Inventor

Scout Handbook

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Science.dk
Scout lex 1998
The Ladybug 1999 DDS
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Hello!

Welcome to.

Your Junior Leaders have chosen that you need some meetings with the "Inventor" badge.

It is great to be able to invent new things, or come up with new solutions to the problems you experience as a Scout. This handbook will provide some suggestions for ways to solve some problems.

Can YOU invent a better way to solve the problems?

Contents

Topics: 6

How do you become good at inventing? 7

Nature's own energy sources. 9

How the wind, which always blows anyway, can be used to power a dynamo or machine. 24

Build your own paper windmill. 26

Make a windmill that can generate electricity 30

How the sun's rays can heat water, and get an idea of how they can be used to create electricity. 31

A solar cooker 31

A solar oven 32

Power from the sun (solar cells) 33

How can you be more sustainable when you are a scout and at home? 37

CO2, energy sources, environment and climate. 39

CO2 and other greenhouse gases 39

Energy sources, environment and climate 43

Ideas for cool things. 45

Hot water for the shower 45

A “refrigerator” 46

A wood-saving stove 47

A carrier for firewood 48

A patrol diary: 49

Emergency bag 50

Oven 51

Heating box 52

Solar collector for patrol 53

Invent a chair for summer camp 54

Ideas for your own inventions: 55

Own thinkers and ideas: Fejl! Bogmærke er ikke defineret.

We are scouts because it's fun.
- and that's the most important thing!

But for it to be fun, you also have to put in the effort. It's often the activities that require the most effort that provide the best experience.

You will find that the more you practice, the easier and more fun it will be to solve the various tasks that your patrol leader or scout leader sets.

Topics:

In this small booklet we will review:

- Nature's own energy sources.
- How the wind, which always blows anyway, can be used to power a dynamo or machine.
- How the sun's rays can heat water, and get an idea of how they can be used to create electricity.
- How water can be used to power machines, and get an idea of how hydroelectric power can be used to generate electricity.
- How you can save energy when you are scouting and at home.
- Energy sources, environment and climate.
- Cool stuff for summer camp.

How do you become good at inventing?

“That's a really good question”

Some people believe that you are either an inventor or you are not.

If this is true, how can you take the inventor badge if you are not a born inventor?

The truth is that no one is born an inventor. Coming up with solutions to problems is something we all do every day, and most of the time, we don't think about it.

For example, in school you are presented with a problem, and you have to find a solution to get the right answer. In scouting you are constantly asked to find a solution.

- Build a dining table.
- Light a fire without using matches.
- Solve a code/secret message.

We probably think of inventions mostly as something physical that solves a problem.

That is, a new thing that makes your and my everyday life easier and better. But in this book, you are also an inventor if you can come up with a solution to a problem, without your solution having to be a physical thing.

“Well… how do I become good at inventing?”

The short answer is that you only become one by practicing – leading by doing .

This handbook cannot give you solutions to all the problems that you as a scout may encounter, but it will provide some examples that you can think about and perhaps use as a basis for creating (inventing) your own solution.

Nature's own energy sources.

Nature (Earth) is full of energy, and much of our energy comes from the sun. Sun, wind and biofuel are energy sources that directly or indirectly come from the sun.

There are many sources of energy, for example:

- Solar cells
- Hydropower plants
- Wave energy
- Solar heating system
- Wood chip power plants
- Biogas power plants
- Coal power plants
- Waste-to-energy plants
- Wind turbines
- Geothermal energy
- Tidal system
- Straw power plants
- Natural gas power plants
- Oil power plants
- Nuclear power plants

The different sources of energy have different impacts on nature and the environment. It has therefore been decided to divide the sources of energy into two groups.

1. Renewable energy
2. Non-renewable energy

The difference is that renewable energy sources continue to be formed, and non-renewable sources of energy can only be used once, and then they disappear.

Renewable sources of energy are:

Solar energy.

- Solar cells – here electricity is generated using sunlight.

Image 1is from sdu.dk

- Solar heating – here hot water is made using sunlight.

Image 2is from sdu.dk

Wind energy.

- Wind turbines – here electricity is generated using the wind.

Image 3is from Altinget.dk

Hydropower.

- Hydropower plants – here electricity is generated using flowing water.

Image 4is from alienenergy.dk

- Wave power plants – here, electricity is generated using the movement of waves.

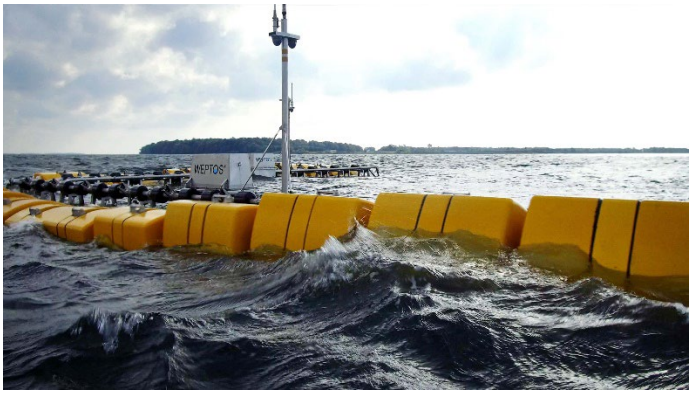


Image 5is from tvsyd.dk

- Tidal power plants – here electricity is generated using tidal movements.

Image 6is from energy-supply.dk

There is also a type where a dam is built across a fjord and the water is utilized in the same way as a hydroelectric power plant.

Biofuels.

The group of biofuels works in the same way, using plant material or manure from farm animals to produce electricity.

- Biogas

Image 7is from naturfaget.dk/

Manure and organic household waste are made into biogas, which can be used in a gas generator to produce electricity.

- Straw

Picture 8is from fritidsmarkedet.dk

Straw can be burned in a furnace (electricity and/or heat), or used to make biogas.

- Wood chips

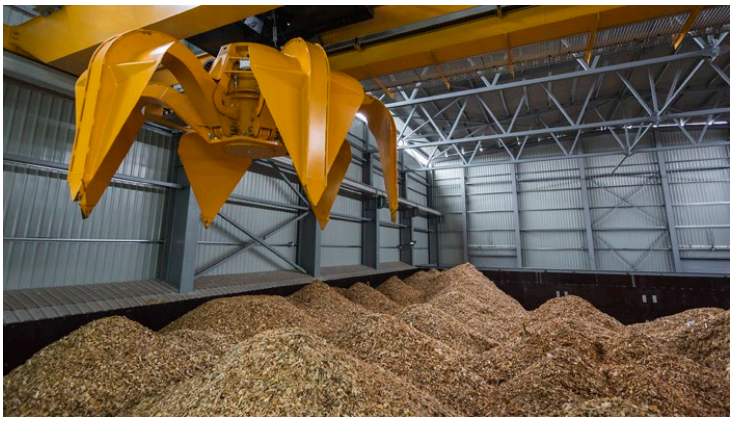


Image 9is from sodra.dk/

Wood chips can be burned in a furnace and can be used to generate both electricity and heat.

Geothermal energy.

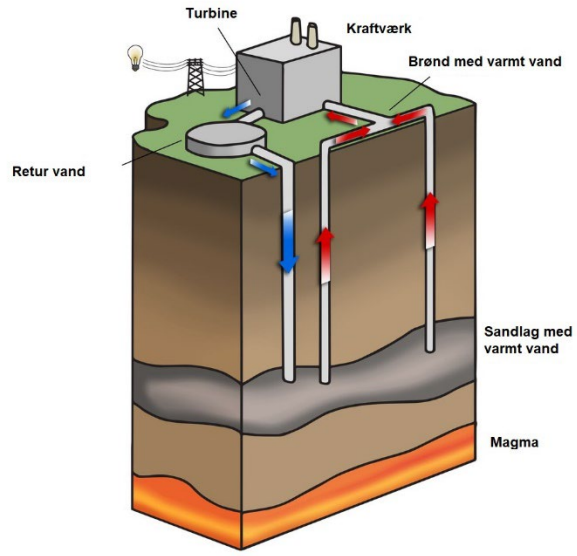


Image 10is from da.wikipedia.org

- For electricity production
  In Iceland and other places where the temperature in the underground is very high (hot), it is possible to use geothermal energy to drive electric turbines to produce electricity.

- For heat production
  In countries with low temperatures underground (e.g. Denmark) it is not possible to generate electricity, but it is possible to

generate district heating. There are 3 geothermal heating plants in Denmark.

You can find them here:

- Thisted with a geothermal heat output of 8.6 MW
- Copenhagen (Margretheholm) with an output of 14 MW
- Sønderborg with an output of 10 MW.

However, only the plant in Thisted is in operation. The other two plants are out of operation due to technical problems, and there is no immediate prospect of them being able to come into operation without significant new investments (more money).

Non-renewable sources of energy

Burning stored CO2

- Coal

Image 11is from Aalborg Municipality.

Coal is organic material (dead plants) that has been exposed to pressure and temperature for many years (millions of years). The problem is that the coal contains CO2 which is released. To make electricity, or heat, the coal is burned in a furnace. In the furnace there are some water pipes that make it possible to turn the heat into steam, or hot water. The steam is used to drive an electric

turbine, and the hot water is used to make district heating.

- Natural gas

  Natural gas is plants and animals that have been exposed to heat and pressure, and where the organic material has been converted into gas (a bit like biogas, just over many years). Natural gas is not worth as much money as oil and is still in many places just vented or burned off when the crude oil is extracted.

- Oil

  Oil or crude oil, like natural gas, has been formed by pressure and temperature over many years. Oil is more valuable than natural gas because it is easy to transport and contains a lot of energy per volume. It is also easier to convert crude oil into other products, such as plastic.

- Waste

Waste or Waste Incineration is a source of energy that we cannot call renewable, as it depends on what is in the waste that is burned. In the old days, some people found that waste filled up too much if they just threw it in a pile.

Picture 12 The dump in Sisimiut 2014

So some people came up with the idea of burning it, then all that's left is ash, and the ash doesn't take up as much space as the waste. Later they found out that the heat

from the combustion could be used to make district heating (hot water). Later some people found out that they could also get enough hot water to drive a turbine and get electricity from the waste. Today we try to avoid creating waste, and the waste that we do create, we try to sort so that there is as little waste as possible that has to be burned.

Image 13comes from skiltedesign-shop.dk/

Disposable sources of energy

You should understand “Non-renewable resources” as materials or substances that will not be regenerated in the foreseeable future. Much of the oil and natural gas we burn today was formed millions of years ago, whereas wood from a tree can be regenerated within 20, 30, 50, 100 or 200 years depending on the type of tree.

Nuclear power

Nuclear power today primarily uses uranium as fuel. The uranium found on Earth was created when our solar system was formed, and no new uranium will be formed until our sun burns out and explodes (it absorbs the earth before that happens). Uranium and the other radioactive substances are therefore a “one-time source” of energy. Once we have used them, no more will be formed until about 3.6 billion years later, when our sun dies. Nuclear

power extracts the energy that is released when the nucleus of radioactive substances splits in two. A lot of heat is produced, which can then be used to drive a turbine that can make electricity.

We are <u>NOT going</u> to build our own nuclear reactor as a scout. A scout has already done that.

Radioactive Boy lives! Student who sparked panic in 1996 after he built a nuclear reactor in his shed survived

- As 'The Radioactive Boy Scout' he built a nuclear reactor in his potting shed two decades ago and shut down a neighborhood of 40,000 in 1996
- Says the $60,000 clear up and burying his 'glowing shed' in the desert was just 'a total overreaction'

Hazard: Moon-suited EPA agents found 1,000 times the amount of normal background radiation

How the wind, which always blows anyway, can be used to power a dynamo or machine.
You've probably seen wind turbines all over the landscape.

The windmill is an invention that has had a great impact on people throughout history. It has been used both to pump water out of the ground and to grind grain into flour. It is believed that the mill was invented in the 9th century in what is now Iran and Afghanistan. The first windmills came to Denmark in the 12th-13th centuries. They were called stub mills and had the problem that if the wind changed direction, the entire mill had to be moved. Therefore, they were replaced by the Dutch mill, whose upper part could be rotated.

Pipe mill – a stump mill

Nordskovmølle – a Dutch mill without its blades

It was Poul La Cour who built the first Danish windmill that produced electricity in 1891. So windmills that produce electricity are not a new invention.

Have you tried making a windmill?

If not, now is the time☺

Build your own paper windmill.

Make a small windmill out of paper.

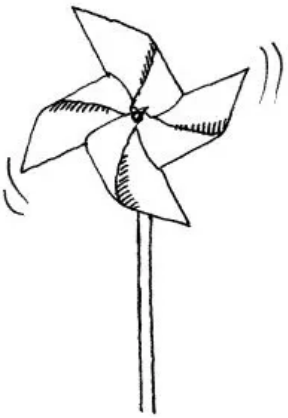
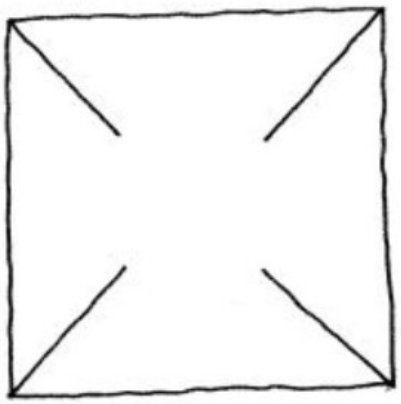


Image 14is from https://skoven-i-skolen.dk/aktiviteter/vindmoelle-af-papir

You can't see the wind, but you can feel it and use it to create energy.

<u>How to do it</u>

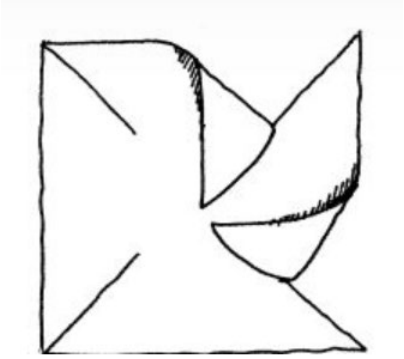
Cut yourself a square piece of paper.

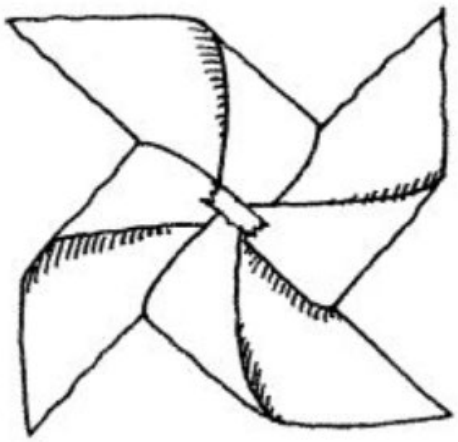


If you want your windmill to have a color, color it before you start cutting the paper .

Cut a slit from each corner, as shown in the drawing.

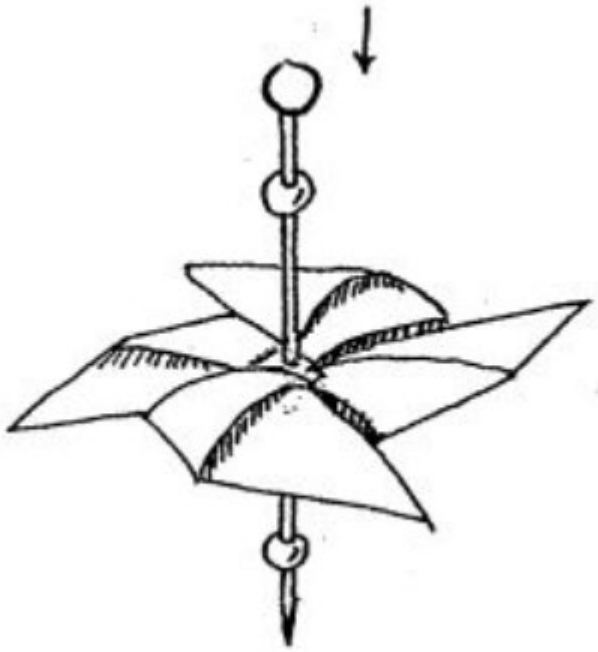
Fold the windmill as shown in the drawing.



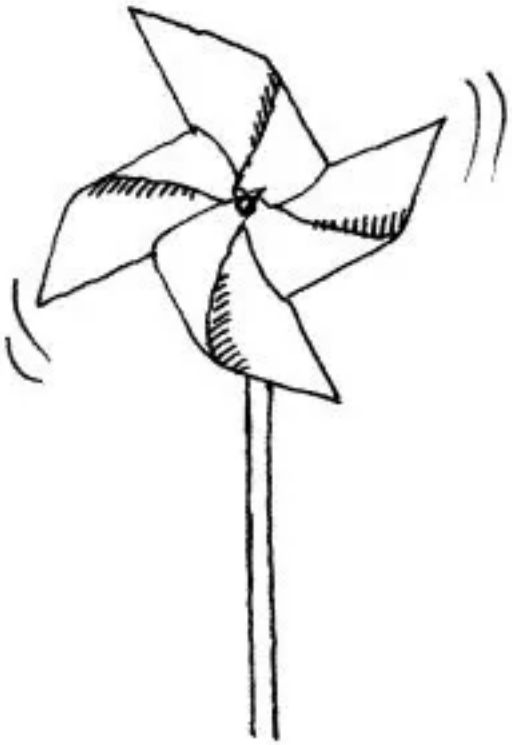


You can try folding the corners in - and securing them with a piece of tape. It is important that you fold the corners in from the same side all the way around. But you don't have to use the tape.

Assemble the mill
Place the first bead on the needle. Then fold the corners in and secure with the needle. Place the second bead on.



Attach your windmill to the pin. Don't press the pin too hard, or the windmill won't be able to turn.

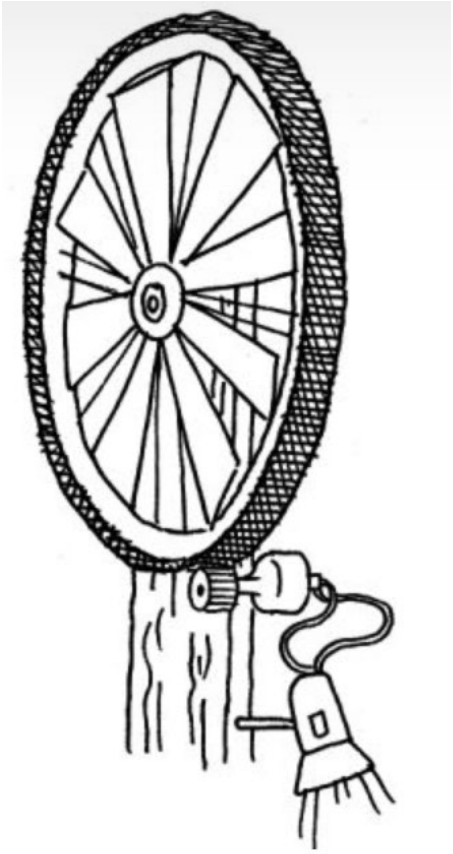


Out in the wind

Take your windmill outside and hold it up in the wind. It should face the flat side directly into the wind. Why do you think it spins? Why do you think you can make electricity with windmills?

Now you've tried making a simple windmill, now it's time for you to make one that can produce electricity.

Make a wind turbine that can generate electricity



There are many different ways you can build a windmill. One of the easiest is to use a bicycle wheel and then attach blades to the spokes. Remember that the blades must be angled or it won't turn. Find an old bicycle dynamo and just hang it up so you can get power.

Can YOU invent a better windmill than the one shown here? For example, one that your patrol can take to summer camps and use to charge your cell phone.

How the sun's rays can heat water, and get an idea of how they can be used to create electricity.

The sun can be used for many things. You can also use the sun's rays to cook food. You can cook food in a solar oven , or a solar cooker. If you haven't tried this, it's time.

A solar cooker

Image 15is from skoven-i-skolen.dk

A solar cooker can boil water and food using the sun's rays. It's a super smart invention that can save firewood and energy.

Parabolic

dish A solar cooker consists of a shiny dish that

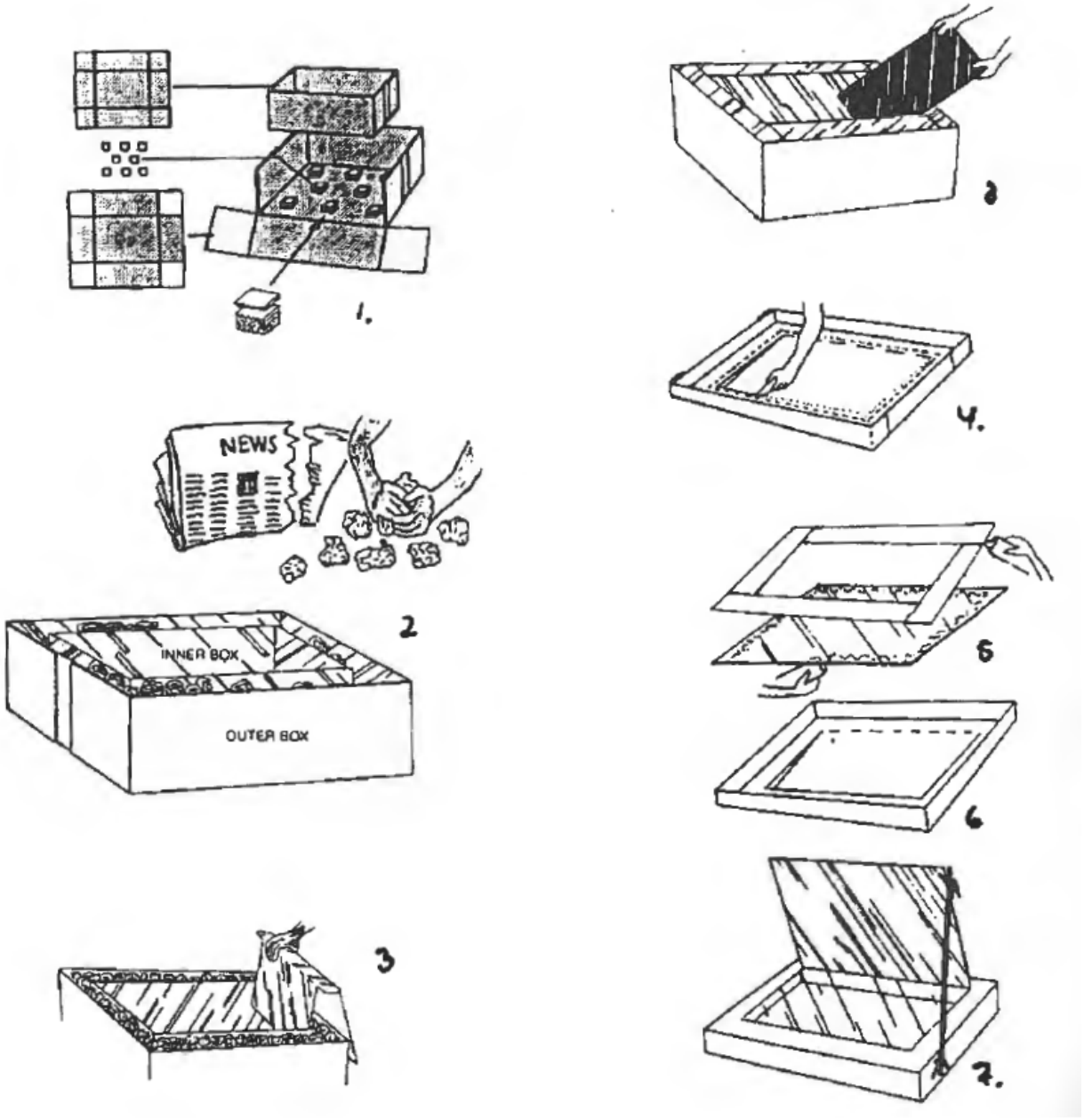
can focus the sun's rays into one point. If you hang a pot on that point, it will get hot enough to cook food. That point is called the focal point.

If you've ever tried to think of a campfire with a magnifying glass, that's the principle that works with a parabolic solar cooker.

A solar oven

A solar oven is “two boxes” where the smaller one is inside the other. The smaller box has a lid made of acrylic or glass so that the sun’s rays can come in, but not out. Between the two boxes there is insulation so that the heat does not disappear. The outer box has a series of

mirrors so that it is possible to get as much sunlight as possible into the smaller box.



The picture is from Ladybird page 36

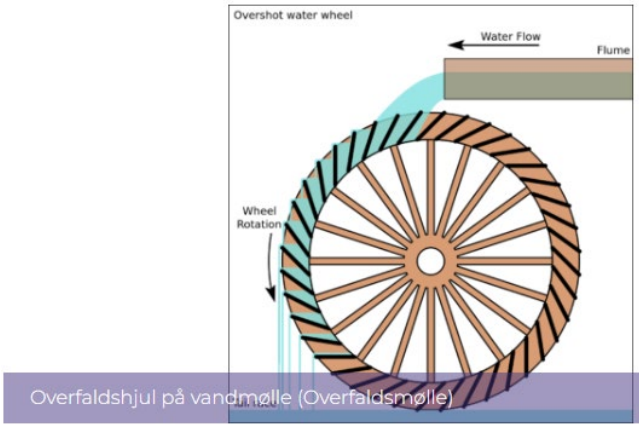
Power from the sun (solar cells)

You can buy a solar cell at scouting stores or online to charge your cell phone when you are at summer camps. If you are very far from the

nearest power outlet, a solar cell can be the best way to get power. However, the sun needs to be shining, it doesn't work at night. Can you invent a solar-powered refrigerator so you can have something cold to drink when you are at summer camps?

How water can be used to power machines, and get an idea of how hydroelectric power can be used to generate electricity.

Water power has been used in Denmark since the year 1000 and the first water mills have been known since the year 300 BC.



Overfaldshjul på vandmølle (Overfaldsmølle)

In many places in the world, hydropower is still used to generate electricity. In Denmark, there are 8 hydroelectric power plants that produce a total of approx. 22 GWh of electricity per year. But they will probably be closed down in the future, as the environmental impact on the watercourse is large in relation to the electricity produced.

You now need to make your own water mill.

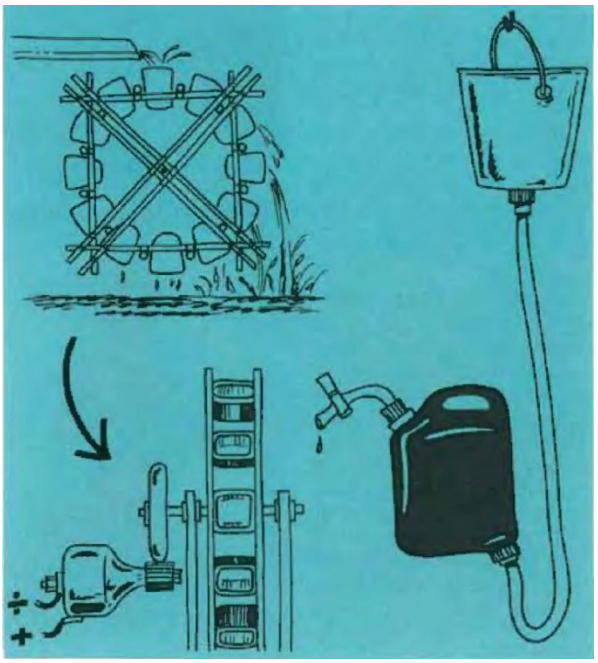


Image 16comes from scout lex

What should your water mill look like?

Can you make it generate electricity?

Is there a watermill near your scout hut that you and the rest of the patrol can visit and see how it works?

Try to find a stream where the water flows quickly, then you will have an easier time getting your water mill to work. Remember that your mill wheel must be firmly attached or the water will take the mill wheel with it.

How can you be more sustainable when you are in scouting and at home?

It is important that we as scouts take care of our planet, we only have one! You need to think about what things you buy or use. How many raw materials have been used? Are they natural materials, or are they materials that can only be used once – and then thrown away?

Try to think about these opportunities to do something good for the environment and the climate, is this something you want to do?

- Use a wood-saving stove instead of a fire.
- Turn off the lights when you're not using them and save on heating (20 degrees instead of 24 degrees).

- Buy organic products.
- Buy products that are produced locally.
- Use reusable shopping bags (cloth) instead of plastic bags.
- Make food from scratch instead of buying ready-made meals.
- Use a mug, plate and regular cutlery instead of disposable cutlery.
- Buy fruits and vegetables that are in season.
- A scout should not be driven to meetings by car! We walk, or cycle, to the meetings.
- Buy things for the scout hut that are made to last, and not always the cheapest.
- Repair instead of throwing it away and buying new.

- Don't buy more food or other things than you need.
- Buy things that have been used before, instead of new things.
- Sell or give away the things you no longer use, instead of throwing them away as trash.

CO2, energy sources, environment and climate.

CO2 and other greenhouse gases

CO2 is the most commonly used greenhouse gas when comparing different goods, materials, or services, but it is more correct to use CO2e, which stands for CO2 equivalent.

CO2 equivalent is a way of converting other greenhouse gases into an impact equivalent to CO2.

You have to think of the different greenhouse gases as different types of fruit, and it's hard to compare an apple to a banana. So to avoid making a fruit salad out of it, you use a conversion factor.

- CO2 has a CO2e of 1
- Methane has a CO2e of 25
- Nitrous oxide, N2O has a CO2e of 310
- CFC gases have a CO2e of 4660

This means that 1 kg of CFC gas corresponds to 4660 kg of CO2.

If a product, material, or service emits different greenhouse gases, they are added together to form a CO2e value.

For example:

<u>Milk's greenhouse effect</u>

	kg CO2 equivalents
Methane	0.52
Nitrous oxide	0.47

CO_2 from tractor	0.07
Purchased feed	0.14
Indirect energy	0.09
Displaced meat and wheat	-0.37
Total	0.90

CO_2e emissions from other things that you know.

Milk chocolate emits 5.3 kg CO_2e per kg (200 g of milk chocolate is equivalent to driving 8.7 km by car)

Beef produced in a typical Danish barn emits between 11 and 19 kg CO_2e per kg

Potatoes, on the other hand, only have a climate impact of 0.2 kg CO_2e per kg.

Cheese has an emission of 27.9 kg CO_2e per kg.

Other “everyday” things.

- One hour of video streaming emits 400 grams of CO_2.
- For every minute you use TikTok , it emits 2.63 g. CO_2.
- An email emits approximately 4g of CO_2 per recipient of the email.
- A Google search emits approximately 7 grams of CO_2
- Visiting a Facebook page (0.6 Mb) costs 1 g of CO_2 per visit.

Energy sources, environment and climate

Energy sources also emit CO2e for every kWh (kilowatt-hour) they produce. Electricity has different impacts on the climate and the environment depending on how the electricity is produced.

	CO2e per kWh
Wind turbines	12 grams
Solar cells	20 grams
Hydropower plants	24 grams
Geothermal plants	45 grams
Nuclear power	165 grams
Biomass	180 grams
Biogas	230 grams
Natural gas	490 grams
Waste incineration	494 grams
Oil (diesel)	773 grams
Coal	820 grams

There is no consensus on how much the different energy sources emit, so you can find other values on the internet.

You just have to be careful where you find information. For example, websites that are in favor of nuclear power have lower CO2 emissions than websites that are against nuclear power.

Biogas has a large CO2e emission because people were not previously aware of leaks in the system and a "lot" of biogas was lost (which has a large CO2e value).

Ideas for cool things.

Hot water for the shower

Picture 17is from Spejderlex

You and the rest of your patrol can make your own hot water.

You need to invent something that contains a water tank, a heating source, and a way to use the hot water. The picture shows the “easiest” way to do it. But you can invent a better way to do it.

Your ideas:

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A “refrigerator”

Image 18is from Spejderlex

Have you thought about how you and your patrol can keep your food cold? The ground is good at maintaining the same temperature, so you don't have to go far underground to keep your food cold, even during a hot summer camp.

Can you invent a “refrigerator” that is better than a “hole in the ground”?

Your ideas:

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A wood-saving stove

Image 19is from Spejderlex

If you use a wood-saving stove instead of the normal scout campfire, you and the rest will be spared.

of the patrol makes many trips to saw and chop firewood, and then there is time for fun and relaxation instead. How would you make a stove that can save firewood?

Your ideas:

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A carrier for firewood

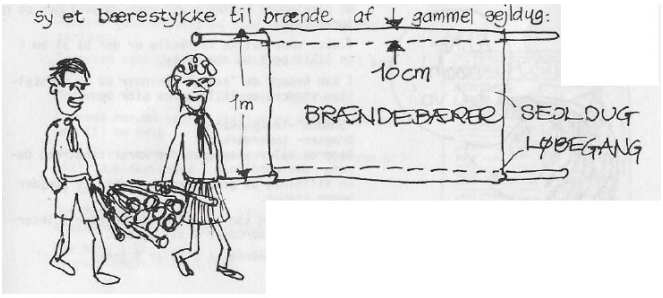

Image 20is from Tandem

You've probably tried to get firewood, and before you get back to the fire, you've lost half of it.

Have you thought about inventing a fire hydrant? How would you make it?

Your ideas:

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A patrol diary:

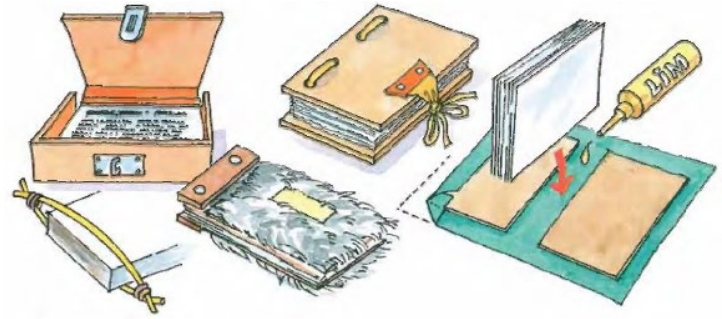

Image 21is from Spejderlex

Every self-respecting patrol has its own patrol book, where the patrol's activities at meetings, scout runs and camps are written down.

Anyone can go to the nearest store and buy a notebook to use as a patrol diary. Good patrols make their own patrol diaries, so what should your patrol's diary look like?

Your ideas:

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Emergency bag

Image 22is from Spejderlex

Have you ever experienced that you are on a hike and a strap on your backpack has broken, or your sleeping pad has a puncture?

Then it's sad that you can't fix it. With this emergency bag, you will have a few different things and tools that can fix most things.

What would you put in your emergency bag?

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Use, for example, drawing as inspiration

Oven

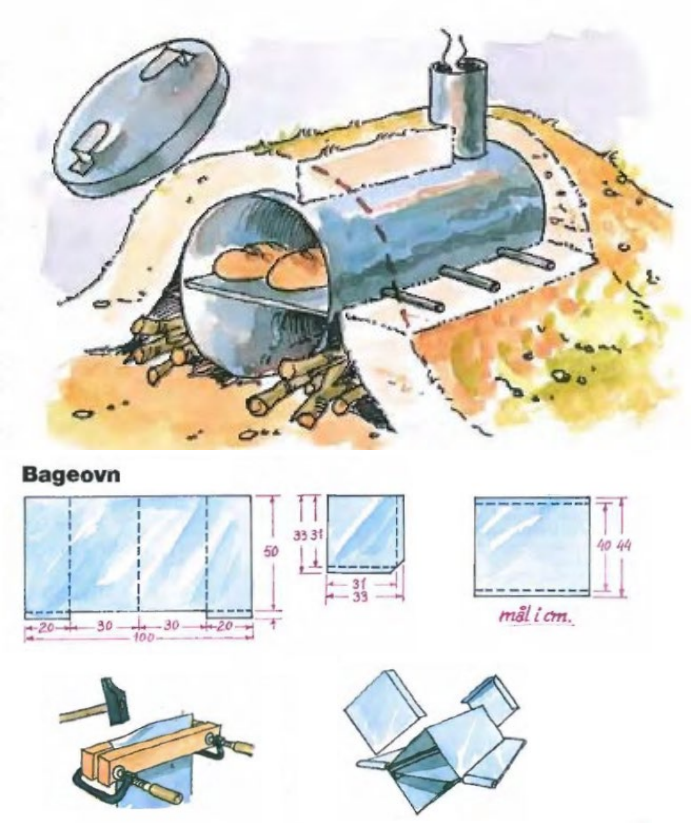

Image 23is from Spejderlex

Have you considered getting freshly baked bread or snails when you're at summer camps?
How about inventing a baking oven for the patrol?

It can be made in many different ways, so see if you can't come up with a way that suits your patrol.

Your ideas:

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Heating box

Image 24is from Spejderlex

Have you considered inventing a "hay box" so that food can cook itself without you having to saw and chop a lot of firewood?

Can you invent a “hay box” that uses materials other than hay as insulation?

Can you, in the patrol, cook in a "hay box" for an entire patrol?

Your ideas:

Solar collector for the patrol

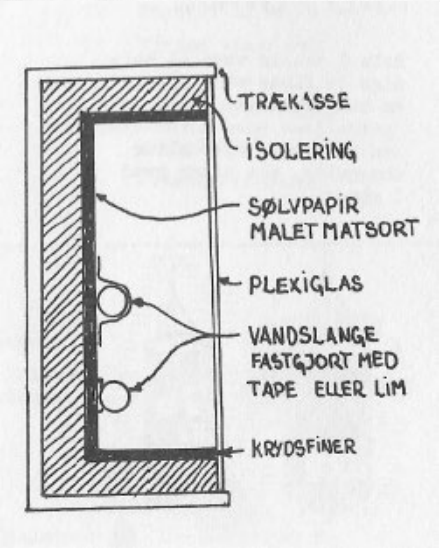

Image 25is from Tandem

Hot water to bathe in, without having to light a fire and make hot water. Just put it in the sun and let the sun do all the work, what could be better?☺
The drawing shows a small system. Is it one that you can use in the patrol?

Or are you going to invent a better system?

Your ideas:

_____

_____

_____

_____

Invent a chair for summer camp

PL-stolen

Som spejdere i andre dele af verdenen har også ghaneserne udviklet deres form for lejrstol. Stolen laves, når man er ankommet til lejrpladsen. Sædet er lavet hjemmefra og genbruges gang på gang.

Materialer

3 rafter på 1,5 m
1 rafte på 1 m
Besnøringsreb
Sæde af sækkelærred, snor eller et kraftigt stykke stof
Saks

Bind de 3 lange rafter sammen i den ene ende med en 8-tals besnøring. Udvælg 2 rafter og bind den korte rafte mellem dem, ca. 20 cm oppe.
Spred benene ud på stolpen og hæng sædet op mellem tværraften og toppen.
Sædet kan laves hjemmefra af et stykke stof/sæk, som klippes i en trekant med en højde på ca.1,5 m. Sædet kan også væves eller knyttes med treslået sisal (som når man laver en hængekøje).

Image 26is from Tandem

Can you invent a chair that you can use when you are camping? How about a chair that can be easily folded and moved?
Does it need rope or fabric to sit on?

Your ideas:

Ideas for your own inventions:

The Scout Promise

I promise to keep the Scout Law.

Scouting Act

Anyone who is part of the Scout community does their best to:

- to find one's own faith and have respect for others'
- to protect nature
- to be a good friend
- to be considerate and help others
- to be trustworthy
- to hear the opinions of others and form one's own
- to take responsibility for family and society

Motto

Be prepared