia, 6th grade,
Östra skolan, Jokkmokk

What have you done to decrease your own impact on climate change?

"I walk quite a lot instead of going in a car. And I don't shower more than 10 - 15 minutes."

Which are the best measures to decrease the human impact on climate change?

"To turn off the stereo and TV when you don't use them so that the standby function doesn't consume energy unnecessarily. I also think that everybody ought to walk more."



● Climate for a just world

● We have seen clearly that, in terms of resource consumption and greenhouse-gas emissions, industrialised countries lay claim to a much greater share of the Earth's ecosystem. These countries account for 20 percent of the world's population, but 80 percent of emissions. In developing countries, the figures are the reverse, yet it is mainly they who bear the brunt of the industrialised countries' greenhouse-gas emissions.

● The effects of global warming are also reflected in the differences between the world's rich and poor. It is mainly the economically weak peoples and nations that risk exposure to the consequences of climate change – drought, torrential rains, floods and extreme weather.

● Therefore, the challenge now and in the future is to create a climate for a just world; a new, generous political climate that enables us to redirect development towards an acceptable physical climate that does not aggravate poverty. Dare we believe this possible to achieve?

*From Stefan Edman's book The Earth has a Fever
– Can we Stop Climate Change? (2003).*

MEET



Gustav, 9th grade, Pitholmsskolan, Piteå

What have you done to decrease your school's impact on climate change?

"I automatically turn off the computers in the computer room at school when I'm done with them."

What have you done to decrease your own impact on climate change?

"I turn off the computer at home as well. Furthermore I switch off the lamps when I leave a room."

Which are the best measures to decrease the human impact on climate change?

"The best way is to use bio fuels instead of fossil fuels, and to replace petrol and diesel with alternative combustibles - like hydrogen for fuel cell engines. I say: Rather rapeseed oil than fossil oil."

→ Practical wisdom builds no walls between different areas of knowledge or disciplines. It knows that all things are independent and it acknowledges the necessity of always maintaining a holistic perspective.

Practical wisdom never pretends that it knows best. It is always curious about what others have to say.

But practical wisdom also leads to an insight into the importance of assuming personal responsibility at the same time as it counteracts decision anxiety and escape mechanisms.

Practical wisdom is individual, even though its effects are often collective.

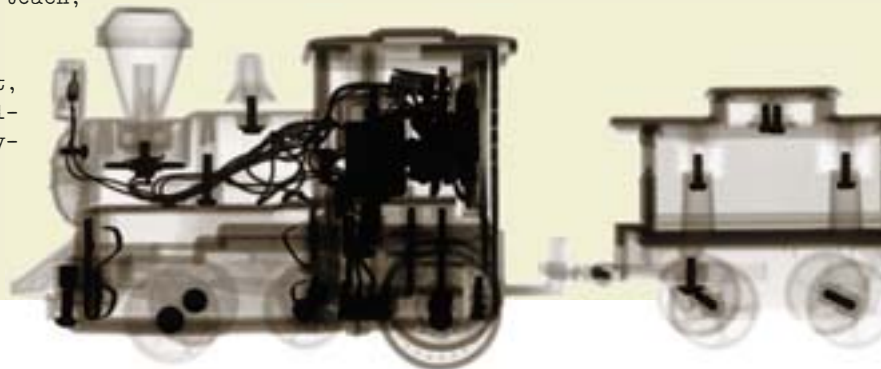
Practical wisdom can only develop at its own pace.

Though practical wisdom is difficult to teach, it is always worthwhile to try.

And here, every teacher, indeed every adult, is faced with an imposing but exciting challenge - especially since there are no ready-made templates or answers.

First and foremost, it is a matter of trying, and then trying again, and again.

Editors appreciation to Carl Wahren for all the practical wisdom he has contributed with.



● Examples of climate change

- All over the world several changes in nature and extreme weather events as a result of climate change are traceable. These events are not themselves evidence that climate change are taking place - the events is a result of climate change. The evidence for climate change is to be found in various observations of greenhouse gases and weather parameters and from confirmations of current climate theory.

● All students of meteorology were previously taught that hurricanes do not exist in the south Atlantic. Textbooks and encyclopedias stated that the natural conditions for hurricanes to arise in the south Atlantic are simply not enough.

● The Coriolis Force, is a great power that makes cyclones transform into a swirling inferno. But, according to textbooks, it is only at five latitudes north or south of the equator that the Coriolis Force gains enough strength to develop this inferno. But on the 26 of March 2004 the impossible became possible. A hurricane, named Catarina, arose in the south Atlantic. It hit Brazil and caused the death of about ten people and a great deal of devastation. How could this - that was supposed to be impossible - happen?

● The climate is an extremely sensitive system. Some parts of the world may be completely unaffected while in other parts the changes will be considerable. With a warmer climate will also temperatures at sea will also change and so will the sea-currents. This in turn means that the conditions for the origin of hurricanes will also have changed.

Further examples

- International scientific experts have found an average rise in temperature of 0.6 degrees in the 1990s, based on observations made during the last century.
- The 1980s and the 1990s were the warmest decades of the 20th century.
- The twelve warmest years in a hundred years, have occurred since 1983.
- The glaciers in Europe have diminished significantly in the 1990s and there has been a rise of 20 centimetres in the average sea level.
- There has been an increase in extreme precipitation events.
- The frequency, intensity and extension of El Nino have increased since 1970, which means that the periods of flooding and dry have been accentuated in the tropics.

The list could be made much longer. There are still some "normal" periods but the trend is unambiguous. Human behaviour affects weather, climate and environment and we are not only unable to control the future, more seriously - we do not take enough responsibility for it either.

Data from Swedish Weather Center, www.weather.se

MEET



**Faruk, 6th grade,
Östra skolan,
Jokkmokk**

What have you done to decrease your own impact on climate change?

"I always travel by bike a lot and I try to always turn off the lamps when I leave a room."



Tove, upper secondary school, media programme, 2B, Luleå

What have you done to decrease your school's impact on climate change?

"We haven't had the opportunity to do anything."

What have you done to decrease your own impact on climate change?

"I try to remember to un-plug the adapter to the mobile and turn off the standby

function when I don't use the appliances. I also try to switch off the light when I leave a room and car-share or go by bike when I need to go somewhere."

Which are the best measures to decrease the human impact on climate change?

"It's about doing several small things like buying locally produced foods, turning off standby functions, un-plug the mobile adapter, go by car less often, switch off lights and so on."



**Stina, 4th grade,
Vidselskolan, Älvsbyn**

What have you done to decrease your school's impact on climate change?

"I participated in an experiment that a TV-programme made, where you should turn off all the lights at home for one hour. And I tried to make as many as possible at school to do the same thing.."

What have you done to decrease your own impact on climate change?

"I often go by bike. And in the autumn we buy apples that come from Sweden because they have not been transported a long distance."

Which are the best measures to decrease the human impact on climate change?

"Use more wind power and more electric cars."



**Lisa, 9th grade,
Pitholmsskolan,
Piteå**

Which are the best measures to decrease the human impact on climate change?

"Find ways to produce the electricity we need via renewable energy sources such as wind power and hydrological power instead of using coal fired power plants. And change to cars that only emit half the amount of carbon dioxide"

● Substantially reduced emissions presuppose changes in lifestyle

● At least in the wealthier countries, fossil fuels are now used in all sectors of society. Transportation, power generation, manufacturing, agriculture, forestry and many other industries are more or less dependent on such fuels.

● The responsibility for limiting carbon dioxide emissions cannot, therefore, be placed on industry, the transport sector or any other specific sector – it rests with society as a whole. Substantial reductions in emissions would probably require significant changes in lifestyle on the part of the individual. Our consumption, housing standard and travel habits are major contributors to climate-impacting emissions, which is why they risk being placed in question if demands for emission limitations are intensified.

● From *A Warmer World – the Greenhouse Effect and Climate*, Naturvårdsverket, Swedish Environmental Protection Agency (2003).

Decentralized sources

Renewable energies are indispensable in order to face the main problem we will have to deal with in the next few years, climate change. These energies have a lot of advantages: they don't produce greenhouse effect, they contribute to the energy independence of our country, they represent decentralized sources of production...

...I believe we are today at dawn of new challenges, to allow sustainability of our way of life and consumption. First of all is the energy challenge and climate change.

Quotation by Serge Lepeltier, French Minister of Environment (30 september 2004)

CLIMATTITUDE

utställning • www.raee.org

La planète chauffe et moi je fais quoi ?

The planet is
warming up,
what am I
doing about it?



The work on the exhibition was done in a close cooperation with Education people (teachers, decisions makers in education). In collaboration with RAEE, the partner AGEDEN was coordinating the realisation. The panels are voluntary simple and clear adapted to the young public.

A name has also been chosen for the French exhibition and the project in Rhône-Alpes region: «CLIMATTITUDE, La planète chauffe et moi je fais quoi?». This title means the link which exists between the climate and the actions one can make everyday, inciting to act !

Content of the exhibition

- eleven panels

- five interactive installations:

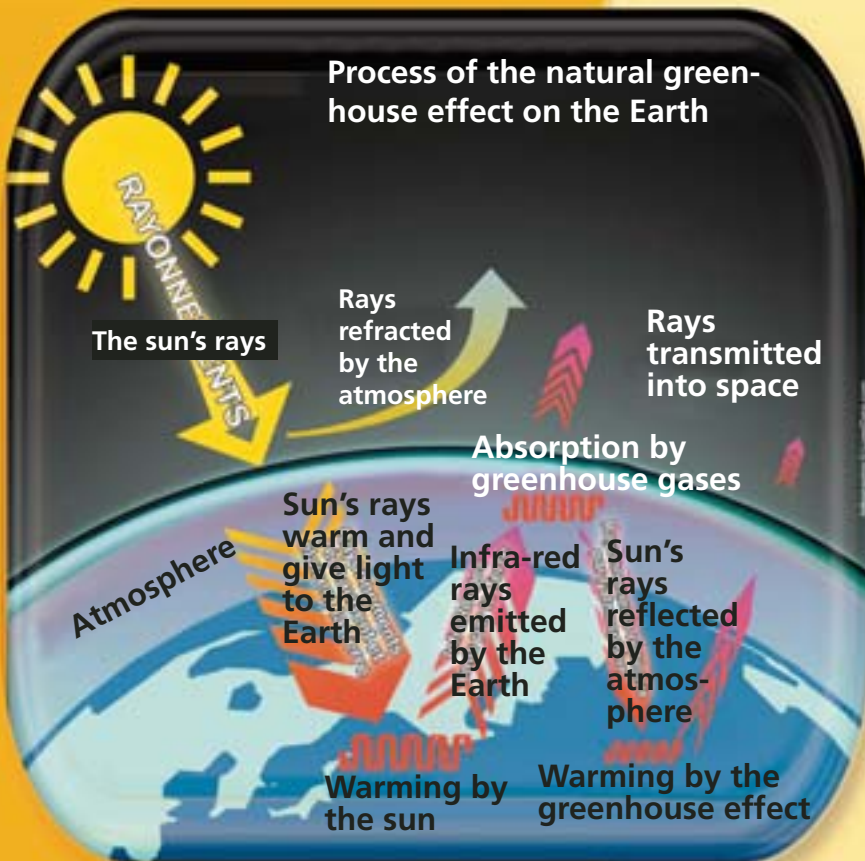
- an interactive explaining greenhouse effect with a removable plastic sphere, a lamp, and a temperature measurement system, showing the temperature gap with the plastic sphere and without,
- an interactive with a small windmill and multimeter showing the energy produced according to the speed,
- a photovoltaic panel driving a small train according to the light power,
- a PC showing a short slideshow on climate change,
- a PC running a cd-rom on renewable energies.



L'effet de serre c'est quoi ?

What is the greenhouse effect?

The sun is our star, which gives the energy (light and warmth) needed for life on Earth

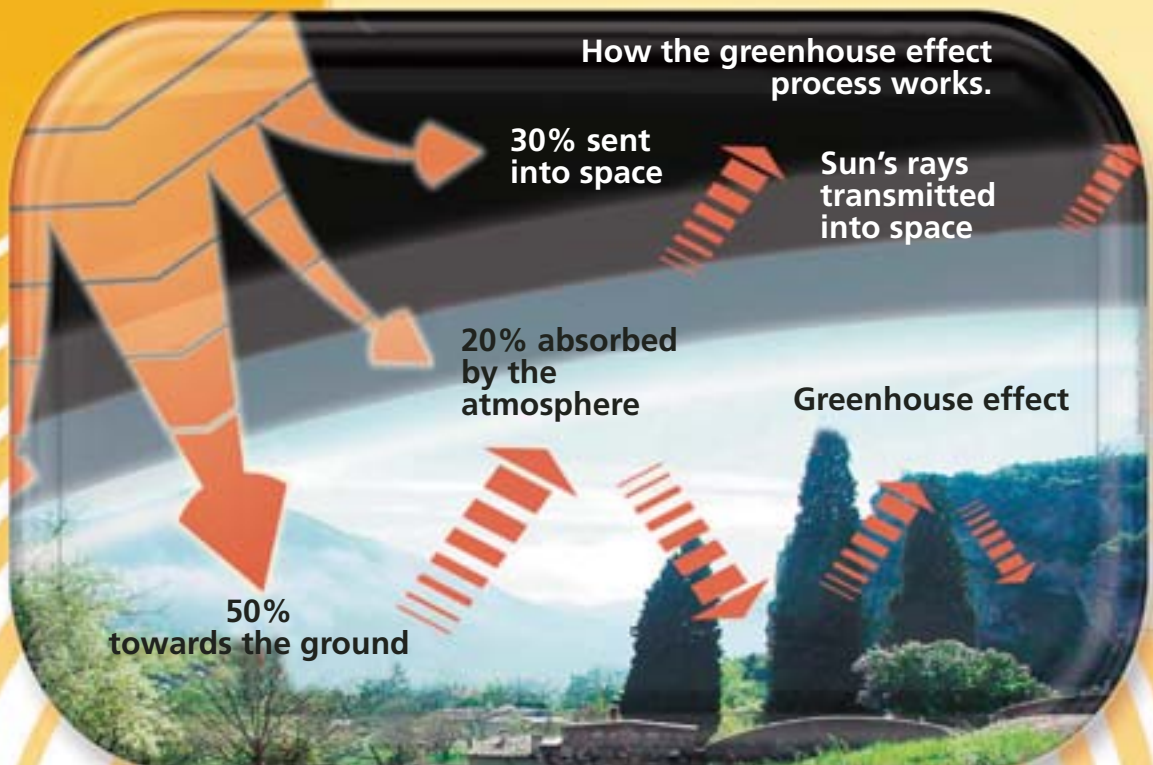


If the Earth had no atmosphere, the average temperature on its surface would be around -18°C



Fortunately, the Greenhouse Gases in the atmosphere, mainly made up of water vapour and carbon dioxide (CO_2) absorb and retain the heat produced by the surface of the Earth.

It's because of this phenomenon that the average temperatures reach a comfortable $+15^{\circ}\text{C}$



La Terre se réchauffe !

The Earth is warming up!

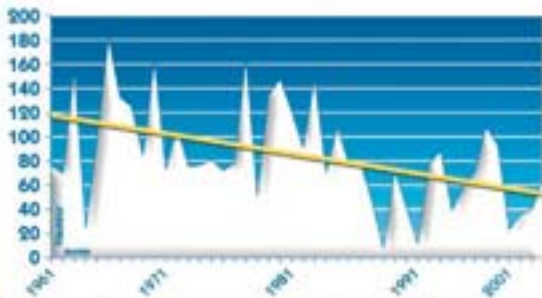


The Argentière glacier in about 1860



The Argentière glacier in 2004

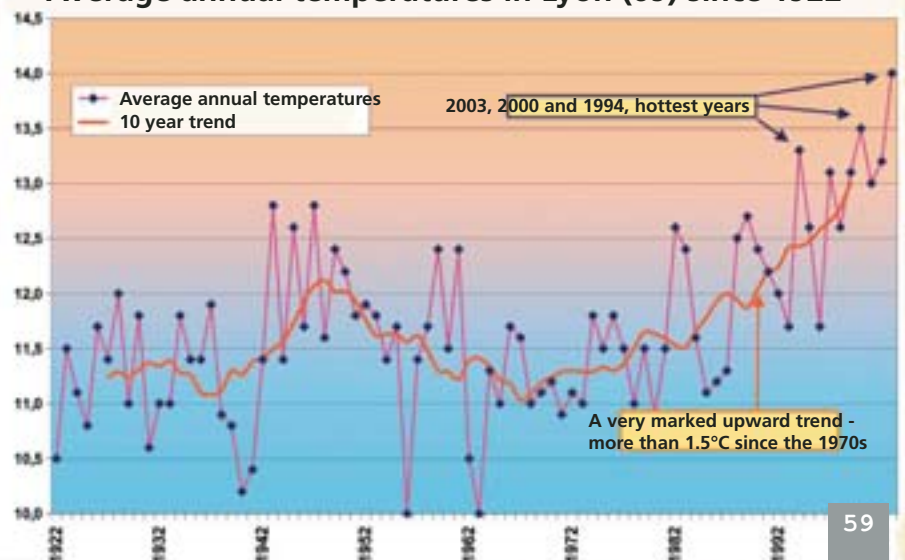
Variation of the average snow level at the Col de Porte in Chartreuse (38) since 1961



Weather forecasters state clearly that the weather is getting warmer. As such international scientific experts from the GIEC (a group of intergovernmental experts on climate change) have found during the course of the 20th century:

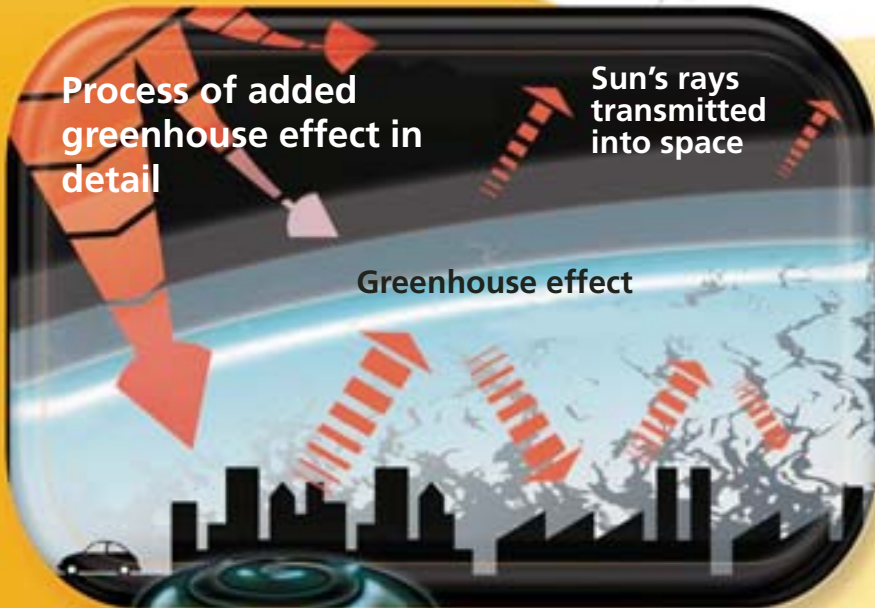
- an average rise of 0.6°C in world temperature ($+0.9^{\circ}\text{C}$ in France)
- a decrease of 10% in snow covering and withdrawal of alpine glaciers
- an increase of 5 to 10% in rainfall in the Northern Hemisphere
- a decrease in rainfall of 3% in Northern and Western Africa
- a thinning of the ice floe in the Arctic Ocean
- a rise of 10 to 20cm in the average sea level

Average annual temperatures in Lyon (69) since 1922



POURQUOI ça se réchauffe ?

Why is it warming up?



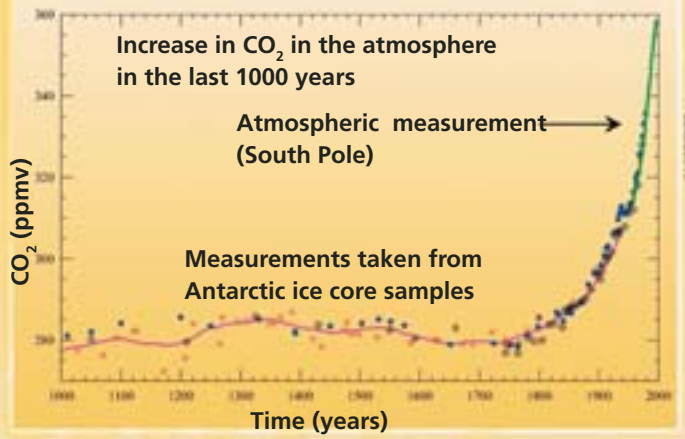
When we use fossil fuel energy sources (oil, gas, coal, etc.) we emit Greenhouse Gases, particularly carbon dioxide which is responsible for global warming.

So, since the industrial revolution (19th century), the use of these sources of energy has increased steadily, mainly in the Northern Hemisphere, and the concentration of greenhouse gases in the atmosphere is therefore becoming more and more significant.

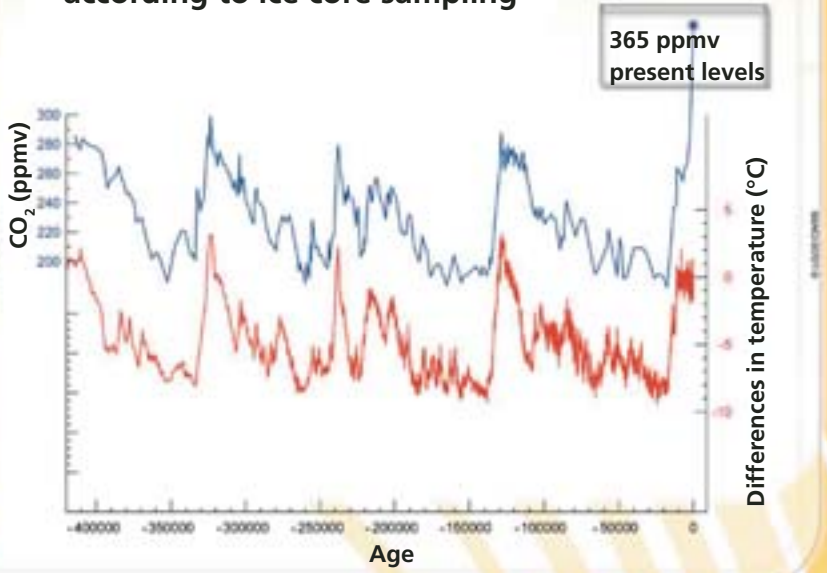
In fact, the concentration of carbon dioxide in the atmosphere is the highest it's been for 420,000 years.



Increase in CO₂ in the atmosphere since the year 1000



Temperature and CO₂ variation in the atmosphere since 420,000 years ago according to ice core sampling



LES CONSÉQUENCES DU RECHAUFFEMENT

The consequences of global warming

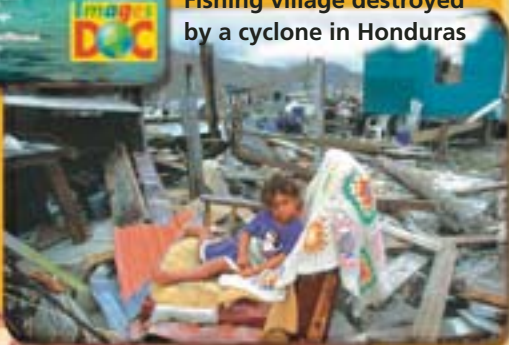
The average temperature on the Earth's surface is rising.

If this continues at the present rate, in 2100 it could increase by between +1.4°C and +5.8°C, according to the scientists' different predictions. That would cause major upheaval:

- worsening of climatic conditions (rainfall and drought) and disturbance in natural climate variations, causing storms, cyclones, floods and frequent heat waves.
- a change in the ecosystems (melting of mountain glaciers, upheaval in the water cycle, changes in the seasons, extinction of certain species and global threats to biodiversity....).
- a rise in sea levels, up to 88cm, threatening numerous populations living near sea level (Northern Europe, Bangladesh, Islands of Oceania)
- an increase in parasitic illnesses (malaria, etc.)



Fishing village destroyed by a cyclone in Honduras



Making barriers to stabilize the dunes and slow down the advance of the desert in Mauritania



Floods at the mouth of the Rhône (December 2003)

Can we just wait and do nothing?

Eh moi, qu'est-ce que je peux faire ?

What can I do about it?



I can be just as comfortable if I change my attitude and change my habits:

- at home and at school,
- when I travel around,
- when I choose what to eat.

The CO₂ emissions in France are about 9.2 t CO₂ per inhabitant.

Here are a few ideas to control energy consumption, thus reducing the CO₂ emissions:



At home I can switch off the TV every evening instead of leaving it on standby. That avoids:

12kg CO₂ per year per household

34,000 t CO₂ per year for the whole of the Rhône-Alpes region

10Mt* CO₂ per year for the whole of Europe



At home, I can replace 4 high wattage bulbs with low consumption light bulbs. That avoids:

42kg CO₂ per year per household

12,000t CO₂ per year for the whole of the Rhône-Alpes region

10Mt* CO₂ per year for the whole of Europe



I can walk to school or go by bike instead of going by car. That avoids:

300kg CO₂ per year per pupil

300,000t CO₂ per year for all the pupils in the Rhône-Alpes

22Mt* CO₂ per year for all the pupils in Europe

*Mt CO₂ = Millions of tonnes of CO₂

Et moi, qu'est-ce que je peux faire ?

What can I do about it?

I can be just as comfortable if I change my attitude and change my habits.



I can sometimes eat eggs rather than meat. That avoids;

70kg CO₂ per year per pupil

400,000t CO₂ per year for the whole of the Rhône-Alpes region

32Mt* CO₂ per year for the whole of Europe



I can take a shower more often than I have a bath. That avoids:

200kg CO₂ per year per pupil

1,100,000t CO₂ per year for the whole of the Rhône-Alpes region

87Mt CO₂ per year for the whole of Europe



I can heat my house at 20°C rather than 23°C and dress accordingly. That avoids:

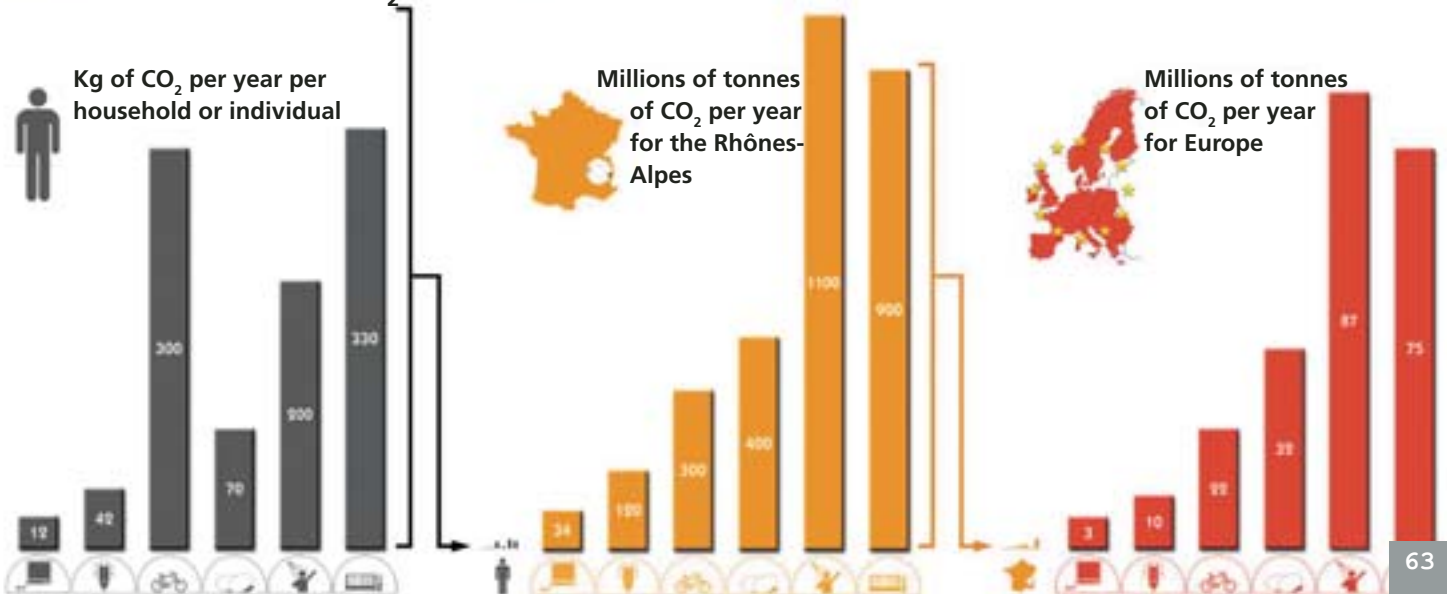
330kg CO₂ per year per household

900,000t CO₂ per year for the whole of the Rhône-Alpes region

75Mt* CO₂ per year for the whole of Europe

How about you? Any more ideas?

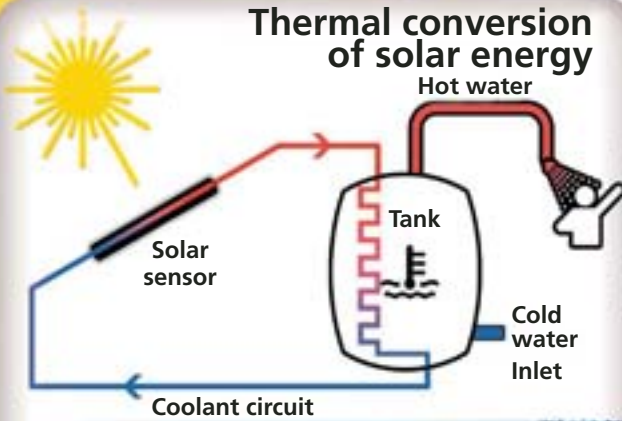
Reductions in CO₂ emissions:



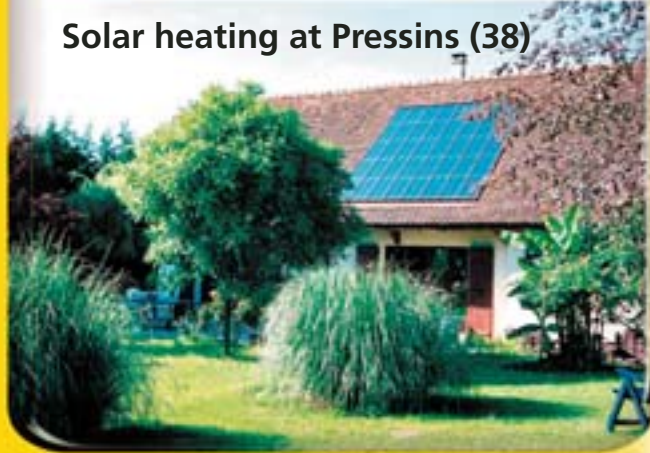
LES ÉNERGIES RENOUVELABLES: le soleil

Renewable sources of energy: the sun

Thermal conversion of solar energy



Solar heating at Pressins (38)



For example, I can use THE SUN'S ENERGY in two ways

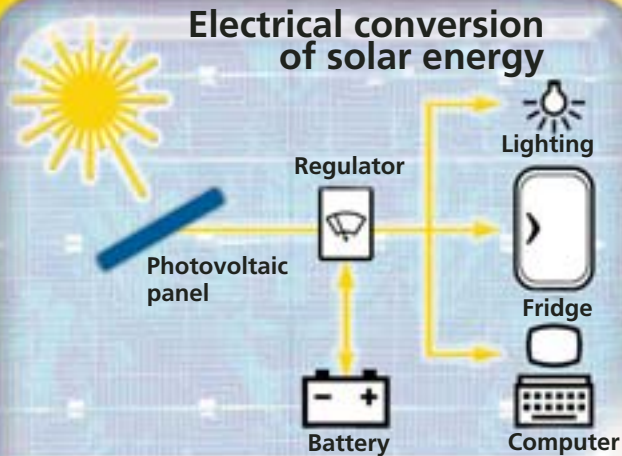
THERMAL SOLAR ENERGY

Black panels capture the sun's heat and warm up the coolant which circulates inside. The coolant exchanges its heat with the water contained in the tank. The water is then used for washing or heating. In our region, solar cells can provide a family with half of the warm water and heating it needs. (That can avoid the discharge of more than 1.2t CO₂ per year per family.)

PHOTOVOLTAIC SOLAR ENERGY

The blue sensors composed of silicon solar cells (semi-conductor) transform sunlight into electricity. This phenomenon is called "the photovoltaic effect". The electricity produced in this way is used for numerous applications, from the electricity supply for a pocket calculator to power stations producing electricity, not forgetting the supply to isolated places (houses, radio aerials etc.)

Electrical conversion of solar energy



Photovoltaic sensors at Echirolles (38)



At present, 0.03% of the energy used in Europe comes from the sun.



Les énergies renouvelables: le vent et l'eau

Renewable sources of energy: wind and water



For example, I can use WIND ENERGY

WIND TURBINE ENERGY

The energy of the wind is transformed into electrical energy by an aerogenerator or wind turbine. A group of several aerogenerators is called a "wind farm". In France, the windiest sites and the most suitable for setting up wind turbines are situated along the coast and in the Rhône Valley.

At present, 0.12% of the energy used in Europe comes from wind turbines.

For example, I can use WATER ENERGY

HYDRAULIC ENERGY

The water is stored in large reservoirs and in ornamental or artificial lakes. At the level of the dam, the water is released through a turbine. The turbine activates a generator which transforms the force of the water into electrical energy.

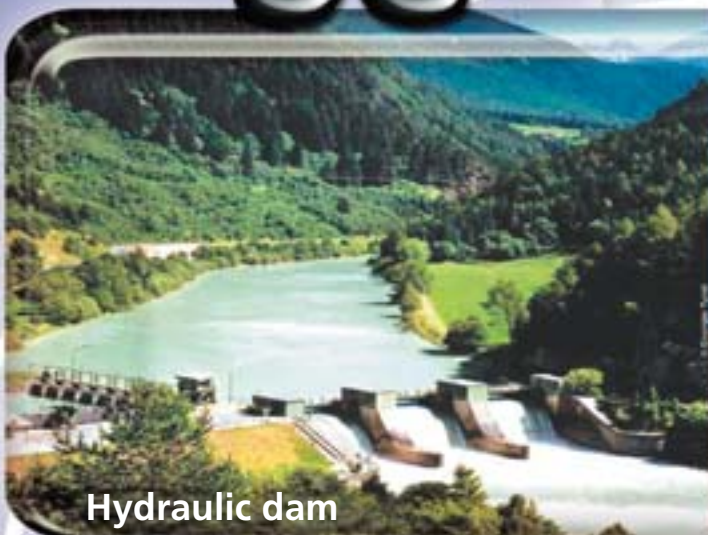
At present, 1.85% of the energy used in Europe comes from water.



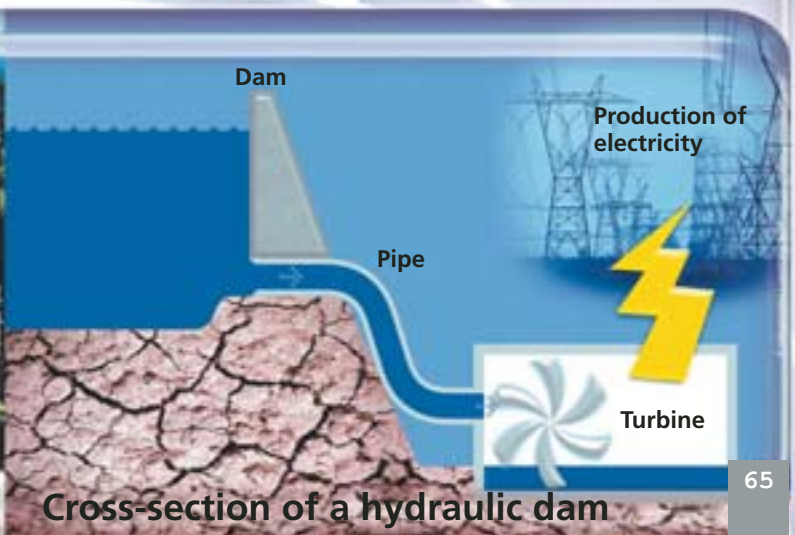
Wind turbines at Dunkirk



Manufacture of a wind turbine

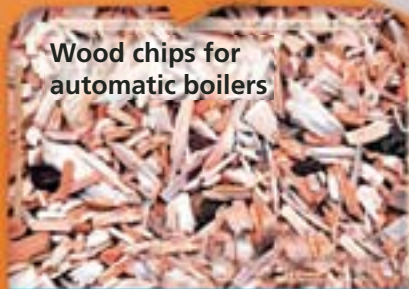


Hydraulic dam



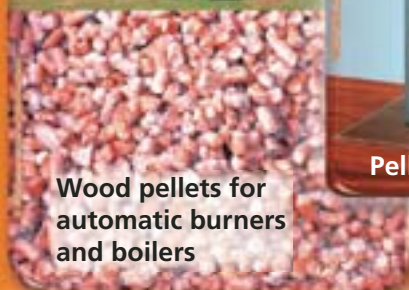
Cross-section of a hydraulic dam

Les énergies renouvelables: la biomasse et le biogaz



Wood chips for automatic boilers

Grinding in the Vercors (38)



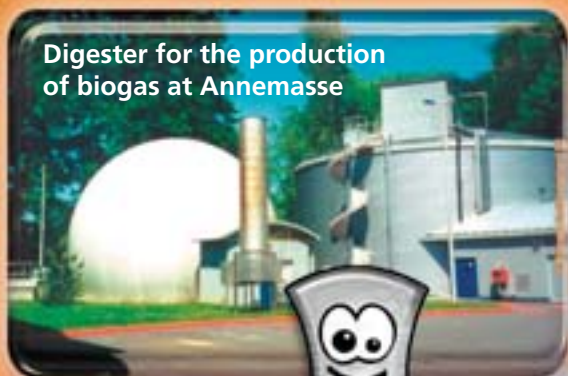
Wood pellets for automatic burners and boilers



Pellet burner



Fields of rapeseed



Digester for the production of biogas at Annemasse



Renewable sources of energy: Biomass and biogas

For example, I can use

BIOMASS ENERGY

Thanks to the sun's energy, trees and plants trap the CO₂, absorbing it while they grow (we call this phenomenon photosynthesis).

The energy stored is given back:

-in the form of heat when wood is burned in stoves, boilers and fireplaces

-in the form of mechanical energy in the combustion of fuel for transport

Fuels which come from agriculture are made from rapeseed, sunflowers, cereals and beet-root...

For example, I can use

BIOGAS ENERGY

The fermentation of organic matter contained in household waste, manure, sludge from treatment plants, etc. gives off a gas called methane. Just like natural fossil fuel gas, this biogas can be used for cooking, heating, and in vehicle motors.

At present, 3.73% of energy used in Europe comes from biomass and biogas.

L'avenir dépend de mes choix

The future depends on my choices

The countries of the North represent 1/4 of the world's population, but use 3/4 of its energy resources. At present, other countries such as China, for example, are adopting our economic patterns, and an increase in greenhouse gases seems likely.

The countries of the North, including Europeans, must learn to control their energy consumption and use clean and renewable energy so that the needs of all the peoples of the world can be met, today and in the future.

On an international level, certain countries have already started to reduce their CO₂ emissions, but it is up to all the countries and citizens of the planet to cooperate in the struggle against climate change.

So let's do everything we can quickly, and take action for sustainable development, let's adopt CLIMATTITUDE!

"We do not inherit the earth from our ancestors, we are borrowing it from our children"
(*Antoine de Saint Exupéry*)

The planet is warming up,
and what are you doing now
at home?
at school?
in the community?



- CLIMATTITUDE "La planète chauffe et moi je fais quoi ?" -

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Rhônalpénergie-environnement tient à disposition le détail des calculs expliquant les chiffres présentés - © Septembre 2004

GRASPING OF CLIMATE

An EU project

Pictures from the teacher-training programme at Teknikens Hus. Photo: Nicke Johansson.

EU collaboration

Four partners from three EU countries have participated in the project. The project partners have located one another via the EU's network of local and regional energy agencies (among others, via www.managenergy.net). Two of the project's partners have extensive experience of working with school-related activities. The other two are established energy agencies with a considerable experience of energy- and environment-related projects. The project partners are:

Teknikens Hus

Luleå, Norrbotten County, Sweden. Established: 1988

Mandate: Regional Science Centre whose objective is to stimulate interest in science and technology in primarily children and teenagers. An educational resource for the schools in the region.

Website: www.teknikenshus.se

NENET (Norrbottens energikontor AB, NENET, Norrbotten Energy Network)

Luleå, Norrbotten County, Sweden. Established: 1997

Mandate: Regional energy efficiency office whose task is to promote the use of renewable energy and environmentally sound technology in Norrbotten.

Website: www.nenet.nu

NEF (The National Energy Foundation)

Milton Keynes, England. Established: 1990

Mandate: Independent educational charity whose objective is to work for the more efficient, innovative, and safe use of energy and to increase public awareness of energy in all its aspects.

Website: www.nef.org.uk

RAEE (Rhônalpénergie-Environnement)

Lyon, Rhône-Alpes, France. Established: 1978

Mandate: Regional energy efficiency office whose task is to promote the use of renewable energy, energy efficiency and environmentally sound technology in Rhône-Alpes.

Website: www.raee.org

The official project start was a two-day kick-off at Teknikens Hus, in Luleå, in mid-March 2003. During these two days, the partners became acquainted with one another and a definitive structure was given to the project. Discourse during the kick-off touched on everything from differences and similarities between the participating regions to openhearted discussions about success and failure in the dissemination of information and knowledge concerning complicated and intersectoral social issues. At the conclusion of the meeting, the partners agreed unanimously that the project should speak to the individual directly, inspiring in him or her independent choices in everyday living that favour the common good – choices that make it possible for all who live on this planet as well as for future generations to live a good life. Quite simply, it is a matter of inspiring the people we meet and ourselves to try to save the world.

Partner meetings, among others in Milton Keynes, England, during



October 2003 and in Grenoble, France in September 2004, followed the kick-off. At the meeting in France, participating teachers from the three partner countries discussed the possibility of increased exchange among the schools of the regions and countries.

The French partner decided at an early stage to select some of the activities of Teknikens Hus and NENET for practical application in its own region. The activities in Rhône-Alpes were therefore implemented at a somewhat slower pace compared to activities in Sweden and England. However, RAEE deduced early that there was a great interest among French Education authorities for the work developed in the frame of the project.

The Project

The project has been carried out during the period January 2003 – June 2005. In addition to funding from the EU, the Swedish part of the project has been financed through support from the Swedish Energy Agency, Svensk fjärrvärme (a trade association of district heating companies), the Swedish Road Administration, Banverket Northern Region (the national Swedish rail administration), the County Administrative Board of Norrbotten and the City of Luleå. Many other national and regional organizations in Norrbotten (among them, Luleå University of Technology) have also contributed ideas, funding and equipment to the project's interactive exhibition, "Grasping of Climate – a sunny story". IEH (the Swedish Institute for Ecological Sustainability), whose director general has been a member of the project's reference group, has also provided support and assistance.

The French part of the project has been funded by Région Rhône-Alpes and Direction Régionale de l'Environnement Rhône-Alpes (DI-REN). In England, the Government Office for the East of England (GO-East) has assisted the project financially. Other co-operative partners in England have included the Environmental Education Managers in Norfolk, Suffolk and Cambridgeshire, and the Milton Keynes Museum.

Work within the project has always been characterized by a great openness towards new ideas and streams of thought concerning climate change and its underlying factors. Since there has never been any ambition that the project would result in an unequivocal answer to what is perhaps the greatest and most serious environmental question facing the world, work has been suffused with a willingness to accept new ideas and new ways of thinking. "Grasping of Climate" has thereby lived up to the motto that "the journey, itself, is the destination".

Grasping climate in school

The project has been conducted in different phases. After the initial **detail planning** of the Swedish part of the project was completed, Teknikens Hus in Luleå arranged a

teacher-training programme in climate and lifestyle issues. Teachers from throughout Norrbotten were invited to take part in a course consisting of three whole days and evening seminars that featured lectures by guest speakers and practical exercises. Several teachers from the northern community of Kiruna had to complete sections of the course in Kiruna, owing to the great distance to the coastal city of Luleå (about 300 km).

To allow participating teachers to work with their new knowledge and apply it in their own teaching between course meetings, seminars were held throughout the entire autumn term of 2003. During these seminars, teachers were able, among other things, to acquaint themselves with current research findings, conduct laboratory experiments, meet and discuss with colleagues, gain inspiration and assemble tools and material for working with climate and energy issues in school.

Teachers were also given the task of "grasping climate" in their own teaching, and were then required to submit an account of their experiences to Teknikens Hus. As a special incentive for the teachers, several of the organizations represented in the project's Swedish reference group took it upon themselves to award prizes, in the form of study visits, lectures and teaching aids, to the teachers or schools that succeeded in achieving the "best" grasp on climate.

In England, NEF conducted teacher training in climate and lifestyle issues in close collaboration with Norfolk County Council's environmental education group and Oxfordshire County Council. These programmes were carried out in January and February 2004. In both cases, NEF used its own demonstration bus, "The Green Energy Machine", to present sustainable energy technologies and interactive drama.

Experiences of the project's teacher-training programmes in Sweden and England were adapted to French conditions and subsequently used by RAEE in its own region, in order to implement seminars for teachers.

"A sunny story"

While the teacher-training programmes were being conducted, planning and **construction of the exhibition** "Grasping of Climate – a sunny story" took place. It was decided from the outset that this would be a public, "hands-on" exhibition, as is customary for Teknikens Hus. Children and other visitors would be able to experiment with the components while at the same time being free to choose their own path through the exhibition. Teknikens Hus also works according to the principle that each exhibition should stand on its own, and that it should be possible to grasp its purpose and function with only basic knowledge.

Since the guides and technicians at Teknikens Hus had never focused so intently on energy use and its implications for climate change, the role of lifestyle in the context of the latter and the goal of long-term sustainability, much of their preparation involved study of these complex and interdependent issues. The competencies of NENET and other project partners and networks were invaluable in this regard.

Planning and construction of the exhibition were done in close



collaboration with experts in the fields of energy, environment and transportation, many of them at Luleå University of Technology. Several companies contributed expert knowledge and equipment for the exhibition. The project's French

and English partners were also active during this phase.

In all, about 60 to 70 people of varying backgrounds and with different competencies have contributed to the creation of the exhibition.

The exhibition was built in three interconnected sections. In the first, which acts as a framework for the entire exhibition, the visitor is given an insight into the energy principle and how our current use of fossil fuels such as oil, coal and natural gas influences the greenhouse effect and the Earth's climate. The sun is presented as mankind's eternal energy source, a source of energy that can even be used indirectly in the form of renewable energy sources such as wind power, hydropower and bio energy.

The second part of the exhibition features technical solutions and personal choices related to food, transportation, electricity consumption, etc., that can contribute to long-term sustainable development for all life on Earth. The energy-technology exhibits presented include solar panels connected to heat storage media, solar cells, wind power, cooking with homemade wood pellets as a heat source, hydropower and a hydrogen-driven fuel cell motor.

In the third and final part of the exhibition, which consists of a combined theatre and film-viewing room, visitors watch a Canadian-made animated film featuring, among other things, several sheep that are evidently worried about what humans are doing to the climate. This room is also used for staging interactive drama with the participation of teachers and small groups of children and youths.

The exhibition at Teknikens Hus, for which texts and captions were presented in Swedish, English and French, was officially opened on April 2nd 2004. EU environment commissioner Margot Wallström's adviser, Dr. Minna Gillberg, represented the European Commission.

Ian Bradley represented the project's English partner, NEF.

During this phase of the project, NEF concentrated its efforts on renewing and adapting the existing mobile exhibition "The Green Energy Machine", which features many interesting and topical exhibits, including a game that shows students how much carbon dioxide their energy use creates, a bicycle with which visitors attempt to generate as much electricity as possible, as well as a display that demonstrates how choice of colour can influence the heat absorption capacity of a surface exposed to sunlight.

In collaboration with teachers and education authorities, RAEE built its own small climate exhibition, much in the same spirit as that of Teknikens Hus in Sweden. The French exhibition, entitled CLIMATTITUDE, *La planète chauffe et moi je Fais Quoi?*, illustrates the connection between ongoing climate change and the choices we humans make on a day-to-day basis. It comprises a number of interactive displays consisting of a house and garden surrounded by a plastic dome symbolizing the greenhouse effect, a solar-powered model train, a model wind-power generator, PC stations with a multi-image presentation from the Swedish exhibition and a CD, about renewable energy sources, that RAEE had produced previously.

The exhibition at Teknikens Hus was in operation until November 7th, when it was dismantled for repairs and maintenance. Owing to the positive response to the project, the exhibition was sent out on tour, both in Sweden and abroad.

Teknikens Hus used direct mail and its network of personal contacts to invite schools in the northern Swedish counties of Norrbotten and Västerbotten to visit the exhibition. Throughout the exhibition period, personnel were occupied with maintaining and improving the exhibition technically to make it even more durable. According to an unwritten rule, even though makers of science-centre exhibits may think they have foreseen all the possible ways in which their exhibit will be handled, the visitors, who are most often children, are guaranteed to come up with several new alternatives.

To increase interest in the different parts of the exhibition, some of the visiting students were given quizzes, the answers

to which were to be found in the exhibition. This helped to increase the students' involvement. After their visit to Teknikens Hus, the students were able to take the completed quiz back to their classrooms and use the information in continued study of climate problems and solutions.

In England, a tour of "The Green Energy Machine" coincided with the exhibition.

RAEE's exhibition was displayed in several schools and centers for environmental education during the school year 2004 – 2005. All the materials linked to the exhibition (exploration book, notice for teachers...) were put at disposal on the web.

Surna and Werna The **interactive drama** production, mentioned above, is entitled *The Earth – our only one*. During the period April – October 2004, it was played for different school groups of students aged 10-18, of which the majority were 10-12 years old. Teknikens Hus uses interactive drama as a means of activating children in a setting in which they learn many new things without feeling they are being taught. For the children, the whole thing becomes a fun and exciting performance in which they, themselves, can respond, suggest solutions, vote on various issues and speculate about what would happen if they and their friends acted a certain way in different situations. At the same time, they are often totally unaware that they are increasing their own knowledge.

The interactive drama project was led by two teachers, one of whom assumed the role of the calm and collected climate guardian Werna (whose name in Swedish is a play on the word defend). The other teacher played the role of the unruly and extroverted Surna (whose Swedish name denotes acidification). In their conversations with these two characters, the children have had to take a stance in relation to how they, themselves, live their lives and the consequences their actions have for the climate. At the same time, by assuming the role of either carbon dioxide molecules or sunrays, they have gained a deeper insight into what happens in the atmosphere.

All the school groups participating in the drama project have received study material as an aid to further climate work in the classroom. This material begins with the words: "Many thoughts: Does it matter



what I do? This is where we must think again. Each one of us is a drop in the ocean, but the ocean is made up of all the drops". The aim is to make everyone who has participated in the project feel as if everything they do matters – even the little things. The study material contains seven suggestions for how teachers and students can continue working with climate in school.

NEF chose to develop an interactive play that had been produced earlier in the context of the Green Energy Machine project. Depending on the age of the students, different components of the play can be added or removed. The emphasis in the new sections is on helpful hints for saving energy, description of various climate scenarios and

understanding the greenhouse effect.

RAEE selected role-plays used in the Region and inserted them in the French guidebook for teachers put at disposal on the internet.

Workshops In conjunction with the exhibition and interactive drama, Teknikens Hus has also conducted **pedagogical activities** in the form of three different workshops for students in the age groups 13-15 and 16-18. The content of workshops has varied and the sessions have been 45, 60 and 90 minutes long. In these workshops, students have worked with various value and creativity exercises such as "hot seat" and "four corners" as well as participating in role-play activities and acting selected parts of the interactive drama with Surna and Werna. In role-plays, students have assumed different roles in debating environment and climate issues from different perspectives.

Students have also participated in lectures arranged in conjunction with the project, some of which have been given at Teknikens Hus while others have been held at the schools. During school breaks, Teknikens Hus has also given children the opportunity to build their own windmills, test miniature power stations and build their own mini-universe, etc.

Together with Luleå University of Technology, The Swedish Road Administration, Svensk fjärrvärme, Teknikens Hus invited secondary-school students of the region to participate in a theme week on sustainable development. The programme included several lectures, seminars and workshops on energy and climate issues. Teknikens Hus also arranged a debate on the theme "Sustainable development – for whom?", which gave the high-school students the opportunity to discuss climate and lifestyle with a panel of experts. The week-long programme, in which each secondary-school student was able to spend a whole day learning about and discussing these issues, was such a great success that Teknikens Hus decided to arrange similar theme days in the future.

In England, students were able to try out NEF's new demonstration facilities for renewable energy. For example, one of these enables students to work on their own computers with wind-power data from NEF's own wind-power generator.

During the course of the project, Teknikens Hus realised that a planned tour of the exhibition should focus on quality. Following interviews and project evaluations, it became evident that many teachers and students had found it difficult to grasp the complexity of the climate problem and to see their own role in what is now happening on the planet. Therefore, it was decided that a **tour** would be arranged whereby instructors from Teknikens Hus would visit the schools to assist teachers and students with full theme days. The aim of these theme days was to encourage the personal commitment of each individual.

The tour theme days consisted of a condensed version of the interactive drama with Surna and Werna and exercises related to energy.

In England, different forms of educational activities were also arranged in about half of the locations visited by The Green Energy Machine during this period.

In France, a selection of pedagogic activities and pedagogic sequences has been made and put at disposal in a guidebook for teachers on the internet. The tools for visiting the exhibition (for teachers and children) have also been used during the school year 2004-2005.

More teachers The overall response from teachers involved in the project has been positive. During the autumn of 2004, Teknikens Hus invited the participation of even more teachers by offering a series of **seminars and lectures**, some of which were mini-workshops for teachers working with pupils aged 9 to 12. During these workshops, teachers were given the opportunity to test a number of practical exercises, for example, capturing solar energy.

In collaboration with local authorities and organisations, NEF has arranged seminars on renewable energy, energy efficiency and climate change for teachers active in schools that have a reputation for working with sustainable development in their teaching. These seminars have featured theoretical lectures as well as practical exercises using simple hands-on equipment and collected data. The teachers have also been informed of how interactive drama can be used to facilitate students' grasp of complicated interrelationships.

In France, a main seminar for the teachers was organised by RAEF in cooperation with the academy reaching 150 teachers interested in the topic of climate change. The goal was to raise consciousness about this issue and inspire teachers to work with the subject in their classes helped by the materials produced in the frame of the project.

Assessments of activities conducted by Teknikens Hus indicate an overall positive response from participating teachers and students. Aside from the fact that a majority of the students felt they had learnt something new from the project, many of the teachers expressed their great appreciation for the interactive drama, which, they felt, not only helped the students but also helped them, personally, to resolve



many questions to do with the growing climate problem and our modern lifestyle. Many of those who took part in the project also expressed a desire to do something to reduce human impact on climate.

The results of the project have been **disseminated** throughout the project period. Via their networks, the project partners have spread information about the project at all levels, locally and internationally. The most effective information transfer has been via word of mouth among the thousands of people in France, England and Sweden who have in one way or another encountered the project. Furthermore, the project has attracted attention in regional and national news

and information media and in numerous international, national and regional conferences and seminars.

Before the project was concluded, the experiences of the project partners, as well as of a number of other participants, were recorded and compiled in a **guidebook**. Hopefully, this book will inspire teachers in Europe and encourage them to "grasp climate" in the schools.

(In fact, you are now holding the book.)

And as is customary in these situations, upon conclusion of the project, a **final report** was submitted to the European Commission.

Conclusion In the two and a half years during which it was realised, the project "Grasping of Climate" activated at least **23,000 people** from three EU countries in a direct, joint European effort to "get a grasp on climate". Of those directly involved in one or several of the project's activities, about **1000 were teachers** and **22,000 students**. In addition, many others including parents and friends were indirectly affected. If we assume that each person who was directly involved spread information about the project and/or the importance of personal choice in the context of climate problems to at least three acquaintances, then we can safely say that the project's message reached a **further 70,000 people**.

To these, we can add **the 70,000 public visitors** that were registered by Teknikens Hus in Luleå in the seven-month period during which "Grasping of Climate – a sunny story" was exhibited, as well as those who visited the exhibitions in England and France. In the following years, as the exhibition from Teknikens Hus tours throughout Sweden and Europe, even more people will be influenced.

This means that, in the final analysis, a few years from now, when all the touring has been completed and the exhibits have been packed up for the last time, the project may well have reached hundreds of thousands of Europeans. In that case, the project partners can be very pleased with the result. Again, the main goal has been to inspire ourselves and the people we meet to try, if just a little, to save the world – and to have fun while doing it.

