



# SCHOOLS FOR A HEALTHY ENVIRONMENT

# SCIENCE AND TECHNOLOGY

Module 6



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# INTRODUCTION

This Module is designed to be used by teachers and facilitators during relevant school and/or Environment Club activities. Each Module provides the curriculum linkages which would help the teachers in choosing activities when planning the lessons during the weekly meetings. Each section of the Module follows the similar format of a seven step inquiry model. The inquiry model is chosen to be followed in the activities because this method focuses on student centred learning. When applying the steps of the inquiry model the teacher will act as a facilitator and the students will:

- gain a deep understanding of the subject matter
- develop thinking and reasoning skills
- develop problem-solving skills
- have their intellect challenged
- take greater responsibility for their own learning
- understand the relationship between what they are studying and the real world
- have varied and interesting learning experiences

**The seven steps used in the Inquiry Model are as follows:**

1. Tuning In
2. Deciding Directions
3. Finding Out
4. Sorting Out
5. Drawing Conclusions
6. Considering, Planning and Taking Action
7. Evaluation and Reflection

Each of the 6 Modules has been designed with subheadings for purpose, time, materials required and procedure. These subheadings have been included to guide teachers to plan and conduct the activities. The times provided with each activity are suggested times to help the teachers plan the class. This is a guide only; some activities may take less or more time. The inquiry process is based on developing critical thinking and problem solving skills, so the duration of activities should be related to the interest and development of the student's knowledge and skills. Each Module has also been designed with Student Resource Sheets and Teacher Information Sheets for each section, to assist in preparing for and conducting activities. Sample Student Resource Sheets have also been provided to guide teachers as to the kind of responses expected on each Sheet. Once again, this is offered as a guide and responses should not be limited to the suggested ones. Each Module has been written in plain English, however for some subjects it has been necessary to include more technical terms. A glossary has been included at the end of the Modules to explain these technical terms. Where possible photos and illustrations have also been included in each Module to explain or demonstrate specific activities.

These Modules are also accompanied by 2 toolboxes; one for indoor equipment and one for outdoor equipment. The toolboxes provide the physical materials needed to conduct the activities with the required materials being specified for each activity. The toolboxes also contain reference materials, posters and Flip Charts providing the necessary background for these Modules. The contents of the toolboxes and instructions for care and maintenance are included in the following pages.

# OVERVIEW OF THE MODULES

There are 6 teaching and learning Modules in this series that are linked to themes in the Environmental Studies curriculum. Each Module provides instructions for a number of activities that might be used with a class to explore aspects of the issue that is being addressed. These Modules do not comprise a complete unit; rather they may be used to supplement other work being done within a topic area and what is found in the established syllabus.



## Module 1: Ourselves

1. Island Environment
2. Traditional Knowledge
3. Environmental Impact Assessment
4. Common Diseases and Prevention



## Module 4: Resources from the Environment

1. Energy used at School and at Home
2. Conservation, Management and Reuse of Water
3. Managing Waste
4. Reduce, Reuse, Recycle
5. Composting Waste



## Module 2: Earth

1. Weather
2. Safe Drinking Water
3. Water Quality Monitoring



## Module 5: Interdependence

1. Food Web
2. Exploring my Atoll
3. Ecological Footprints



## Module 3: Life Around Us

1. Mangroves
2. Beaches
3. Coral Reefs
4. School Gardens



## Module 6: Science and Technology

1. Wind Energy
2. Solar Energy

# ENVIRONMENTAL STUDIES CURRICULUM LINKS

	MODULE	SECTIONS	GRADES 1 - 3	GRADE 4 - 5	NUMBER OF LESSONS
1	OURSELVES	Island Environment		x	3 - 4 lessons
		Living by Traditional Knowledge		x	3 - 4 lessons
		Environmental Impact Assessment		x	4 - 6 lessons
		Common Diseases and Prevention	x		4 - 6 lessons
2	EARTH	Weather	x		4 - 6 lessons
		Safeguarding Drinking Water		x	4 - 6 lessons
		Water Quality Monitoring		x	4 - 6 lessons
3	LIFE AROUND US	Mangroves		x	4 - 6 lessons
		Coral Reefs		x	4 - 6 lessons
		Beaches		x	4 - 6 lessons
		School Gardens	x		3 - 4 lessons
4	RESOURCES FROM THE ENVIRONMENT	Energy used at Home and School	x		4 - 6 lessons
		Conservation, Management and Reuse of Water	x		4 - 6 lessons
		Managing Waste	x		4 - 6 lessons
		Reduce, Reuse, Recycle	x		4 - 6 lessons
		Composting Waste		x	3 - 4 lessons
5	INTERDEPENDENCE	Food Web		x	3 - 4 lessons
		Exploring My Atoll	x		3 - 4 lessons
		Ecological Footprints		x	4 - 6 lessons
6	SCIENCE AND TECHNOLOGY	Wind Energy	x		4 - 6 lessons
		Solar Energy		x	4 - 6 lessons

# TOOLBOX CONTENTS

DRY KIT		
	Item	Details
1	Plastic vials/jars screw top	100-300ml.
2	Hand lenses	Magnification x 3, lens diameter 90mm, plastic handle.
3	Long handled tongs	Jaws corrugated inside, length 150x200mm, stainless steel.
4	Insect catching nets	Hand net for insects, overall length 1.48m, diameter 250mm.
5	Plankton nets	Plankton net, nylon monofilament netting, with tough nylon collar, diameter 300mm, overall length 900mm, brass frame with 7m tow line and a PVC filter, aperture size 0.1mm and 0.3mm.
6	Thermometers	Mercury in glass, permanent amber markings, with anti-roll clip, range -10 to 110o Celsius, 6mm diameter with reinforced bulb, in plastic case.
7	Globe of earth	Rubber ball - globe of the earth, fully numbered meridian ring, diameter of globe 30 cm.
8	Twine	Brightly coloured nylon twine (20m).
9	Measuring tape	Sturdy, length 50m.
10	Measuring tape	Length 1 meter.
11	Student microscope	Monocular head rotates 360 degrees and has a 10x eyepiece. DIN 4x, 10x and 40x glass achromatic optics on the triple nosepiece.
12	Binoculars	Magnification 7x50, waterproof.
13	Litmus paper	Red and blue.
14	pH strips	Full Range pH from 1 to 14, colour reference chart with clearly printed pH values and instruction leaflet.
15	Low cost water monitoring kit	Provides simple and non-hazardous method of testing 8 basic water quality parameters: coliform bacteria, dissolved oxygen, BOD, Nitrate, pH, Phosphate, Temperature and Turbidity.
16	Water quality - H <sub>2</sub> S	Bottle with hydrogen sulphide strip (H <sub>2</sub> S water test kit).
17	Compass	90 mm in diameter and 22 mm high, and graduated in easy-to-read increments, waterproof.
18	Measuring staff	Metre pole sections in red and white.
19	Jars with screw top lids	500ml with wide lid.
20	Measuring containers	Clear plastic, capacity 1000ml, show divisions every 10ml.
21	Torch	Solar, kinetic, magnetic LED, waterproof.
22	Gloves	Cloth gloves (10 small and 10 medium).
23	Safety spectacles	Clear frames, should be able to wear over prescription spectacles.
24	Sediment sorting trays (3 sizes)	Diameter or length up to 30, Plastic sieve, aperture size 0.1mm, 0.3mm and 0.5mm.
25	Stopwatch	0.1sec, 30sec, 15min dials, diameter 45mm, housed in a plastic case, water proof.
26	Garden fork	Children's garden fork with plastic handle.
27	Garden spade	Children's garden spade with plastic handle.
28	Solar cell educational kit	Comprises of Solar cell module, solar energy introductory booklet; Small DC motor, screws and nuts, wire with motor clips; colour spinner discs; paper aero plane and bird models; plastic turnables with 4 sizes, 5/82, 1.52, and 22; plastic fan spinner.
29	Weather kit	Australian Geographic Weather Watch kit, comprises of rain gauge, thermometer, wind speed indicator flap and measuring cylinder. ( <a href="http://www.australiangeographic.com.au">www.australiangeographic.com.au</a> )
30	Coral watch kit	Coral watch reef education package, The University of Queensland, Brisbane, Australia.
31	Cubic metre set and corner inserts.	A set of three alternately coloured dm triangle metre sticks, nine blank triangle metre sticks and eight corner blocks for the construction of an accurate internal dimension cubic metre.
32	Spring balance	Spring scale, calibrated in grams (to weigh up to 50kg).

## DRY KIT

	Item	Details
<b>Identifications Guides:</b>		
1	Plastic cards	Plastic card set containing pictures and names of fish and other invertebrates.
2	Field Guide	Field guide to Maldivian Birds & Beach Ecosystems (2008).
3	Field Guide	Field guide to Maldivian Plants (2008).
4	Field Guide	Field guide to Maldivian Mangroves (2008).
<b>Flip Charts:</b>		
1	Weather, Water, Waste and Energy	Weather, Water, Waste and Energy Flip Chart (2008).
2	Environment and Biodiversity	Environment and Biodiversity Flip Chart (2008).
<b>Reference Books:</b>		
	Subject	Author, year of publication, title, publisher and ISBN
1	Biodiversity	Krys Kazmierczak (2000) <i>A field guide to the Birds of India, Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives</i> , Gopsons Papers Ltd, ISBN 81-87107-04-9
2	Biodiversity	Dr. R.C. Anderson, <i>Living Reefs of the Maldives</i> , Novelty Publishers, ISBN 99915-801-1-5
3	Biodiversity	Dr. R. Charles Anderson, (2005), <i>Reef fishes of the Maldives</i> Manta Marine Pvt. Ltd, ISBN 99915-5401-7
4	Biodiversity	National Centre for Linguistic and Historical Research, (2002), <i>Gasgahaagehi</i> , ISBN 99915-1-016-8
5	Biodiversity	National Centre for Linguistic and Historical Research, (2001), <i>Dhivehi raajjeygai hedhey baeh meyvaa</i> , ISBN 99915-1-009-5
6	Biodiversity	National Centre for Linguistic and Historical Research,(2002), <i>Maamelaameli</i> , ISBN 99915-1-025-7
7	Traditional Knowledge	National Centre for Linguistic and Historical Research, (2004), <i>Dhivehi Raajjeyga Huri Aasaaree Thanthan</i> , 99915-1-063-X
8	Traditional Knowledge	National Centre for Linguistic and Historical Research, (2002), <i>National Museum</i> , ISBN 99915-1-016-8
9	Traditional Knowledge	Naseema Mohamed and P.Ragupathy (2005) <i>Inscriptions of Maldives No 1</i> , National Centre for Linguistic and Historical Research, ISBN 99915-1-069-9
10	Traditional Knowledge	Naseema Mohamed, (2006), <i>Essays on early Maldives</i> , National Centre for Linguistic and Historical Research, ISBN 99915-1-083-4
11	Traditional Knowledge	Dr.Philos Egil Mikkelsen, (2000), <i>Archeological excavations of a Monastery at Kaashidhoo</i> , National Centre for Linguistic and Historical Research, ISBN 99915-1-013-3
12	Traditional Knowledge	National Linguistic and Historical Research, (2006), <i>Vihivana garunuge thereyga Dhivehi Raajje 1</i> , Novelty press, ISBN 99915-1-061-3
13	Traditional Knowledge	National Centre for Linguistic and Historical Research, (2006), <i>Vihivana garunuge thereyga Dhivehi Raajje 2</i> , Novelty press, ISBN 99915-1-084-2
14	Traditional Knowledge	National Centre for Linguistic and Historical Research,(2006), <i>Vihivana garunuge thereyga Dhivehi Raajje 3</i> , Novelty press, ISBN 99915-1-085-0
15	Traditional Knowledge	National Centre for Linguistic and Historical Research , (2006), <i>Vihivana garunuge thereyga Dhivehi Raajje 4</i> , Novelty press, ISBN 99915-1-069-6
<b>CD:</b>		
1	Hygiene and sanitation	UNICEF hygiene and sanitation TV advertisement clips
2	Biodiversity	Coral Watch Reef Education CD, in the Coral Reef Education Package (see above)

## WET KIT

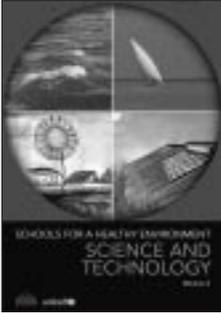
	Item	Details
1	Snorkel	Colourful, snorkelling - Ordinary
2	Masks	Colourful, snorkelling - Small 8 , Medium 12
3	Booties	Colourful, snorkelling - Small 5 , Medium 10, Large 5
4	Footwear / Gumboots	Rubber footwear, gumboots
5	Kick boards	Swimming boards for children (ages 6-13)



## OPERATION AND MAINTENANCE OF TOOLBOXES:

- Toolbox Log – each time someone takes any equipment from the toolbox they should sign for which pieces they are using and sign again when they return them. An equipment log will be kept in each toolbox.
- Paper materials – it is important that books, posters, Flip Charts and pictures be kept in a dry place that is well aerated and free from insects. If these materials do get wet it is important to dry them immediately and not to put wet items back with the dry items.
- Outdoor equipment – if any equipment is used outdoors it is very important to ensure that it is clean and dry before it is put away. It is important to store this equipment in a dry, well aerated area that is free from insect or animal damage.
- Wet equipment – some equipment such as masks, snorkels, booties, etc are made for using in the ocean, but if you don't rinse them in fresh water after each use they will quickly become damaged. It is important to store this equipment in a dry, well aerated area that is free from insect or animal damage.
- Specialist equipment – some items don't just need care in storage they need skill in setting them up for correct use. Binoculars for example need to be calibrated for use – different people may need it adjusted for their eyesight.
- Damage – if items are damaged beyond use it may be possible to get replacement items from your local Teacher Resource Centre. They only have limited replacement items so keep your toolboxes in good order.

# MODULE SUMMARY



This Module is developed to complement the theme ‘Science and Technology’ in the Environmental Studies curriculum. ‘Science and Technology’ deals with tools, equipment, materials and components to make quality products. The students would evaluate processes and products. They would also develop, plan and communicate ideas by using a variety of methods, including drawing and making models. The Module helps students to draw together the other areas of knowledge and learning of skills in the other 5 Modules. It includes things such as exploring force and motion using experimental and investigative work, energy consumption and efficiency, major environmental and sustainability issues.

The table below depicts the toolbox contents needed for the practical application of this Module.

Item	Details	Section
Weather Kit	Australian Geographic Weather Watch kit, comprises of rain gauge, thermometer, wind speed indicator flap and measuring cylinder. ( <a href="http://www.australiangeographic.com.au">www.australiangeographic.com.au</a> )	1
Solar cell Educational kit	Comprises of Solar cell Module, solar energy introductory booklet; Small DC motor, screws and nuts, wire with motor clips; colour spinner discs; paper aeroplane and bird models; plastic turnables with 4 sizes, 5/82, 1.52, and 22; plastic fan spinner.	2
<b>Flip Charts</b>		
Water, Weather, Waste and Energy Flipchart (2008)	Water, Weather, Waste and Energy	1,2

# 1

# WIND ENERGY

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**Grades:** 1 to 3

**Number of lessons:** 4 to 6

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## Purpose

To help students become more aware of the wind and its impact on our daily lives. This will lay the foundation for higher order concepts about wind energy that can be more readily addressed in later years of schooling.

## Key questions

Key focus questions for this section are:

- How do we use the wind?
- How could we use the wind more?

## Links with other Modules

Resources from the environment

## Toolbox

### Physical materials

Weather Kit

### Flip Charts

Weather, Water, Waste and Energy Flip Chart

## 1.1 TUNING IN

The following activities help to engage and focus students' interest on the topic.

### ACTIVITY 1: VISUALISATION OF THE WIND

**Purpose:** To visualize and reflect upon experiences of being in the wind.

**Time:** Approx. 30-35 minutes

**Materials Required:** N/A

**Resource / Information Sheets:** N/A

#### Procedure

Introduce the topic of wind study by encouraging students to reflect upon and share their experiences of being in the wind. Explain to students that we are going to do a short visualization exercise to stir up our memories of experiencing windy conditions.

Ask students to sit comfortably, close their eyes and listen to your voice, which will help them to remember previous experiences.

Proceed to describe the following situations in which the students are likely to be able to readily picture themselves. Provide prompts and ask questions to help them focus their thinking on the wind aspects of their visualization.

Make sure the pace of your statements and questions is appropriate to the student's ability and experience with visualization.

Students will need thinking time between each comment you make.

Your comments may follow this format:

*Picture yourself alone on the beach on a warm, sunny day. You are walking on the sand, looking at the ocean. What time of day is it? Think about how you feel and the kinds of things you are seeing. Can you see birds? What kinds of plants can you see?*

*Become aware of the wind. How strong is it? Is it a gentle breeze? Is it gusty? How can you tell? What sort of movements can you see that indicate the strength of the wind? How are the birds moving, if you can see birds? How are the plants moving? How does the wind feel against your skin? Is the wind warm? Is it cool? Is it a pleasant sensation? Can you smell anything?*

*Now let's try to imagine a different experience of the wind. Picture yourself in a storm. Where are you experiencing the storm? Are you inside or outside? How hard is it raining? Is there any thunder and lightning?*

*How strong is the wind? Is it warm or cold? Is it gusty or steady? How can you tell? Think about how the rain is falling – is the wind affecting the angle at which it is falling? Can you see how trees and other plants are moving in the wind? Can you hear the wind in the trees? What does it sound like? How does it make you feel? Where do you feel safest when the wind is like this?*

*Now let's compare these two different experiences of the wind. Which scene did you prefer? Which was easier for you to imagine? Do you sometimes think of the wind as 'good' and sometimes 'bad'? How do you like the wind to be?*

## ACTIVITY 2: EXPERIENCING THE WIND

**Purpose:** To observe and experience the effects of the wind.

**Time:** Approx. 20 minutes

**Materials Required:** N/A

**Resource / Information Sheets:** N/A

### Procedure

Alternatively, if the weather is suitable, take students outside where they can experience the wind directly!

Ask students to stand with their eyes closed and experience the wind. Encourage them to think about how it feels.

Also encourage them to move around and observe the effects of the wind – how does it move the plants? Is it stronger higher up in the trees or at ground level?

Prompt the students to make these kinds of observations and provide an opportunity for students to share their observations with the rest of the class.

## ACTIVITY 3: SHARING VISUALISATIONS OR EXPERIENCES

**Purpose:** To visualize, record and share experience of the wind.

**Time:** Approx. 20-25 minutes

**Materials Required:** N/A

**Resource / Information Sheets:** 1.1 Student Resource Sheet - Describing the Wind

### Procedure

Ask students to form pairs for small group sharing of their visualizations and/or experiences.

Guide this sharing if students are very young or are unfamiliar with pair work by allowing a set number of minutes for the first speaker and indicating when it's time to move to the second speaker for the same length of sharing time.

Have students record each other's visualizations in their pairs on the chart provided as *Student Resource Sheet 1.1*. Write down key words and phrases your partner uses to describe the wind in each scenario. Encourage the scribe to ask the speaker questions from the resource sheet to help them fill it in and ask a prompt to the speaker for more detail.



*A very calm day.*

Have students display their resource sheets around the room – either on the wall or on tables around the classroom – so that everyone can walk around and view the kinds of words and phrases different people have used to describe their visualizations.

For younger students you can do this as a whole class activity in which each student has a chance to share her/his thoughts on at least one of the scenarios and you as teacher write their key words on a class chart.

All these phases (visualising, discussing, recording) should lead to students becoming much more aware of the wind and what they already know about it. This awareness can then be used to guide the students as appropriate to their ages and levels of understanding / development into discussion about the concept of wind as a form of energy.

From the above charts and from discussions occurring as the charts are filled in, introduce the term 'energy' as depicting the power associated with the strength of the wind.

Document a simple definition that is age appropriate for display in classroom. (The definition for junior primary/early year students might be as simple as 'Strong winds have lots of energy'.)

## 1.2 DECIDING DIRECTIONS

The following activities will assist students to decide on the directions they wish to take in their research.

### ACTIVITY 4: WHO USES THE WIND AND FOR WHAT?

**Purpose:** Using any of the activities on Teacher Information Sheet 1.1, have students record their observations about the power of the wind (this is already there- first sentence).

**Time:** Approx. 20 minutes

**Materials Required:** Paper bags, or pieces of ribbon, scissors, pins, rulers, square paper, plastic bags, string, pencils, pieces of eekel, palm leaves and hibiscus.

**Resource / Information Sheets:** 1.1 Teacher Information Sheet - Finding Out About Wind Energy Activities

#### Procedure

Using any of the activities on *Teacher Information Sheet 1.1*, have students record their observations about the power of the wind.

Students can either all do the same activity, or different groups can do different activities.

Once activities have been conducted, have groups identify the key lessons from their experiments in order to share their learning with the rest of the class.

This can happen either by groups reporting back to the whole class or by organising students into new groupings that are made up of students who took part in different activity groups. This would allow each student to have unique observations to share with the rest of their new group.

### ACTIVITY 5: HOW CAN THE WIND BE USED?

**Purpose:** To observe and describe ways in which plants, animals and humans make use of the wind.

**Time:** Approx. 20-25 minutes

**Materials Required:** Large piece of paper and markers.

**Resource / Information Sheets:** N/A

#### Procedure

Divide students into groups of 4-6. Give each group a topic – plants, animals, people (you may have more than one group working on a topic).

On a large sheet of paper have each group describe ways in which their topic makes use of the wind.

After students have had a chance to come up with their own ideas, take them outside to try to observe other ways in which plants, animals and humans make use of the wind in their daily lives.

Ideas on the kinds of issues students might come up with include (but are not limited to):

- Plants use the wind to distribute their pollen
- Birds use the wind when they fly
- Animals pick up scents that carry on the wind
- People use the wind for drying clothes
- People use the wind for ventilation – cooling down the house by opening doors and windows to let the air through
- Fishermen and other people use the wind to sail dhoni's to travel between islands in the Maldives
- People use windmills which catch the wind and use that power to pump water
- People use the wind for flying kites



*Birds use the wind when they fly.*

## 1.3, 1.4 FINDING OUT AND SORTING OUT

The following activities involve students in shared experiences that provide new information about the topic and stimulate curiosity. Students at this stage will also be collating, processing, analyzing and presenting the information in a variety of ways.

### ACTIVITY 6: WIND STRENGTH

**Purpose:** To discuss and create an agreed upon scale to describe wind strength.

**Time:** Approx. 20 minutes per day over 2 days

**Materials Required:** N/A

**Resource / Information Sheets:** 1.1 Student Resource Sheet - Describing the wind

1.1 Teacher Information Sheet - Finding out about wind energy activities

1.2 Teacher Information Sheet - The Beaufort Scale

#### Procedure

Based on the findings from the visualisations and from thinking about how the wind can be used, introduce the idea that different strengths of wind are useful for different purposes.

Encourage students to consider the value of having an agreed upon scale of ways to describe the strength of the wind. You can use the Beaufort scale as an example (see *Teacher Information Sheet 1.2*).

Encourage students to share their own descriptions of the strength of the wind. Use the descriptions recorded on *Student Resource Sheet 1.1* as a starting point.

If students have created wind monitors (see *Teacher Information Sheet 1.1*) they can use the data collected in that activity to help here.

Also, if students have undertaken weather monitoring activities as described in the Earth Module, that data can be used here.

Comparing the results from the weather station and from these hand made wind monitors will help students create their own scale of wind strength.

On the board record the various descriptions of wind strength. As a whole class or in small groups, cluster together the different ways of describing similar strengths of wind.

Discuss the different ways of describing the wind's strength and as a class agree upon your own scale that applies to local conditions.

Encourage students to test the scale. Take it home and ask people who live and work in different locations to use your class scale to describe the strength of the wind they encounter.

From this, work out the windiest and calmest places in your area.

Draw a map that covers all the places where people have tested your scale and mark the different wind strengths described in different places on it.



*Testing hand made wind monitors.*



*Hand made wind monitor on H.A. Baarah.*

## 1.5 DRAWING CONCLUSIONS

The following activities will help students to interpret information, establish connections and confirm/reject or modify predictions.

### ACTIVITY 7: MAPPING THE WIND

**Purpose:** To make generalizations about patterns of wind movement.

**Time:** Approx. 15-20 minutes

**Materials Required:** Maps from activity 6

**Resource / Information Sheets:** N/A

#### Procedure

Having created a map that shows the strength of the wind at different points on your island, have students discuss in small groups why certain areas have certain patterns of wind movement.

If students are struggling in their discussions, ask prompting questions such as:

- Are there many trees in the windiest places?
- Is it windier at sea or on land?
- Is it very windy in places where there are lots of buildings?



*Coconut palms growing in a windy location.*

## 1.6 CONSIDERING, PLANNING AND TAKING ACTION

As a result of students being actively involved in decision-making throughout the inquiry process, it is hoped that they will be empowered to take action which has positive personal, community and global effects.

### ACTIVITY 8: THE WIND IN OUR COMMUNITY

**Purpose:** Encourage students to think about how they would take wind into account if they were to modify the local community layout.

**Time:** Approx. 40 minutes

**Materials Required:** Pen, paper, coloured pencils

**Resource / Information Sheets:** N/A

#### Procedure

Ask prompting questions such as the following:

- Would you move certain buildings or community centres to different locations to make better use of the wind?
- If you were to create a garden somewhere nearby, where would it be and why?
- If you had to choose a place to dry wet clothes, where would it be and why?
- Do the wind conditions on the sports grounds impact on how games unfold? Would a different place be better for playing games?



*Consider how the wind affects certain activities.*

Older students could write essays about how they would redesign the local area. Younger students can draw pictures of how they would design the local area to make best use of the wind patterns.

## 1.7 EVALUATION AND REFLECTION

At this stage it may become evident that there is a need to return to some stages of the inquiry process to clarify knowledge or refine skills. The following questions may be asked:

- Are you happy with the ways in which your information was gathered, analysed and presented?
- Is there anything you would change?
- Are there things you need to investigate further?

### ACTIVITY 9: DEBATE ON WIND

**Purpose:** To discuss and reflect upon the positive and negative aspects of the wind.

**Time:** Approx. 30 minutes

**Materials Required:** Pen, paper

**Resource / Information Sheets:** N/A

#### Procedure

Divide the class into two groups. Appoint one group to talk about the negative aspects of the wind while the other group presents the positive aspects of the wind. Thus conduct a debate among the two groups. Once the debate is over select the winning group, based on the information presented and their presentation skills.

Essentially, at primary school level, the purpose of learning about wind energy is to raise awareness of this force and how it impacts our daily lives.

Recognising the power of the wind as a positive force which can initially help us with simple tasks such as drying our clothes and cooling our homes is the initial understanding to be developed.

The ultimate desired outcome is that students come to see themselves as active users of wind energy as they engage in such tasks as thinking about where to site the clothes line to best catch the wind and monitoring wind direction and force at various locations.

It is also important to recognise the power of the wind as a negative force from which plants, animals, people and structures sometimes need protection.

Modify discussions to be appropriate for age.

With upper primary students, the development of these understandings could lead to them being involved in school-based decision making and planning with regard to, for example, the siting of such things as rubbish bins out of the wind and ball game areas in places with some protection from the wind.



# STUDENT RESOURCE SHEET

## DESCRIBING THE WIND

Write down key words and phrases your partner uses to describe the wind in each scenario.

	Gentle wind – on the beach	Strong wind – in a storm
How did it feel?		
What could you see?		
What could you smell?		
What could you hear?		

## 1.1

## EXAMPLE OF COMPLETED STUDENT RESOURCE SHEET DESCRIBING THE WIND

	Gentle wind – on the beach	Strong wind – in a storm
How did it feel?	soft on my cheek my hair moving a bit at the back	almost pushed me over my clothes pressed against me
What could you see?	leaves moving a little bit small ripples in the sea	plants and trees bending sand blowing
What could you smell?	smell of salt smell of flowers	smell of oil smell of dust
What could you hear?	rustling of leaves sound of small waves	sound of strong wind blowing big waves breaking

## 1.1

# TEACHER INFORMATION SHEET

## FINDING OUT ABOUT WIND ENERGY ACTIVITIES

The following activities provide opportunities for students to witness the power of the wind.

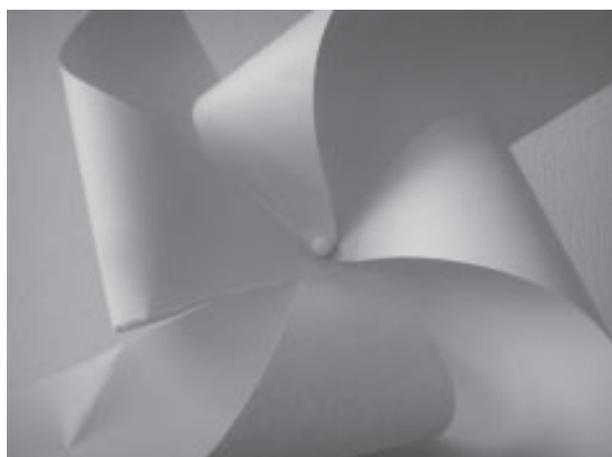
### Pinwheels

Take a piece of *eekel* (the mid rib of a palm leaf) about 6 inches long and two strips of palm leaf, each about 4 inches long. Make a turbine blade (Burafathi) with the palm leaves and insert the *eekel* in the middle. You can use the bottom part of a hibiscus to stop the palm leaves from slipping on the *eekel*. Twist the palm leaves so the wind will catch the edge. Place in a spot where the pinwheel will catch the wind, or blow on it gently to see how the wind will make it spin.

Alternatively, you can give each student a square piece of paper and talk the class as a whole through the following construction of a pinwheel. Lay the piece of paper flat on the desk and rule diagonal lines from corner to corner. This will



*Wind turbines are large versions of pinwheels.*



*Pinwheel.*

mark the centre of the piece of paper – punch a small hole through this centre point with the pin. Cut along each line until you are about 3cm from the centre. With a pin, punch a small hole in the top left hand corner of each of the 4 flaps (no 2 holes should be next to each other). Pick up a flap by the corner with a hole in it and curve it toward the centre hole. Do not fold it down, but hold it in the curve. Do this with each flap and then use the pin to secure all 4 flaps through the aligned holes. Very carefully secure the pin into the end of a pencil. Do this by lying the pencil flat on the desk and gently pressing the pin into it. Once secure, pick the pencil up at the other end. Let the pinwheel catch the wind or blow on it gently to see how the wind will make it spin.

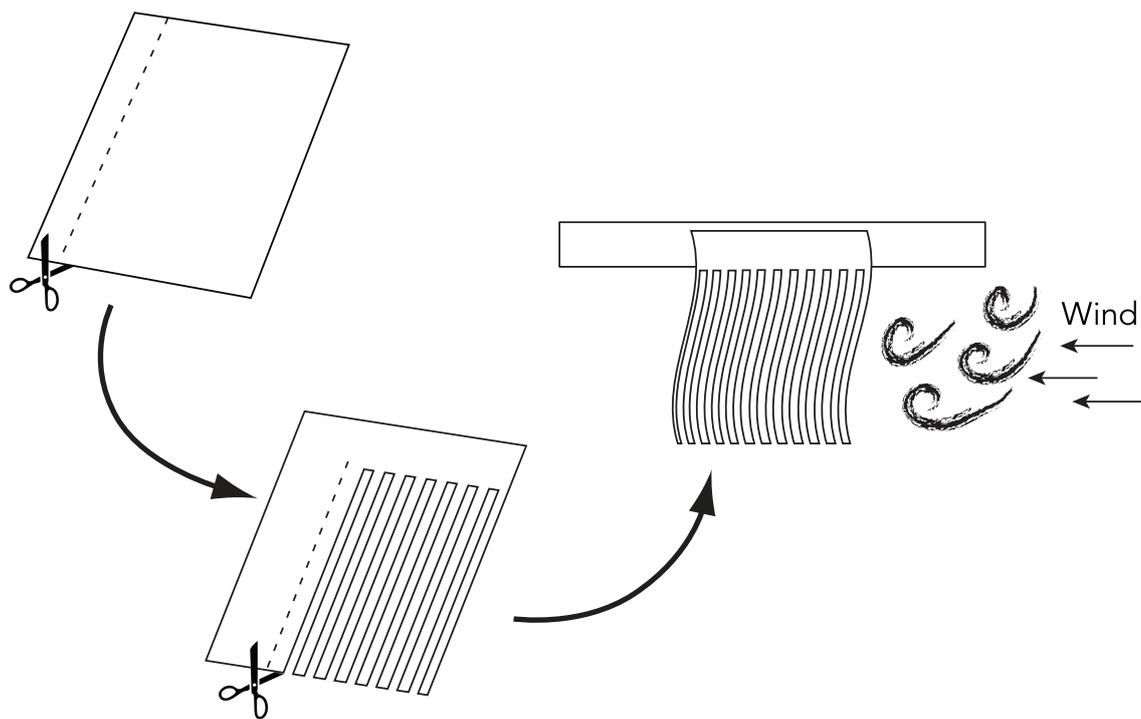
Pinwheels are an excellent introduction to a discussion of wind as a source or energy. Wind turbines are comparable to pinwheels and the idea of wind farms can be introduced from this.

In some places wind turbines are grouped together to form wind farms. These are built in places that are exposed to strong winds, such as on the ridges of hills or mountains, or along the coast. Here the turbines capture high levels of energy from the wind and feed it into electricity grids for whole communities to use.

### Wind monitor

Give each student a piece of plastic (such as one side of a plastic shopping bag) that is about 30cm square. Instruct students to cut the plastic into 2cm strips, making sure that they all remain joined together in a thick band at one end. Glue or stick the thick band to a ruler so that the strips are all hanging from the solid base.

Attach the ruler to a fence or similar object. Make sure that the plastic strips can blow freely with the wind. Have students place their wind monitors in different places around the school so that when they compare their results they will have a sense of different strengths of wind in different parts of the school. Make observations of the movement of the plastic strips at agreed upon times throughout the day. Students should describe different levels of movement, e.g. 'strips blowing straight out', 'strips lifting', 'strips stirring but not lifting', 'strips not moving', etc.



*Making a wind monitor.*

This activity has strong links with the weather activities in the Earth Module.

### Paper bag kites

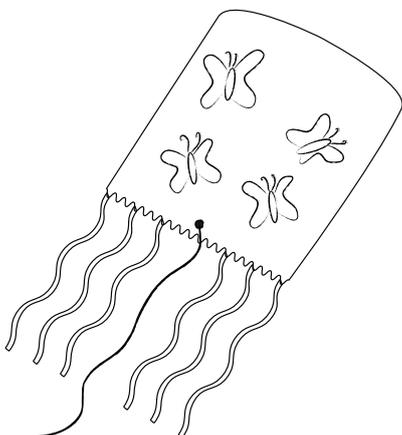
Give each student a small paper bag – approximately 30 cm square. Provide time for students to decorate the bag with drawings, paintings etc. Ensure students attach strings or pieces of ribbon at the bottom of the bag as this will help students witness the movement of the wind. Attach a string to the open end of the bag. Take students outside to run around with their paper bag kites. The wind will fill the bag and the bag will move in accordance with the currents of the wind around it. Return to the classroom and have students describe what happened. Could they feel the pull of the

wind on the bag? How did the kite move? Did the speed of movement of the students affect the ways in which the bags moved in the wind? What did the flying kites remind students of or make them think about?

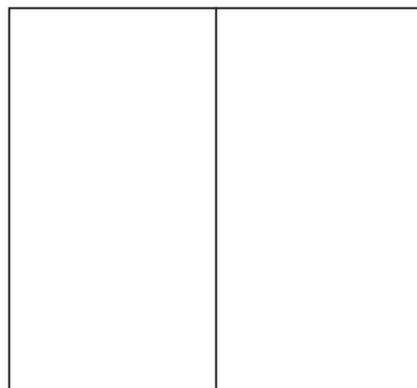
### Paper airplanes

Activity to demonstrate wind direction changes: students make paper aeroplanes and fly them from the ground and higher places if possible.

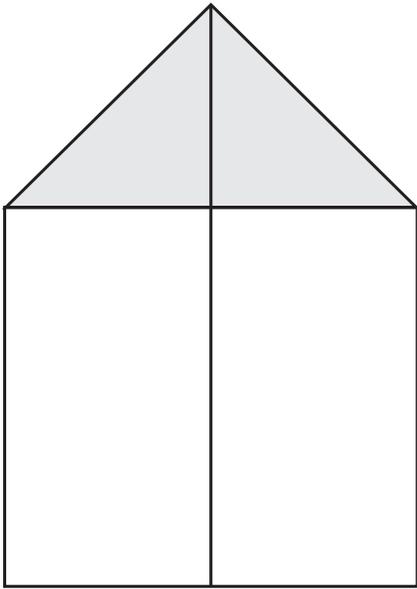
- ▼ Firstly fold the sheet in half along the line shown in DIG. 1 and then open it out again.



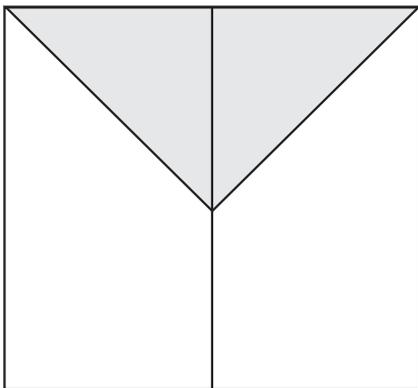
*A paper bag kite.*



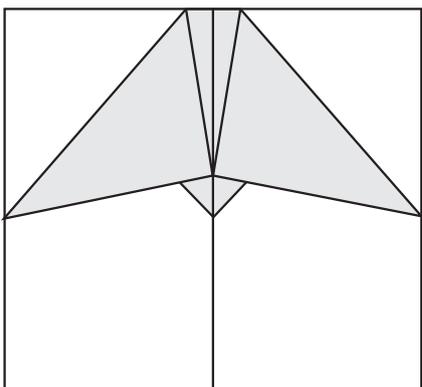
- ▼ Fold the two top corners in to the center line to give the form in DIG. 2.



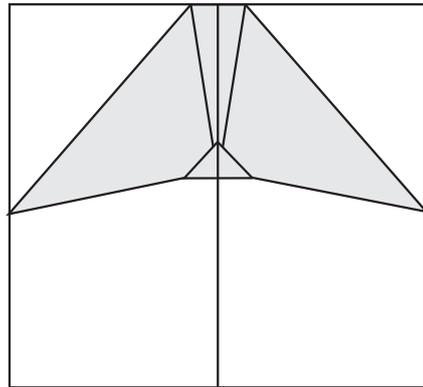
- ▼ Then fold the top large triangle over so that the two flaps formed in step 2 are underneath the large triangle. Your paper should now look like DIG. 3.



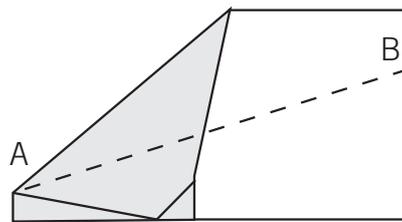
- ▼ From the form in DIG. 3 fold the two top corners into the center line again in such a way that you get the form in DIG. 4.



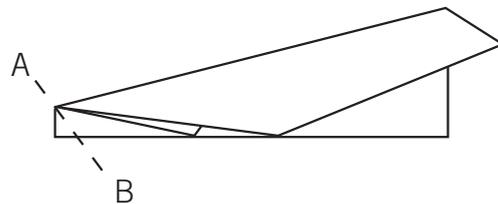
- ▼ Now fold the small triangle up over the two flaps to give DIG. 5.



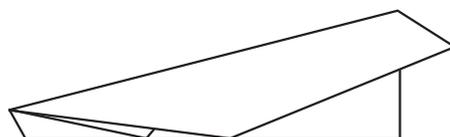
- ▼ Fold along the center line so that the small triangle is on the underside of the plane on the outside along with the two flaps as shown in DIG. 6.



- ▼ Fold along the line AB on DIG. 6 then turn the plane over and do the same to the other side producing DIG. 7.



- ▼ Fold along the line labelled AB on the diagram first one way and then the other creasing really well. Tuck the triangular shaped depression inbetween the two wings to produce DIG. 8. This stabilises the plane.



## 1.2

# TEACHER INFORMATION SHEET

## THE BEAUFORT SCALE

The Beaufort Scale is a way of estimating wind strength without the use of any instruments to measure it accurately. Use this as an example to help students come up with their own scales for wind speed and cloud cover.

FORCE	DESCRIPTION	CONDITIONS	WIND SPEED (KPH)
0	Calm	Smoke rises vertically	0
1	Light air	Smoke drifts	1-5
2	Light breeze	Leaves rustle, wind vane moved by wind	6-11
3	Gentle breeze	Leaves in constant motion, light flag extend	12-19
4	Moderate breeze	Raises dust and loose paper, small branches move	20-29
5	Fresh breeze	Small trees sway, crested wavelets on inland water	30-38
6	Strong breeze	Large branches in motion	39-50
7	Moderate gale	Whole trees in motion	51-61
8	Fresh gale	Breaks branches off trees, impedes walking	62-74
9	Strong gale	Slight damage to buildings	75-86
10	Whole gale	Large branches broken, some trees uprooted	87-101
11	Storm	Large trees uprooted	102-120
12	Cyclone	Widespread damage	120+

## 1.3

TEACHER INFORMATION SHEET  
WIND ENERGY

Wind is a powerful source of energy. To capture this energy scientists have created wind turbines (see photo below). In some places wind turbines are grouped together to form wind farms. These are built in places that are exposed to strong winds, such as on the ridges of hills or mountains, or along the coast. Here the turbines capture high levels of energy from the wind and feed it into electricity grids for whole communities to use.

### Advantages

As the demand for electricity grows and as fears about the effect of using non-renewable fuel sources (e.g. fossil fuels), many experts believe that the use of wind energy will continue to increase. As wind power becomes an increasingly cost-effective source of electricity, more and more people are turning to wind energy to help supply their needs.

### Disadvantages

Wind energy is an exciting source of electrical power because it is a clean and renewable resource (i.e. it occurs naturally and does not produce greenhouse gases like power plants). However, because wind speeds vary by time of day, season, and even from one year to the next, wind energy is an intermittent resource (i.e. it comes and goes).

### Wind Energy in the Maldives

In the Maldives, we are very dependent on non-renewable fuels such as diesel to make electricity. However we often get strong gales, so wind energy becomes an option for islands to consider. In fact a couple of islands (e.g. Baa Goidhoo, H.A. Uligam) are currently experimenting with wind turbines to make energy for their islands.

For further information see [www.meew.gov.mv](http://www.meew.gov.mv)



*Wind turbines on H.A. Uligam.*

<http://www.stomaldives.com/pilotproject.html>

# 2

# SOLAR ENERGY

**Grades:** 4 to 5

**Number of lessons:** 4 to 6

## Purpose

To understand the ways in which we make use of the energy from the sun and to stimulate thinking about how we could make better use of this energy source.

## Key questions

Key focus questions for this section are:

- How do we use the sun?
- How could we use the sun more effectively?

## Links with other Modules

Resources from the Environment

## Toolbox

### Physical materials

Solar cell educational kits – comprising: solar cell Module; solar energy introductory booklet; small DC motor; screws and nuts; wire with motor clips; colour spinner discs; paper aeroplane and bird models; plastic turntables with 4 sizes,  $\frac{5}{8}$ ,  $1$ ,  $1.5^2$  and  $2^2$ ; plastic fan spinner.

### Flip Charts

Weather, Water, Waste and Energy Flip Chart

## Preparation

You will need the Weather, Water, Waste and Energy Flip Chart for this topic. Also read *Teacher Information Sheet 2.3* and *2.4* to familiarize yourself with this topic.

## 2.1 TUNING IN

The following activities help to engage and focus students' interest on the topic.

### ACTIVITY 1: DAY AND NIGHT

**Purpose:** To describe and share information that relates to the different times in a day.

**Time:** Approx. 20-25 minutes

**Materials Required:** A3 paper, Markers, coloured pencils

#### Procedure

Divide the students into pairs. Organise the pairs around large pieces of paper so that there is a pair on each side of the paper. With younger students, place 2 pairs on opposite sides of the paper rather than 4 pairs around the edges.

Divide the piece of paper with 2 diagonal lines for 4 pairs and 1 diagonal line for 2 pairs. Students will work in their allocated triangle.

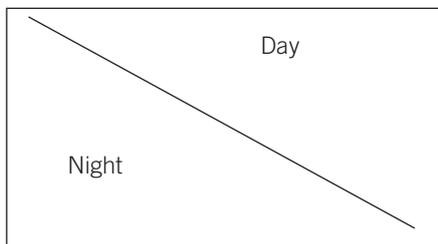
If working with younger students, for whom the paper is divided in 2, nominate one pair to work on 'day' and the other pair to work on 'night'.

If working with older students, divide into categories of 'dawn', 'dusk', 'midday' and 'midnight'.

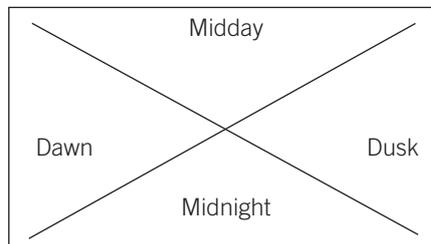
Instruct students to write in their section of the paper all the words they know that relate to the time of day they are working with. Younger students may prefer to draw.

Sheets will look like this (students can write their own labels for the space they are working in):

For younger students:



For older students:



Younger students may have only a few adjectives such as light/dark; cool/warm; quiet/noisy; scary/safe. Older students might get into such descriptors as light fading/light growing.

Older students might also describe elements across the four time periods such as changes in temperature; changes in animal, plant and human activity; changes in the sky's appearance relating to colour; movement of clouds; and lightness and darkness.

Initial sharing of information recorded on 'sheets' may be carried out by passing the sheets between groups for other pairs or foursomes of students to read.

Whole class sharing should be documented onto a summary chart that can be displayed in the classroom.

From this discussion and documentation it should be possible to see that when we are exposed to the sun (i.e. in the daytime) we have light and heat from the sun. This provides a basic definition of solar energy.

## ACTIVITY 2: WHAT DO WE ALREADY KNOW?

**Purpose:** To develop ideas about the sun and solar energy.

**Time:** Approx. 20 minutes

**Materials Required:-** N/A

**Resource/ Information Sheets:** 2.1 Student Resource Sheet - KWL Chart  
2.1 Teacher Information Sheet – How to use KWL Chart

### Procedure

Begin work on the KWL chart provided as *Student Resource Sheet 2.1* (see the *Teacher Information Sheet 2.1* for more detail on how to use it). Students can fill in column 1 ('what do we know about the sun / solar energy?') at this stage.

Ideas they may cover include (but are not limited to):

- it provides heat
- it provides light
- it marks day from night
- we can use it to measure time (day and night, number of days and weeks, etc)
- it makes shadows
- it can burn us
- it can fade clothes or furniture
- it dries out clothes, nets, food

Ask students to fill in column 2 of the KWL chart as well. This can be done individually or in small groups.

Try to find links between the areas of interest students identify in column 2 and the activities suggested in the Finding out activities. You may also like to research other activities your students could try that more closely address their areas of interest.



*Fish drying in the sun.*

## 2.2, 2.3 DECIDING DIRECTIONS AND FINDING OUT

The following activities involve students in shared experiences that provide new information about the topic and stimulate curiosity. Students at this stage will also be collating, processing, analyzing and presenting the information in a variety of ways.

### ACTIVITY 3: THE POWER OF THE SUN

**Purpose:** To record and share observations about the power of the sun.

**Time:** Approx. 25-30 minutes

**Materials Required:** pens, markers

**Resource/ Information Sheet:** 2.1 Student Resource Sheet – K W L Chart  
2.2 Teacher Information Sheet - Finding out about solar energy activities

#### Procedure

Using any of the activities on *Teacher Information Sheet 2.2*, have students record their observations about the power of the sun.

In choosing activities, try to make links with the areas of interest students identified when filling in column 2 of the KWL chart.

You may have the whole class working on one activity in small groups, or you may like to give different groups different activities as a way of providing a broader range of observational opportunities to the class as a whole.

Once activities have been conducted, have groups identify the key lessons from their experiments in order to share their learnings with the rest of the class.

This can happen either by groups reporting back to the whole class or by organizing students into new groupings that are made up of students who took part in different activity groups. This would allow each student to have unique observations to share with the rest of their new group.



*Plants use sunlight to make food via photosynthesis.*

### ACTIVITY 4: HOW CAN THE SUN BE USED?

**Purpose:** To describe, observe and share ideas of ways in which plants, animals and humans make use of the sun.

**Time:** Approx. 40-45 minutes

**Materials Required:** A3 paper, pens, markers

**Resource/ Information Sheets:** N/A

#### Procedure

Divide students into groups of 4-6. Give each group a topic – plants, animals, humans (you may have more than one group working on a topic).

On a large sheet of paper have each group describe ways in which their topic makes use of the sun.

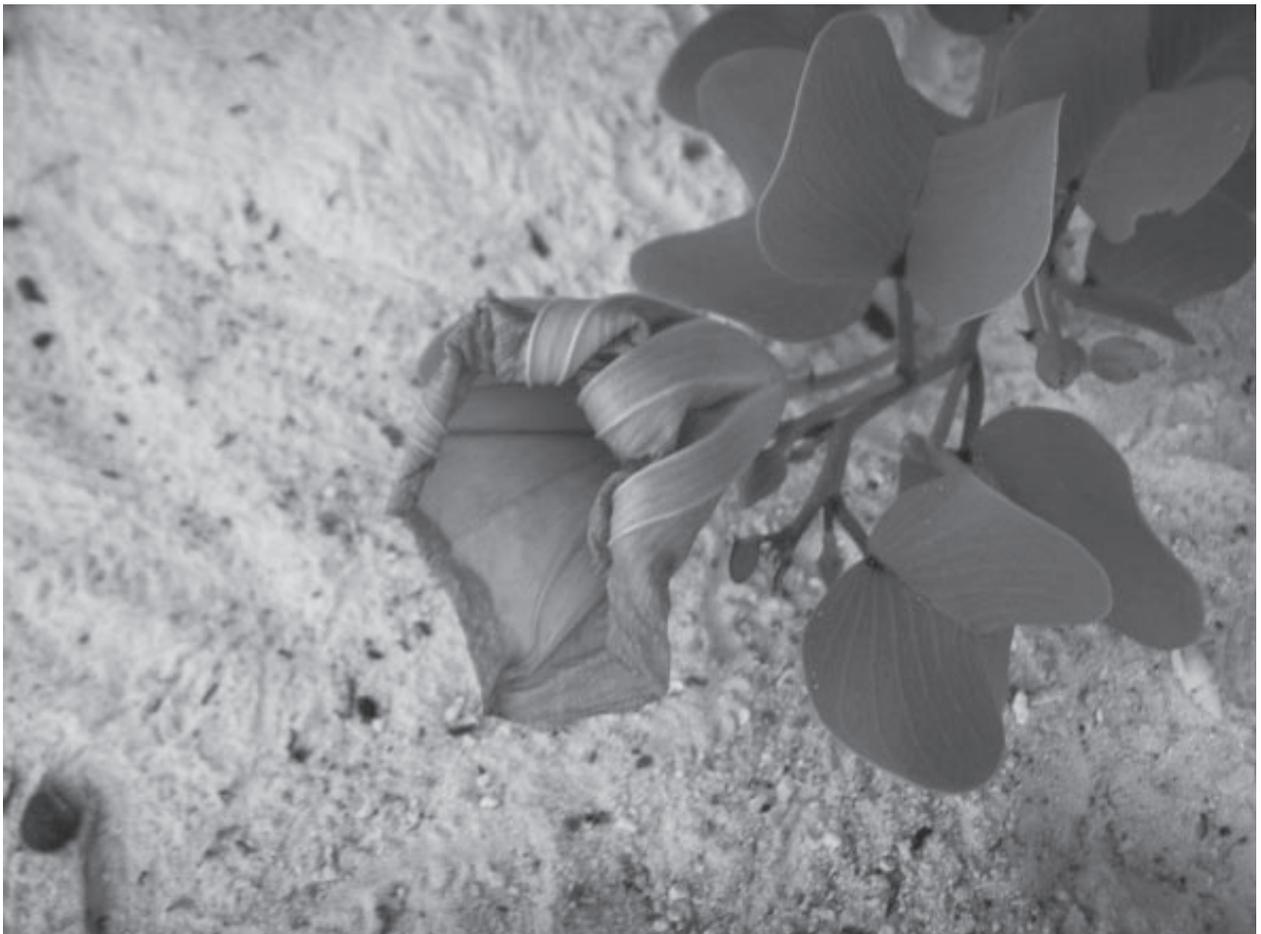
After students have had a chance to come up with their own ideas, pass the sheets to a new group and see if they can add any ideas to those already generated.

After students have had a chance to come up with their own ideas, take them outside to try to observe other ways in which plants, animals and humans make use of the sun in their daily lives.

Share ideas with the whole class and summarize the student's findings on a chart. Use this to demonstrate the ways in which plants, animals and humans use the sun in similar and different ways.

Ideas on the kinds of issues students might come up with include (but are not limited to):

- Plants use energy from the sun to grow
- The sun ripens fruit
- Some flowers open and close with the sun and others turn with the sun over the course of a day
- Animals use the energy from the sun to grow
- Animals use the energy from the sun to keep warm
- Animals use the energy from the sun to see by
- Animals and humans eat plants that have made use of the sun in other ways
- Humans have used the sun to make fire with magnifying glasses or mirrors
- Humans can also use magnifying glasses or mirrors to signal to each other over distance (try this)
- Humans use the sun to heat water
- Humans use the sun to dry clothes, fish, fruit, coconuts, nets
- Humans use the sun to see by
- Humans use the sun to grow food



*Some flowers start to curl up when the sun goes down. E.g. Goat's Foot Vine or Thanburu.*

## 2.4, 2.5 SORTING OUT AND DRAWING CONCLUSIONS

Students at this stage will be collating, processing, analyzing and presenting the information in a variety of ways. The following activities will help students to interpret information, establish connections and confirm/reject or modify predictions.

### ACTIVITY 5: WHAT HAVE WE LEARNT ABOUT THE SUN?

**Purpose:** To record and discuss ideas about the use of the sun.

**Time:** Approx. 20 minutes

**Materials Required:** N/A

**Resource/ Information Sheet:** 2.1 Student Resource Sheet- K W L Chart

#### Procedure

Ask students to complete the KWL chart by filling in column 3.

Ask students to turn to their partner or the person beside them and have a brief conversation about how we can make use of the sun's energy. This will draw on ideas students have recorded on their charts.

You may like to bring this back to a whole class discussion that you can document on the board under the heading 'How does the sun help us?' (the list might include: planting and growing, drying, signalling, heating, dyeing, etc).

### ACTIVITY 6: THE SUN AND ME

**Purpose:** To create and illustrate a story showing conclusions drawn about the sun and solar energy.

**Time:** Approx. 40 minutes

**Materials Required:** pen, paper

#### Procedure

In pairs, ask students to creatively express their understanding of how reliant we all are on the sun by creating and illustrating a story.

Ideas for stories include (but are not limited to):

- What would life be like if we did not have a sun?
- What would life be like if the day was only half as long as it is?
- What would life be like if the sun was too powerful for us to be out in?
- What would life be like if we did not know when the sun would come out?
- What would life be like if I controlled the sun?

## 2.6 CONSIDERING, PLANNING AND TAKING ACTION

As a result of students being actively involved in decision making throughout the inquiry process, it is hoped that they will be empowered to take action which has positive personal, community and global effects.

### ACTIVITY 7: SOLAR WATER HEATERS

**Purpose:** To develop and present ideas on how to use solar energy.

**Time:** Approx. 40 minutes

**Materials Required:** Solar cell education kit and Weather, Water, Waste and Energy Flip Chart

**Resource/ Information Sheet:** 2.4 Teacher Information Sheet- Solar Energy

## Procedure

Introduce the idea that other people are also thinking about the ways in which we can harness the power of the sun. One such way is through the use of solar cells – devices that convert the energy of the sun into energy that can power things we otherwise would run on mains electricity or batteries.

Encourage students to play with the solar cells educational kits. The booklet that accompanies these devices contains a range of activities students can try.

Show students the Weather, water, waste and energy Flip Chart and describe the ways in which solar cells are used to heat water, power street lights or garden lights, etc. If there are students who have solar panels in their homes, let those students talk about how it is used, how it operates etc. The idea here is not to explain the science so much as to illustrate the wide variety of ways in which solar energy can be used.

Encourage students to think about these ideas in the Maldives. How could people in the Maldives make use of the kinds of solar powered devices seen in the flip chart images? How could we make use of this kind of technology at school and at home?



Solar hot water heater.



Mapping the sun.

Ideas students might come up with include (but are not limited to):

- We could use solar powered lights around the school buildings
- We could use solar water heaters to heat water at home

## ACTIVITY 8: MAPPING THE SUN

**Purpose:** To make decisions on how to make the best use of the sun.

**Time:** Approx. 1 hour

**Materials Required:** Map of the island, markers

**Resource/ Information Sheet:** N/A

### Procedure

Looking at a map of the island, think about where the power of the sun is strongest and most accessible. An observational walk around the island might help with this.

Ask students to think about where we would locate solar powered items in order to make best use of the power of the sun, and where solar powered items would be less efficient?

Mark these places on a map.

## ACTIVITY 9: SELLING THE SUN

**Purpose:** To design a poster for raising awareness about the benefits of solar energy.

**Time:** Approx. 40 minutes

**Materials Required:** Paper, pens, markers, coloured pencils

**Resource/ Information Sheet:** N/A

### Procedure

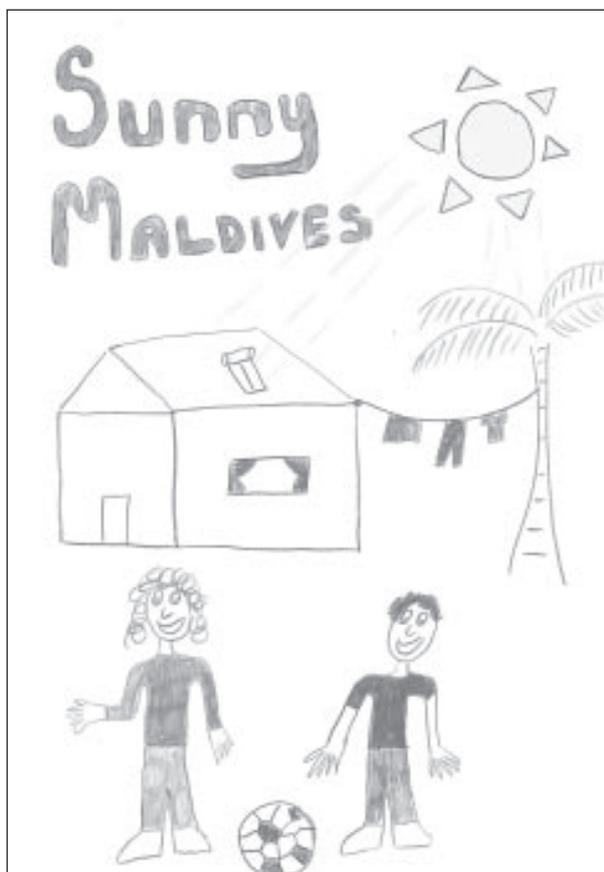
Ask students to work in pairs to design an advertising poster that explains why solar power is good and how it can be used in the Maldives.

These posters can be used to raise community awareness and understanding of the benefits of solar power and can be displayed in public places such as the community centre.

## 2.7 EVALUATION AND REFLECTION

At this stage it may become evident that there is a need to return to some stages of the inquiry process to clarify knowledge or refine skills. The following questions may be asked:

- Are you happy with the ways in which your information was gathered, analysed and presented?
- Is there anything you would change?
- Are there things you need to investigate further?



*Student poster.*

## ACTIVITY 10: ASSESSING THE POSTERS

**Purpose:** To develop and use a guideline to assess a poster addressing the benefits and uses of solar energy.

**Time:** Approx. 25 minutes

**Materials Required:** Advertising posters from activity 9.

**Resource/ Information Sheet:** N/A

### Procedure

Conduct a peer assessment of the advertising posters. Work with students to develop a guide to what makes a good poster. This may include ideas such as:

- clear design
- simple message
- balance between text and pictures
- relevant to local conditions

Ask students to review a poster other than the one they created and to talk to the class about what they like about the poster.

## ACTIVITY 11: LESSONS LEARNT

**Purpose:** To reflect upon what students have learnt.

**Time:** Approx. 20 minutes

**Materials Required:** Pen and paper

**Resource/ Information Sheet:** N/A

### Procedure

**Ask students to write down:**

- Four important ideas/concepts/information/values I have learnt in this module are .....
- Two things I now want to do for myself and for others are.....

Ask students to decide what they would like to do with the results of their research and discussion. One of the possibilities might be to write a story or play about solar energy.



# STUDENT RESOURCE SHEET

## KWL CHART

Fill in the KWL (Know, Want to Know, Learnt) chart

What do we know about the sun / solar energy?	What do we want to learn about the sun /solar energy?	What have we learned about the sun / solar energy?

SOLAR ENERGY

## 2.1

# TEACHER INFORMATION SHEET

## HOW TO USE KWL CHART

This chart will capture student's changing understanding of a subject. Students fill in the different columns at different stage of the learning process. At the beginning, fill in the K column. This focuses on what we already know about the topic. Once students have been made conscious of what they already know about the topic, they can fill in the W column, which captures what we want to know about the topic. At the end of the learning process, as a part of reflection, ask students to fill in the third column, the L column, which highlights what we have learned about the subject.

### Sample KWL chart

What do we know about the sun / solar energy?	What do we want to learn about the sun /solar energy?	What have we learned about the sun / solar energy?
<p>The sun gives us light.</p> <p>The sun gives us heat.</p> <p>We can use the sun's rays to dry things like coconuts, fish and clothes.</p>	<p>What is solar energy?</p> <p>How do solar hot water heaters work?</p> <p>How hot is the sun?</p>	<p>Solar energy is the energy received by the earth from the sun. This energy is in the form of solar radiation, which makes the production of solar electricity possible.</p> <p>Solar cells installed on roofs collect solar energy and this energy is transferred to water. Hot water is stored in a water tank.</p> <p>The sun is very hot- the outer part of the sun is 5500°C.</p>

## 2.2

# TEACHER INFORMATION SHEET

## FINDING OUT ABOUT SOLAR ENERGY ACTIVITIES

The following activities provide opportunities for students to witness the power of the sun. Have students record their learnings from these experiments in column 3 of the KWL chart.

### Sun tea

Place water and tea (loose or in bags) in at least 2 jars with lids. Set one jar in the sun and the other in the shade, or in a cupboard. Leave both jars for 3-4 hours. Allow students to taste the 2 cups of tea and compare the taste as a way of demonstrating the power of the sun.

Following the tea making activity, students could test the dyeing process using tea bags (loose or in bags) placed in a jar of water along with a small piece of white cotton fabric. Place the room temperature water, the fabric and the tea in each of several jars, which are then placed with some in full sunlight, some in shade and some indoors in a cupboard. Ensure that the size of each piece of fabric is the same, that the jars are the same size and the water and tea in each is the same to make the only variables the light and heat of the sun. Leave for several hours and then inspect the pieces of fabric to see if there are differences in the depth of colour of the fabric from the dyeing or staining effect of the tea aided by the light and heat of the sun.

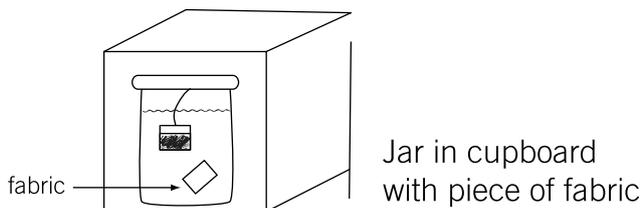
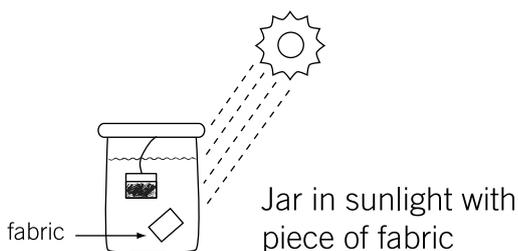
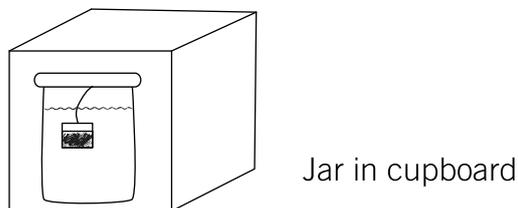
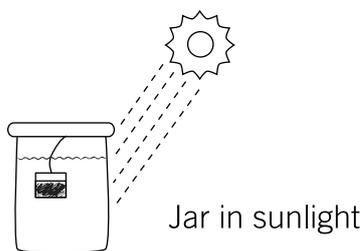


*Melting ice cubes.*

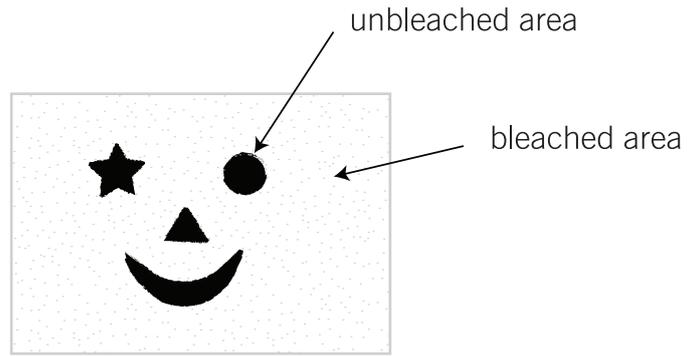
### Melting ice cubes

Place an ice cube in a dish and put in the sun. Place another ice cube in another dish and leave it in the shade. Have students predict which will melt faster. Record the time at which the ice blocks are set out and record how long it takes each to turn to water. Have students make observations about the melting rates of each ice cube.

You can also leave a metal spoon in the sun and then put it on the ice cube to demonstrate the transfer of heat from the sun to the spoon to the ice as it increases the rate of melting.



*Sun tea activity.*



*Bleaching activity.*

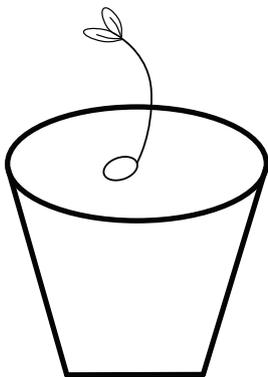
### Bleaching activity

Give each student a dark coloured piece of paper (black, red, navy, blue, purple, dark green, dark brown). Using cardboard templates or real life objects such as leaves (anything with a strong, clear edges), have students construct a pattern on the paper. The desired shape (which must be smaller than the background sheet) should be held in place on the dark background sheet with small stones or other suitable objects as weights. Encourage students to place their papers in places where they receive different amounts of sunlight. Some should be in the strong, direct sun (preferably out of the wind) while others should be in the dark (e.g. in a cupboard). Leave papers in place for several hours (or days).

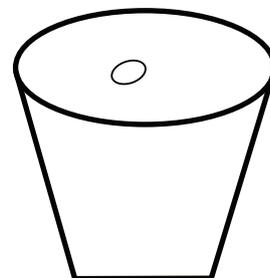
On the sheets that have been left in the direct sun, the bleaching of the exposed dark coloured paper will demonstrate the power of the sun when the students see the difference in colour between the bleached and unbleached areas. Little to no bleaching will be evident on other sheets, depending on the amount of sunlight they were exposed to.

### Plant growth

Students can plant either seeds or small plants in a small amount of soil in a paper cup and provide all seeds/plants with water but provide only some with sunlight by placing some in full sunlight, some in shade and some in a dark cupboard indoors. The differences in plant health and growth rate will allow students to see the need for sunlight and warmth for growth to occur.



Plant growth  
with sunlight



Plant growth  
in the dark

*Plant growth activity.*

# 2.3

## TEACHER INFORMATION SHEET THE SUN

### The Sun

The Sun is the closest star to Earth. The Sun is a huge mass of hot, glowing gas. The strong gravitational pull of the Sun holds Earth and the other planets in the solar system in orbit. The Sun's light and heat influence all of the objects in the solar system and allow life to exist on Earth.

The Sun is an average star—its size, age, and temperature fall in about the middle of the ranges of these properties for all stars. Astronomers believe that the Sun is about 4.6 billion years old and will keep shining for about another 7 billion years.

For humans, the Sun is beautiful and useful, but also powerful and dangerous. As Earth turns, the Sun rises over the eastern horizon in the morning, passes across the sky during the day, and sets in the west in the evening. This movement of the Sun across the sky marks the passage of time during the day.

The Sun provides Earth with vast amounts of energy every day. The oceans and seas store this energy and help keep the temperature of Earth at a level that allows a wide variety of life to exist. Plants use the Sun's energy to make food, and plants provide food for other organisms. The Sun's energy also creates wind in Earth's atmosphere. This wind can be harnessed and used to produce power.

While it lights our day and provides energy for life, sunlight can also be harmful to people. Human skin is sensitive to ultraviolet light emitted from the Sun. Earth's atmosphere blocks much of the harmful light, but sunlight is still strong enough to burn skin under some conditions. Sunburn is one of the most important risk factors in the development of skin cancers, which can be fatal. Sunlight is also very harmful to human eyes. A person should never look directly at the Sun, even with sunglasses or during an eclipse. The Sun influences Earth with more than just light. Particles flowing from the Sun can disrupt Earth's magnetic field, and these disruptions can interfere with electronic communications.

### Physical characteristics of the Sun

The Sun is large and massive compared to the other objects in the solar system. The Sun's radius (the distance from its center to its surface) is 695,508 km (432,169 mi), 109 times



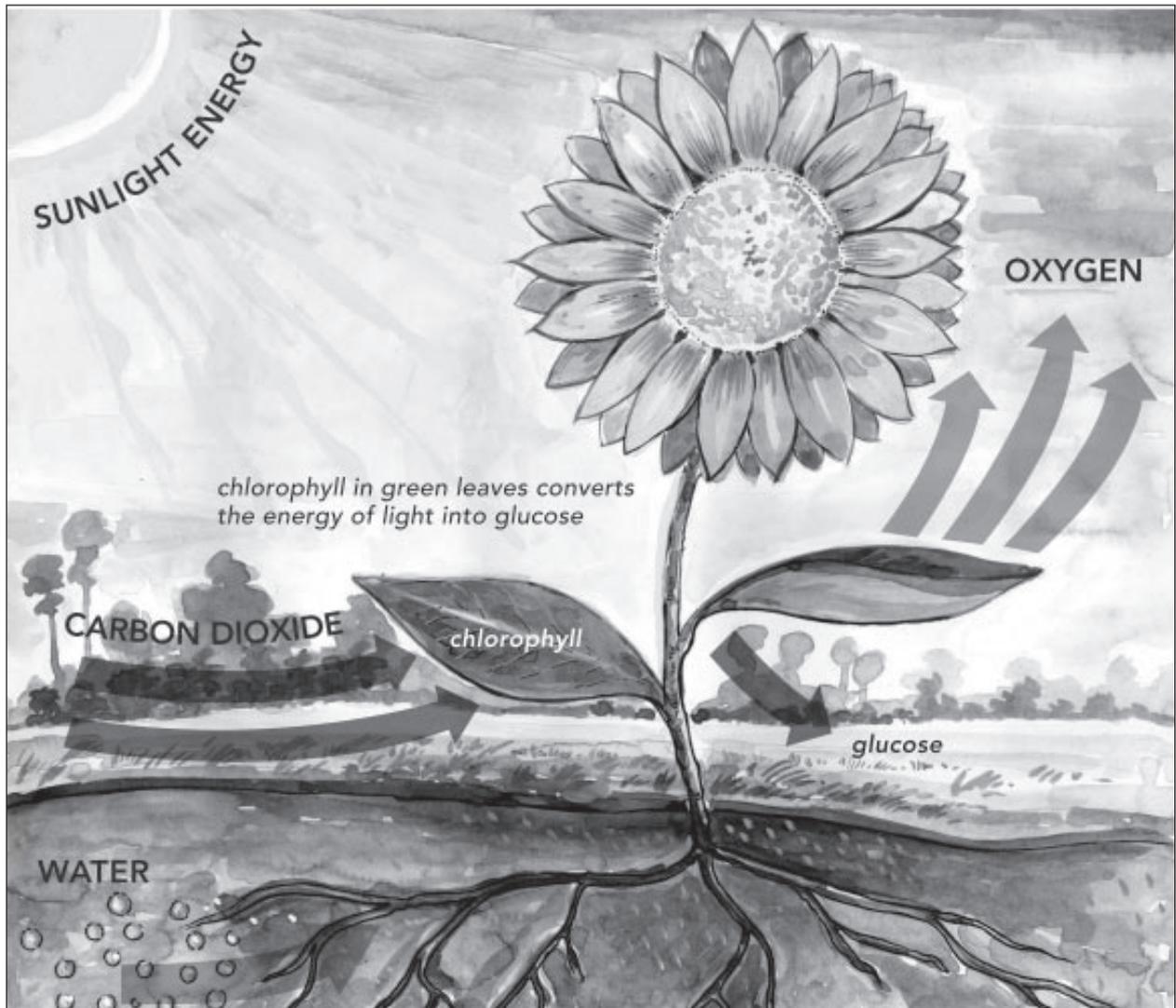
as large as Earth's radius. If the Sun were hollow, a million Earths could fit inside it.

The Sun produces an enormous amount of light. It generates  $3.83 \times 10^{26}$  watts of power in the form of light. In comparison, a normal light bulb emits 60 to 100 watts of power. The temperature of the outer, visible part of the Sun is  $5500^{\circ}\text{C}$ .

From Earth the Sun looks small, because it is far away. Its average distance from Earth is 150 million km. Light from the Sun takes about eight minutes to reach Earth. This light is still strong enough when it reaches Earth, however, to damage human eyes when viewed directly. The Sun is much closer to Earth than any other star is.

### Importance of the Sun

Earth would not have any life on it without the Sun's energy, which reaches Earth in the form of heat and light. This energy warms our days and illuminates our world. Green plants absorb sunlight and convert it to food, which these plants then use to live and grow. In this process, the plants give off the oxygen that animals breathe. Animals eat these plants for nourishment. All plant and animal life relies on the Sun's presence.



*The photosynthesis process.*

The Sun also provides—directly or indirectly—much of the energy on Earth that people use for fuel (Solar Energy). Devices called solar cells turn sunlight into electricity. Sunlight can heat a gas or liquid, which can then be circulated through a building to heat the building.

The Sun's energy produces the winds and the movements of water that people harness to produce electricity (Wind Energy; Water Power). The Sun heats Earth's oceans and land, which in turn heat the air and make it circulate in the

atmosphere as wind. The Sun fuels Earth's water cycle, evaporating water from the oceans, seas, and lakes. This water returns to the ground in the form of precipitation, flowing back to the oceans through the ground and in rivers. The energy of water's motion in rivers can be harnessed with dams.

[http://encarta.msn.com/encyclopedia\\_761562112/Sun.html](http://encarta.msn.com/encyclopedia_761562112/Sun.html)

# 2.4

## TEACHER INFORMATION SHEET SOLAR ENERGY

### Solar Power – Energy from the Sun

The sun has produced energy for billions of years. Solar energy is the solar radiation that reaches the earth. When we hang clothes outside to dry in the sun, we are using the sun's heat to do work -- drying our clothes. Solar energy can be converted directly or indirectly into other forms of energy, such as heat and electricity. The major problems of solar energy are: (1) the intermittent and variable manner in which it arrives at the Earth's surface and, (2) the large area required to collect it at a useful rate. Solar energy is used for heating water for domestic use, drying agricultural products, generating electrical energy, etc.

### Solar Energy in the Maldives

Solar energy is currently being piloted in the Maldives. It is a reliable energy source for the country as all atolls and islands have equal access to it! Atoll chiefs have been keen to see the spread of solar energy technology to their areas.

On Baa Atoll Goidhoo solar panels have been installed to power the recreation centre. This centre is entirely powered by the solar cells – it is not connected to the main grid. The cells run the computer and internet resources and also enable the community to undertake other activities and small industries. There are also plans to locate a solar powered desalination plant on this island.

Raa Atoll Fainu is planning the same kind of arrangement as is already being piloted on Goidhoo.

On Alif Dhaal Atoll Mandhoo a hybrid system is being piloted. This uses solar cells during the day and diesel generators at night.

On H.A. Uligam a wind/solar/diesel hybrid energy project is also being piloted. Solar energy that is collected by solar cells is stored in batteries, waiting to be used by the consumer.

For more information visit [www.meew.gov.mv](http://www.meew.gov.mv)  
[www.stomaldives.com/pilotproject.html](http://www.stomaldives.com/pilotproject.html)



*Solar panels on H.A.Uligam.*

# GLOSSARY

**Breeze**

A light current of air; a gentle wind.

**Consumption**

Use of goods and services.

**Cyclone**

A violent tropical storm, especially one originating in the southwestern Pacific Ocean or Indian Ocean.

**Desalination**

The removal of salt (especially from sea water).

**Drought**

Dryness; dryness of the weather that affects the earth, and prevents the growth of plants.

**Gale**

A very strong wind.

**Humid**

Damp; moist; as, a humid air or atmosphere; somewhat wet or watery.

**Misty/foggy**

Obscure; clouded.

**Potable water**

Water suitable for drinking.

**Rain water harvesting**

Collecting rain water.

**Rain gauge**

An instrument for measuring the quantity of rain at any given place.

**Solar Energy**

The energy transmitted from the Sun. Solar energy can be converted to useful work or heat by using a collector to absorb solar radiation (e.g. solar hot water systems).

**Sustainable**

Capable of being sustained or maintained.

**Ultraviolet light**

Ultraviolet light is a form of radiation which is not visible to the human eye. Though these waves are invisible to the human eye, some insects, like bumblebees, can see them!

**Water lens**

About a third of the rainfall will soak into the ground and infiltrate into the coral sand. This water collects in the sand and forms a body of fresh water. The freshwater is not very thick and it floats on salt water that is underneath it.

**Wind energy**

Power generated by harnessing the wind, usually by windmills.



All kids are gifted,  
some just open their packages earlier