The value of our electricity

Intermediate Phase (Grade 4,5 & 6)

Educator Guide

Natural Science and Technology

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Specific aims for Natural Science and Technology

There are **three** broad subject-specific aims in Natural Science and Technology which relate to the purpose of learning Science and Technology. These are:

Specific Aim 1: Learning Science and Technology (investigating and problem-solving)

Specific Aim 2: Understand and connect ideas (knowledge of the subject content "theory").

Specific Aim 3: Science, Technology and Society (understanding the practical use of Natural Science and Technology in everyday life, understanding the history of scientific discoveries and the relationship between indigenous knowledge and science).

For the educator to take note:

- The energy-wise message is integral to all the activities.
- You may use the activities as they are.
- You can adapt or change the activities.
- You can use other resources where you see appropriate.
- Adapt the activities to suit the grade you teach.
- Adapt the activities according to the level of the learners (consider language or any other barriers).
- Share and discuss the activities with other educators in the same phase and grade.
- You can design your own activities that best suit the level of learners and grade you are teaching.
- Practice the energy-saving behaviour so you become an example of what is expected.
- Share your knowledge and practice on energy-wise education with everyone at school, at home and in the community.
- Saving energy means we don't have to produce so much, using our limited natural resources and limiting the amount of pollution we create, thus taking better care of our environment.

Thank you for taking care of our earth

Energy-saving

Grade 4

The activity/activities which follow have reference to the extracts of content from the Department of Education's (2011) CAPS policy document - Natural Science and Technology (Intermediate Phase Grades 4, 5 and 6).

Activity 1: Comparing energy use

- This activity is done to show the suitability of different materials for different purposes.
- Put up an A4 poster of the traditional incandescent bulb and the compact fluorescent light (energy-saving).
- Ask the learners to describe the lights - what is inside that produces the light.
- The table below shows differences you need to focus on.

1. Study the pictures of the lights and the information in the table and then answer the questions.

A 	B 
The compact fluorescent light (energy-saving)	**Traditional incandescent bulb (old light bulb)**
• Has mercury vapour (gas) • Does not heat up as much • Saves energy	• Has a tungsten wire inside which conducts electricity • The wire has to heat up to 2000°C before heat energy is converted to light energy • Wastes energy

Activity 1: Comparing lights

After the discussion give learners the worksheet as class or homework.

1. Study the TWO light bulbs and answer the following questions".

1.1 Which is the energy saving light, A or B? Give a reason for your answer? [A]

1.2 Which is the old light bulb, A or B? Give a reason for your answer. [B].

1.3 Why do you think mercury vapour (gas) was used instead of the wire in the energy-saving light? [mercury gas conducts less electricity]

1.4 Why do you think plastic was not used to replace the wire inside the traditional bulb? [Plastic will burn out - it will not be able to stand the heat of the electric current].

1.5 Which light must we use to save electricity at home? [Energy-saving light/ compact fluorescent light].

2. Study the TWO light bulbs and answer the following questions

Picture A

Picture B

2.1 Which light is used in picture A? [Energy-saving/compact fluorescent light].

2.2 Which light is used in picture B? [Old light bulb].

2.3 Why is glass used to cover both lights? [Glass is transparent - you can see through it - allows light to pass through].

2.4 Which lights do you think last longer? Give a reason for your answer. [Energy-saving - the old light bulb burns out quickly, that is why the bin is full in picture B].

2.5 From the two pictures above, what shows you that the old light bulb gives off a lot of heat? [Thermometer/temperature reading is higher].

2.6 How does using the right kind of material to make lights help us? [It helps us save money - the electricity account is lower in picture A because the energy-saving light uses gas which does not require a lot of heat].

Energy-saving

Grade 5

The activity/activities which follow have reference to the extracts of content from the Department of Education's (2011) CAPS policy document - Natural Science and Technology (Intermediate Phase Grades 4, 5 and 6).

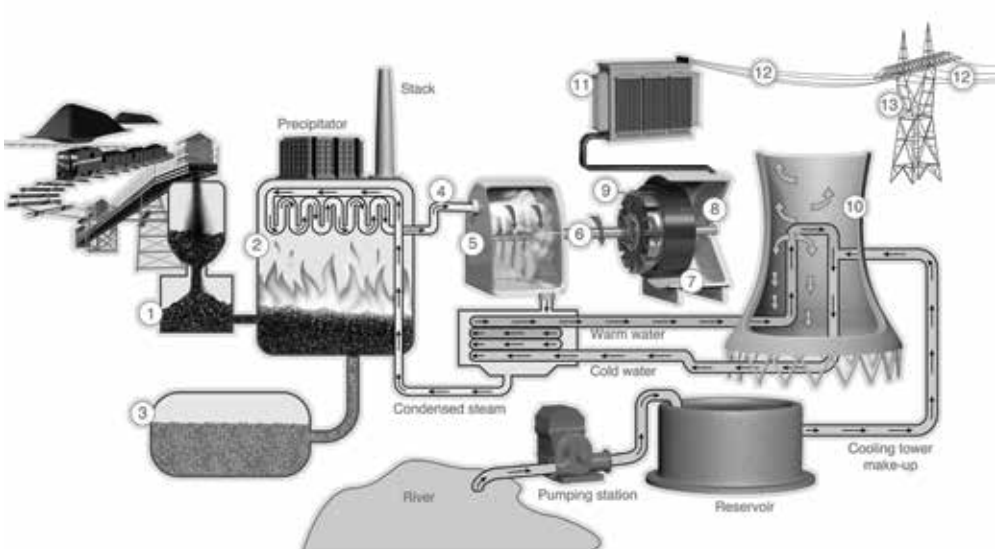
Give each learner a worksheet on renewable and non-renewable resources.

Did you know:

Renewable resources are limitless - we can use these resources again e.g. energy from the sun and wind.

Non-renewable resources are not limitless - these resources get used up e.g. coal (fossil fuel) and water. Fossil fuels can take millions of years to form. Fossil fuels like coal are burnt in a power station to turn huge machines to make electricity.

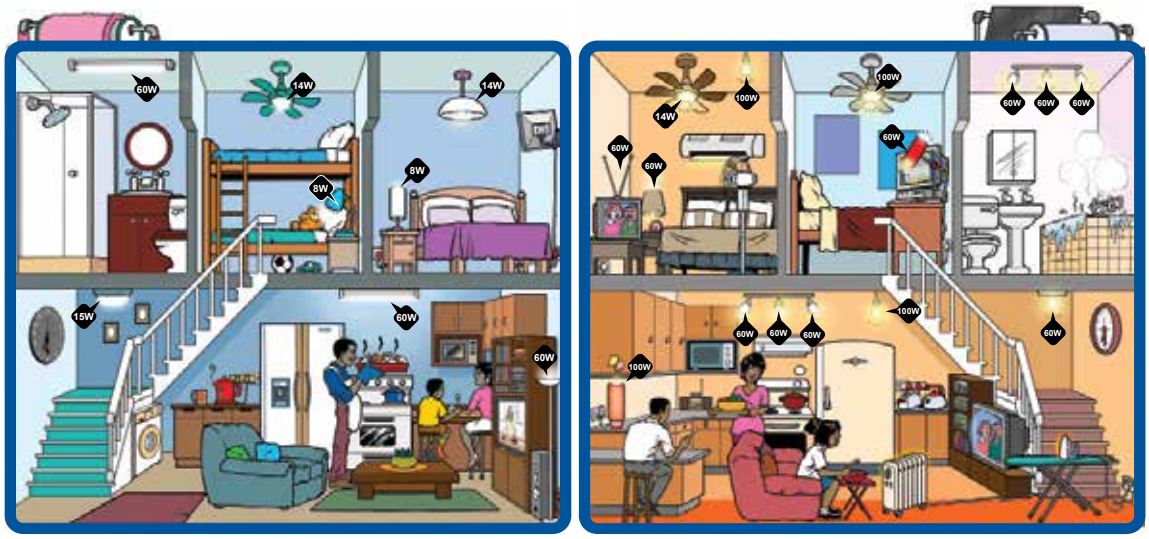
The picture below shows in a very simple way, how coal is used to make electricity.



1. Coal pulveriser (coal mill)
2. Boiler
3. Ash (burnt coal)
4. Water to steam
5. Turbine
6. Rotating shaft linking the turbine and generator
7. Generator made up of a spinning rotor
8. Coil of copper wire
9. Magnet inside a coil of copper
10. Cooling tower
11. Step-up transformer
12. Transmission cables / lines
13. Pylon

1. Is coal a renewable or non-renewable resource? [Non-renewable]
2. Where do you think most of the mains electricity in South Africa comes from? [By burning fossil fuels like coal in a power station to turn huge machines to make electricity].
3. Which two non-renewable resources shown in the diagram are used to generate electricity? [Coal and water].
4. Why is water a non-renewable resource although there is so much water around? [There is sufficient water only if it rains in certain catchment areas - if it does not rain there is likely to be a shortage of water].
5. Why is it a disadvantage to use coal as a resource in the process of making (generating) electricity? [Coal is a non-renewable resource - it will run out one day especially if we waste electricity].
6. Write the following in the correct column on the table provided: wind/wood/water/coal/ natural gas/oil/solar energy/nuclear energy/steam.

Activity 2: Energy, change and mechanism - electrical energy



- Give each learner a worksheet with the Watt and Kilowatt family on.

1. What is the main source of energy the Watt family is using? [Mains electricity].
2. What is the main sources of energy the Kilowatt family is using? Give reasons for your answer. [electricity, solar for water heating].
3. Give examples from the picture to show the following uses of electricity?
   a. Lighting. [Lights in the passage; bedrooms; kitchen].
   b. Heating. [Water; ironing; heater; stove; microwave].
   c. Driving machines. [Fan; washing machine; microwave; fridge motor].
4. Do you think the Watt and Kilowatt families are using electricity wisely (are they wasting or saving energy)? [They are wasting - they have lights on upstairs when there is no one upstairs; the TV is on while they are eating; the TV upstairs is on - no one is watching; the hot water is getting cold in the bath - electricity has been used to heat the water].
5. Why should both families save electricity? [We use mostly coal to generate electricity -
   if we waste electricity we are wasting coal which is a non-renewable resource].
6. What are some of the ways the families can save electricity? [By switching off lights that are not being used; switch off the television at the switch; use hot water when necessary].
7. In order to use our coal resources wisely and save electricity what do you think should be the **golden rule** for the use of electricity?
   [Switch it off if you are not using it]

8. Give examples from the picture to show how electricity is used in the following.

8.1 Lighting [light bulb]

8.2 Heating [heater]

8.3 Driving machines [TV, microwave, fridge]

9. Do you think the Watt and Kilowatt families are using electricity wisely, are they wasting or saving energy? Give reasons for your answer. [No, both families are wasting electricity because they have lights on in the upstairs bedroom.]

9.1 Which appliance do you think uses the most amount of energy in the house? Explain why you chose that appliance.

9.2 Which appliance uses the second most amount of energy in the house? Explain why you have chosen that appliance.

9.3 Which appliance uses the third most amount of energy in the house? Explain why you have chosen that appliance.

10. Based on what you have learnt about lighting technology (CFLs and incandescent lights), what advice would you give the Kilowatt family?

11. Using what you have learnt about electricity write down one energy-saving behaviour you will put into practice in your home or school from today. Write down the behaviour on a piece of paper/cardboard and keep it in a place where it will remind you every day.

Switch it off if you are not using it.

Energy-saving

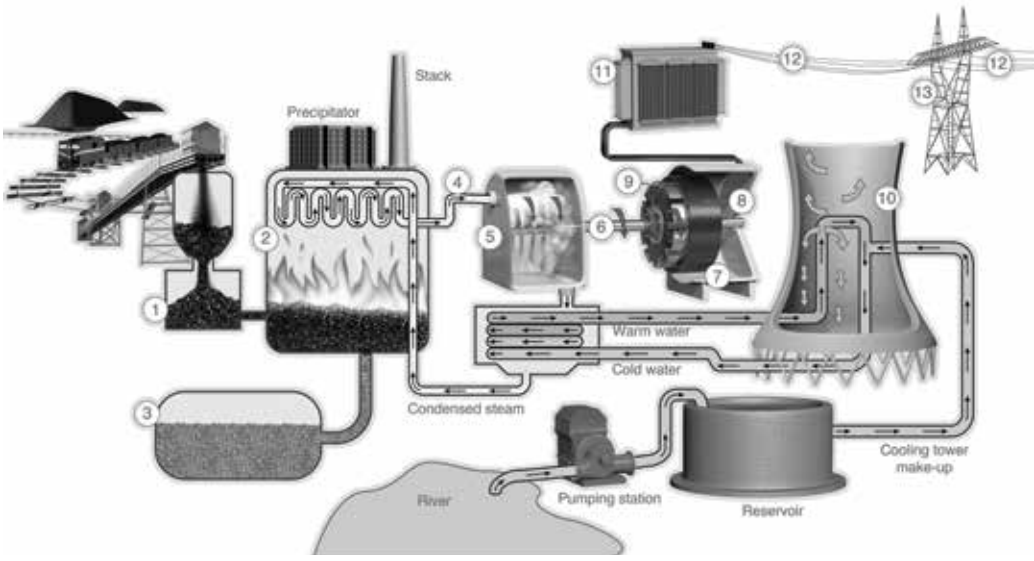
Grade 6

The activity/activities which follow have reference to the extracts of content from the Department of Education's (2011) CAPS policy document - Natural Science and Technology (Intermediate Phase Grades 4, 5 and 6).

Activity 1: Energy and change - energy transfer

- Give each learner a worksheet on energy and change - energy transfer.
- Use the diagram on the worksheet for a class discussion on energy transfer that takes place when coal is used to generate electricity.
- The learners are to answer the questions on their own after the discussion.

Study the diagram on how electricity is generated (made) and answer the questions.



1. Coal pulveriser (coal mill)
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1.1 Request the learners to write down the labels in the diagram above, onto their worksheets, in the table provided.

1.2 Give examples of energy transfers that take place at the following sections of the power station. 2, 5 & 7.

	Input	Output
1.	Coal - burnt	Heat/steam
2.	Steam	Movement - turns the turbine
3.	Movement - turns the turbine	Movement - turbine turns the generator
4.	Movement - generator turns	Electrical energy
5.	Electrical energy	Light/heat energy

1.3 Give examples of the following energy transfers in the picture:

1.	Heat	Burning coal to heat water
2.	Movement	Steam - movement of turbine
3.	Light	Electrical energy to light in the light bulb

Activity 2: Energy and change – energy transfer and energy-saving

- Give each learner a worksheet on energy and change - energy-saving.
- The learners should use pictures of the Watt and Kilowatt families to answer the questions.

Study the picture of the two families (the Watt and Kilowatt families). Note that the design of both houses is the same. All the fan lights are 14W each.

1.1 Which source of energy is the Watt and Kilowatt families using? [Mains electricity].

1.2 Select one of the appliances downstairs and draw a flow diagram to show the input and output energy.

Example of a flow diagram:

Electrical energy (input) → power station → home → stove → heat energy (output)

2. Give examples of appliances where the following are taking place.

	Energy transfer	Appliance
1.	Electrical energy to get heat	Iron/stove/microwave/geyser/heater/light bulbs/ kettle
2.	Electrical energy to get sound	Television/radio
3.	Electrical energy to get light	Light bulbs/television/computer screen
4.	Electrical energy to get movement	Fan/washing machine (inside)

3. While there is some energy loss (wasted energy) like through heating of the fridge motor, what are some ways in which the Kilowatt family is wasting energy? [They have lights on upstairs when there is no one upstairs; the TV is on while they are eating; the TV upstairs is on - no one is watching it; the hot water is getting cold in the bath.

4. In the picture find the following appliances used by the Watt family. [Remote television/s, stove, geyser and refrigerator (fridge)].

4.1 Which appliance do you think uses the most amount of energy in the house? Explain why you chose that appliance. [Geyser - it is on for 24 hours - water loses heat/hot water is used - the geyser has to heat the water].

4.2 Which appliance uses the second most amount of energy in the house? Explain why you have chosen that appliance. [Fridge - also on for 24 hours - every time the fridge door is opened warm air enters - when the door is closed the motor has to work harder to cool the warm air and cool the inside to the correct temperature].

4.3 Which appliance uses the third most amount of energy in the house? Explain why you have chosen that appliance. [Remote controlled appliances - if they are switched off with the remote control, the light is still on - that means electrical energy is still being used - the appliance is not off].

5. Based on what you have learnt about lighting technology (CFLs and incandescent lights), what advice would you give the Kilowatt family? [Use only CFLs].

6. Using what you have learnt about electricity write down one energy-saving behaviour you will put into practice in your home or school from today. Write down the behaviour on a piece of paper/cardboard and keep it in a place where it will remind you every day. [e.g. I will switch off lights that I am not using].

Cost of electricity

1. The labels on appliances usually tell you the power rating of an appliance e.g. kettle – 2000W or television – 300W.
   Sometimes this information is given in advertisements.

Ask learners to find advertisements showing the following appliances and to write down the power ratings. Remind learners that if they have these appliances at home to ask an adult to help them to get their ratings. They must be reminded to be careful when checking appliances and to ensure the appliances are switched off.

Appliance	Power in Watts	Power in watts (appliance in an advertisement or in your home)
Television	300W	
Energy saving light (Compact Fluorescent Light - CFL)	11W	
Electric kettle	1850W	
Old light bulb (incandescent)	60W	
Iron	1400W	

1.1 From the information given in the table the learners must write down the amount of electricity the appliances uses in order from lowest to highest. Let us assume that all the appliances are switched on at the same time for the same period (e.g. for 2 hours).
The power ratings will indicate which uses the lowest and the highest electricity.

	Power in Watts (lowest to highest)	Appliance
1.		
2.		
3.		
4.		
5.		

1.2 Learners must be asked to write down how one can use each appliance in a way that will save electricity. They should first be given the chance to discuss the energy saving tips with their classmates.

	Appliance	Energy saving ways to use the appliance
1.		
2.		
3.		
4.		
5.		

For more information on the schools programme, please visit www.eskom.co.za/idm.