

**FUTURE POWER ENERGY**

# HYDRO POWER

**POWERING THE FUTURE**



**A GREEN NOTE**  
A MESSAGE TO CHILDREN  
BY DR R K PACHAURI, CHAIRMAN  
INTERGOVERNMENTAL PANEL  
ON CLIMATE CHANGE  
JOINT WINNER OF THE  
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ENERGY

# HYDRO POWER

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The Energy and Resources Institute

## A note from Dr R K Pachauri

Human society has reached a stage of prosperity, which was not expected several decades ago. Yet, a large number of people live in poverty and are barely able to keep alive. It appears that they have not been touched by human progress at all. At the same time, what we regard as progress has resulted in damage and destruction of our natural resources and caused serious problems such as human-induced climate change, which threaten all forms of life in different parts of the world in the form of sea-level rise, heatwaves, floods, droughts, and melting of glaciers.

All of this provides a strong reason for us to re-examine what we have mistakenly believed as human progress and change the way we have been pursuing human activities. For instance, we must now use renewable sources of energy and eco-friendly methods of production and consumption, make efficient use of water in every activity, and protect biodiversity.

It is in the hands of the children to try to change their own lives towards greater protection of the environment and all our natural resources. They can also take active part in changing the thinking of adults. Children can take the lead in organizing actions, which support conservation of resources, recycling of waste water, and greater use of renewable sources of energy, at the community level.

This series of children's books is aimed at providing children with knowledge on what needs to be done in all these areas. I hope those who read these books will not only enjoy them greatly but also feel inspired to implement actions that are described in these pages, so that we create a beautiful, peaceful, and healthy future for the human race.



R K Pachauri

Director-General, TERI

Chairman, Intergovernmental Panel on Climate Change

# Contents

All about water	6
Water power...down the ages	8
Why is hydropower good for us?	10
Hydropower comes of age	12
How is hydropower produced?	14
Small is beautiful	16
Riding the waves	18
Turning the tides	20
Giants of engineering	22
The bad side	24
Gizmos	26
Build your own waterwheel	28
Index	30

# All about water

Water is the most important substance for all living beings on the earth. In fact, there is a lot of water inside living organisms—up to 60 per cent of the human body is water! Over 70 per cent of the earth's surface is covered with water, the major portion of it in oceans, and the rest on land.

## Solid, liquid, or gas

Water has some unique properties. Most substances are either solid, liquid, or gas but water is found in all three forms in nature. It is found in solid form as ice (glaciers); in liquid form in oceans, rivers, and lakes; and in gaseous form as water vapour. Water vapour is present in the air. Water is also found below the ground.



## Always on the move

Water is always changing its form.

The ice in the glaciers melts in summer. The sun's heat causes water in the rivers, lakes, oceans, and seas to

evaporate. Water vapour, being lighter than air, rises up into the air. As it rises up, it

meets cold air. It cools and turns into tiny droplets of water. This is called condensation. The droplets form clouds, which collect more water and grow bigger and heavier. They can no longer stay up in the air, and all the water falls to the earth. This is called precipitation.

▲ *Water turns to vapour when heated.*

▲ *Water solidifies into ice on being cooled.*

## In a cycle

The different forms of water are always moving, from land to the air and back to the land. This is called the water cycle. All the water on the earth has been going through the water cycle for millions of years.

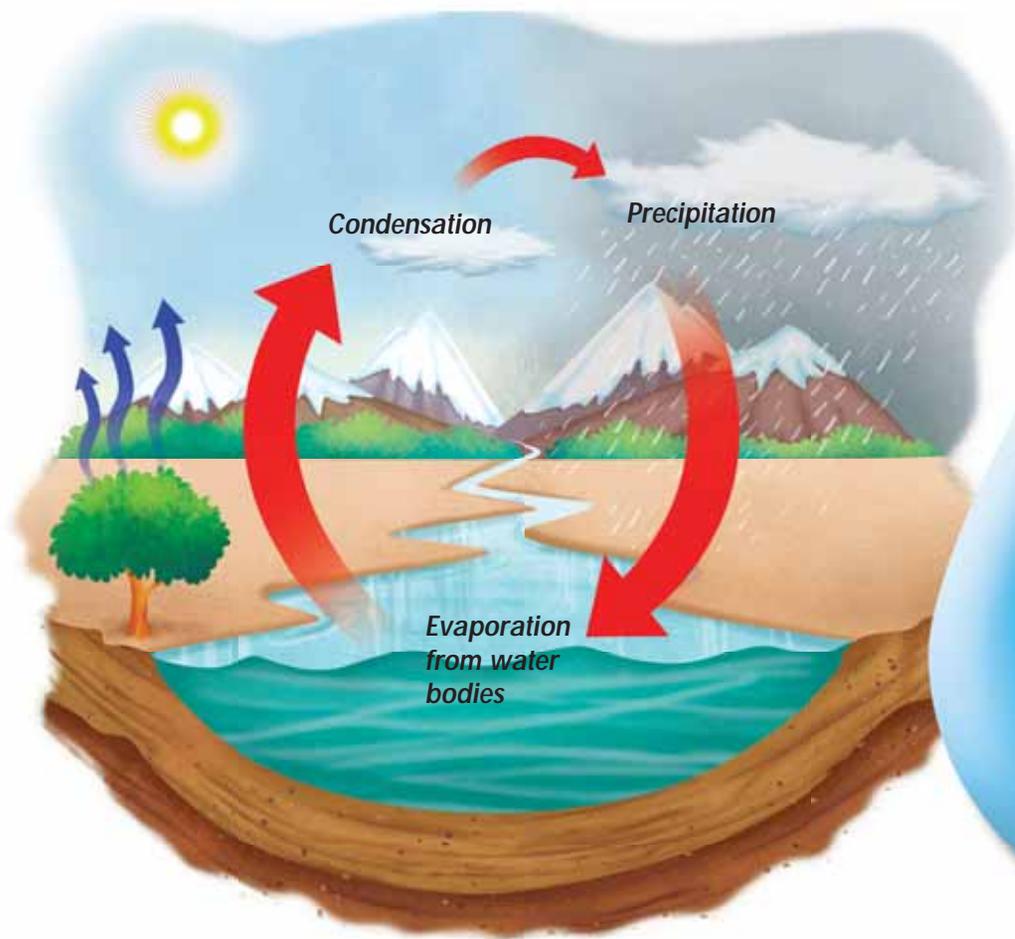
## Water has power, too!

Moving water has force, which can be turned into mechanical energy. This energy can be used to make things move and do work.

## Water on Mars?

The polar ice caps on Mars have fascinated scientists for years. While Earth's polar ice caps are mainly made of water, Mars's ice caps are a mixture of frozen carbon dioxide and water.

▼ *The water cycle*



Condensation: Conversion of vapour, or gas, into liquid



▲ *The presence of ice caps has led people to believe that there may be water on Mars.*

## SUPERPOWERED FACT

*A dripping tap is not as harmless as it seems—leaving a leaky tap is like wasting seventy-five litres of water every day.*

# water power...down the ages the ages

The use of water power to do work is not new. Humans have used hydropower, or the energy from water, since time immemorial.

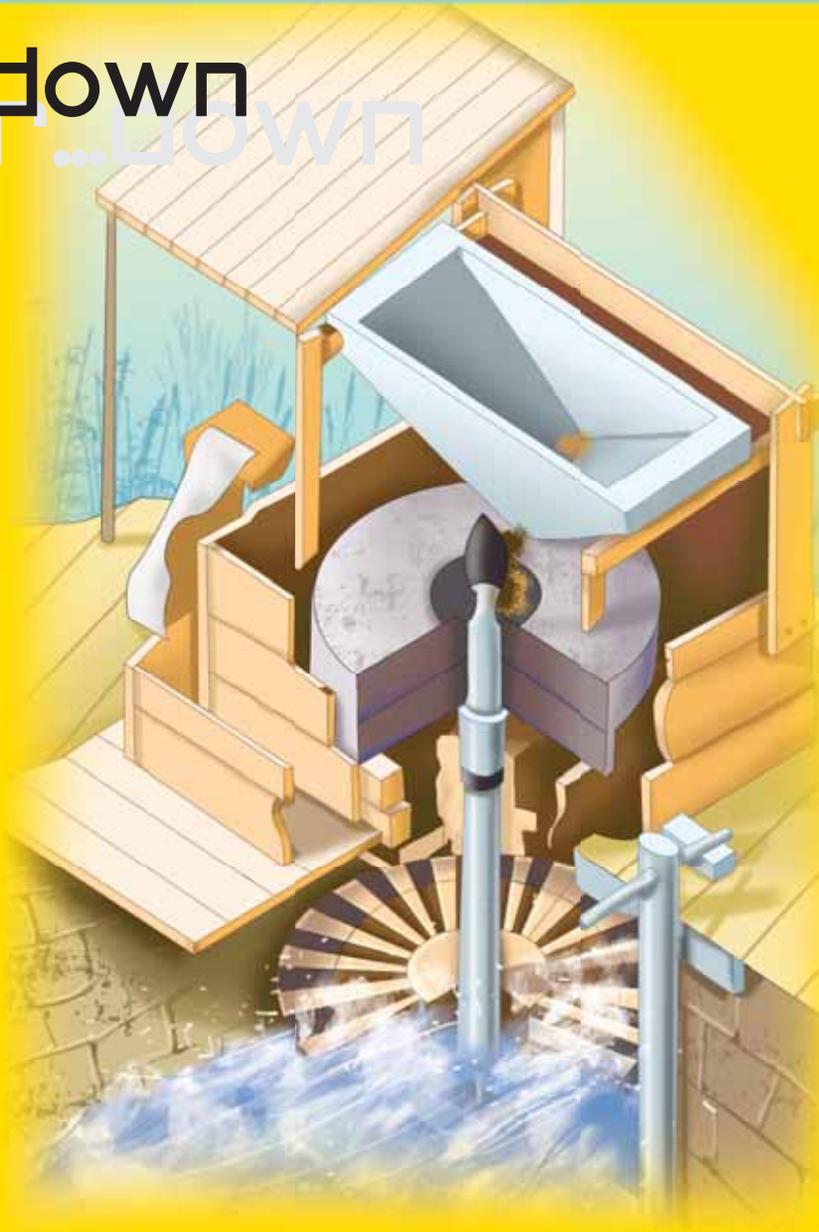
## Waterwheels...at your service

Long ago, the ancient Greeks, Romans, Arabs, Chinese, and Indians were using waterwheels to harness the power of water. The earliest reference to a waterwheel dates back to about 100 BC, when the Greek writer Antipater wrote in a poem, 'Cease your work, ye maids, ye who laboured in the mill . . . for Ceres has commanded the water-nymphs (waterwheels) to perform your task..'

▼ *The Francis turbine is the most common water turbine in use today.*



8-9



▲ *Early waterwheels were placed flat on the water.*

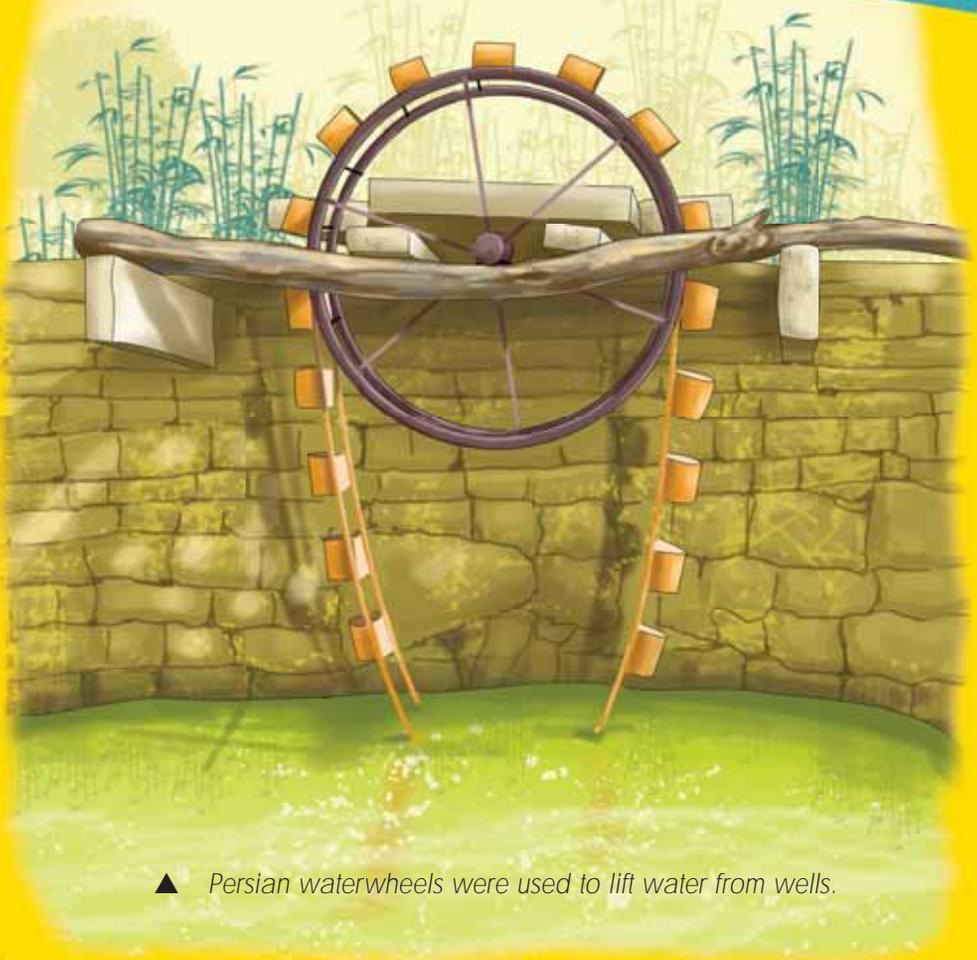
## Early waterwheels

The early waterwheels were placed flat on the water, and turned by the force of moving water. The wheel was connected to a large grindstone. The spinning waterwheel turned the stone, which was used to grind grains like corn and wheat to make flour. Gradually, the waterwheel was made upright, which produced more power.

## Water mills

Waterwheels were most often used to power different types of mills—to saw logs, to crush stone to make porcelain and to obtain metals, to crush sugar cane to make sugar, and to pound wood into pulp in paper mills. The combination of a waterwheel and mill was called a water mill. Persian waterwheels were used to lift water from wells by a system of ropes upon which a series of clay pots turned over two pulley wheels. This kind of water-raising device was used in ancient India to provide water to crops.

**HYDRO  
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▲ *Persian waterwheels were used to lift water from wells.*

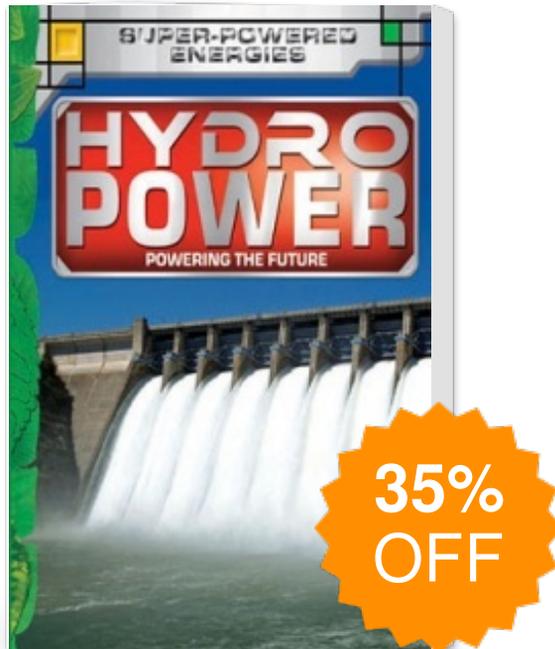
### **SUPERPOWERED FACT**

*The Industrial Revolution  
in the 1700s was largely  
supported by textile mills  
that were run  
on hydropower.*

## From waterwheels to turbines

Waterwheels were large and turned slowly. The power that could be harnessed from them was limited. During the nineteenth century, water turbines were developed to provide industrial power. These were smaller, with curved blades, and turned faster to generate more power. The water turbine designed by James Francis in 1849 was the first modern water turbine. It is still the most widely used water turbine in the world. In the late 1800s, water turbines started being used to produce electricity, known as hydroelectricity.

# Future Power,Future Energy : Hydropower



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Author : Arshi Ahmad

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