

YEAR 7 SCIENCE

ENERGY TOPIC – HOMEWORK BOOKLET



Produced by
**Belper School &
Strutt's North Mill, Belper**

Along with this booklet you will receive a voucher for you and your family. If possible make a family visit to Strutt's Mill in Belper.

Here you will find out all about how renewable energy was used to power the mill in its early years and is still used there today.

You should take this booklet along on your visit and you will find lots of answers to the questions inside. Some you will be able to fill in as you look round and some you will need to research and write at home.

INFORMATION TO HELP YOU ARRANGE YOUR VISIT

Opening Times

Winter: November to February, weekends 1-5pm
Summer: March to October, Wed to Sun 1-5pm
plus Bank Holidays

Contacts and Further Information

Derwent Valley Visitor Centre,
Strutt's North Mill,
Bridgefoot,
Belper,
Derby DE56 1YD
Telephone: 01773 880474
Email: info@belpernorthmill.org.uk

Websites

<http://www.belpernorthmill.org.uk> The website for Strutt's North Mill, Belper, detailing the collections and facilities available at the site.

<http://www.derwentvalleymills.org> Provides information on all the Derwent Valley Mills sites which combine to form the World Heritage Site. Lots of information and a fun section of games and quizzes.

AN INTRODUCTION TO THE MILL AND ITS HISTORY



Jedediah Strutt

Read the passage below and see if you can use the words underneath to fill in the gaps:

..... developed the mill site at Belper from 1776, harnessing the power of the River to drive his mills. Subsequent generations of Strutts continued to develop and improve the site. It continued as a working mill until 1991. Strutt's North Mill was destroyed by fire and rebuilt by Strutt (Jedediah's eldest son) as an iron-framed, "fireproof" building and influenced the building of the modern skyscraper buildings of today.

The beautiful horseshoe and watercourse may be seen showing how the River Derwent was used to the mills and how the power source changed from water to steam and still provides power today by means of a plant. The Strutt mills and workers' housing complex influenced the growth of Belper taking it from a small hamlet to a thriving town. The Strutt family were benefactors to Belper for several generations providing for many of the town's needs from piped and street to war memorials and a post office.

Derwent

water

power

hydro-electric

William

cotton

industrial

weir

lighting

Jedediah Strutt



Now get your thinking caps on!

1. Why do you think Jedediah Strutt chose Belper to build his cotton mill?
2. Why did Belper become a thriving industrial town along with the success of the mill?
3. When did the mill finally cease to be a working cotton mill?
4. What impact has this had on Belper?

See if you can find out the following:

1. Where is the source of the River Derwent?
2. How many other mills lined the banks of the River Derwent in Derbyshire? Can you name them?

Extension

Do some research into the other mills of the River Derwent. Try and find out things like:

- When they were built
- Who built them
- What they were used for
- Are they still in operation or when did they close?

As you walk around the museum see if you can find the answers to these questions about the history of the mill:

On the tour you will go down into the basement and see the Wheel Pit. Look inside: choose four words to describe what you see.

-
-
-
-

Now choose four different words to describe what it would have been like when the wheel was there and turning!

-
-
-
-

From the information in the basement can you find out:

1. How many spinning frames were driven by the wheel?.....
2. How many spindles were on these frames?.....
3. How many carding engines were driven by the wheel?.....
4. How many draw frames were driven by the wheel?.....
5. How many stretching frames were driven by the wheel?.....
6. How many pieces of equipment is this altogether?.....

Look for a card called **water power**. This shows the three types of water wheel.

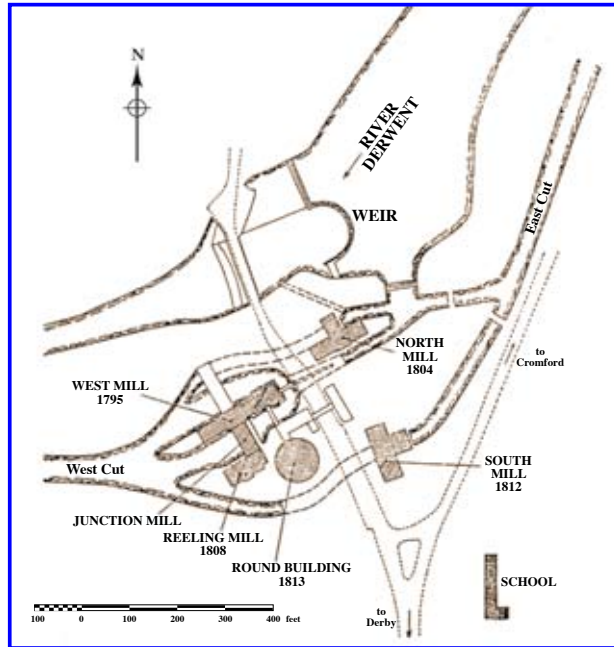
What were the three types called?

- 1.
- 2.
- 3.

Find out which one Belper Mill had and make a sketch of it, and how the water made it turn.

A Map of the Mill Area

- Colour the River Derwent in Dark Blue
- Colour the channels that were cut from the River, to provide the mill with water to power the water wheel, in light blue.
- Add arrows to the map to show the direction of water flow through the channels.
- Colour the Roads and Bridge in Yellow.
- Colour the mill buildings in Red.



Look at the map again:

1. Put the buildings in order of when they were built along with the years.

..... Year 1795
 Year.....
 Year.....
 Year.....
 Year.....

2. Which buildings still exist today?
3. Why are some of the water channels seen as dotted lines?
4. What is the name of the school shown on the map?
5. Why is it called this?

Belper North Mill

- A Water-wheel at Strutt mills supplied all the power needed until 1854 when a steam engine was installed for the first time. The 'wheel' which powered the North Mill was a huge cylinder, 18ft (5.2m) high and 23ft (7m) wide.
- The wheel installed in 1804 was replaced in 1823 at a cost of £1,383. It was constantly repaired as daily use took its toll. The wheel pit which now stands empty gives some indication of the power once generated and needed to operate the mill.
- The water-wheel, at one end of each mill, turned a vertical shaft which reached up to the top floor. On each floor a gear wheel on the vertical shaft turned a horizontal drive-shaft which ran the length of the building. The main spindles of the spinning frame worked off this, and could be stopped independently. On the top floor the drive-shaft operated a hoist to move materials between floors.

Task 1

Using the diagram on the next page, shade in and label the water-wheel, the vertical shaft, the horizontal drive-shaft and hoist.

Task 2

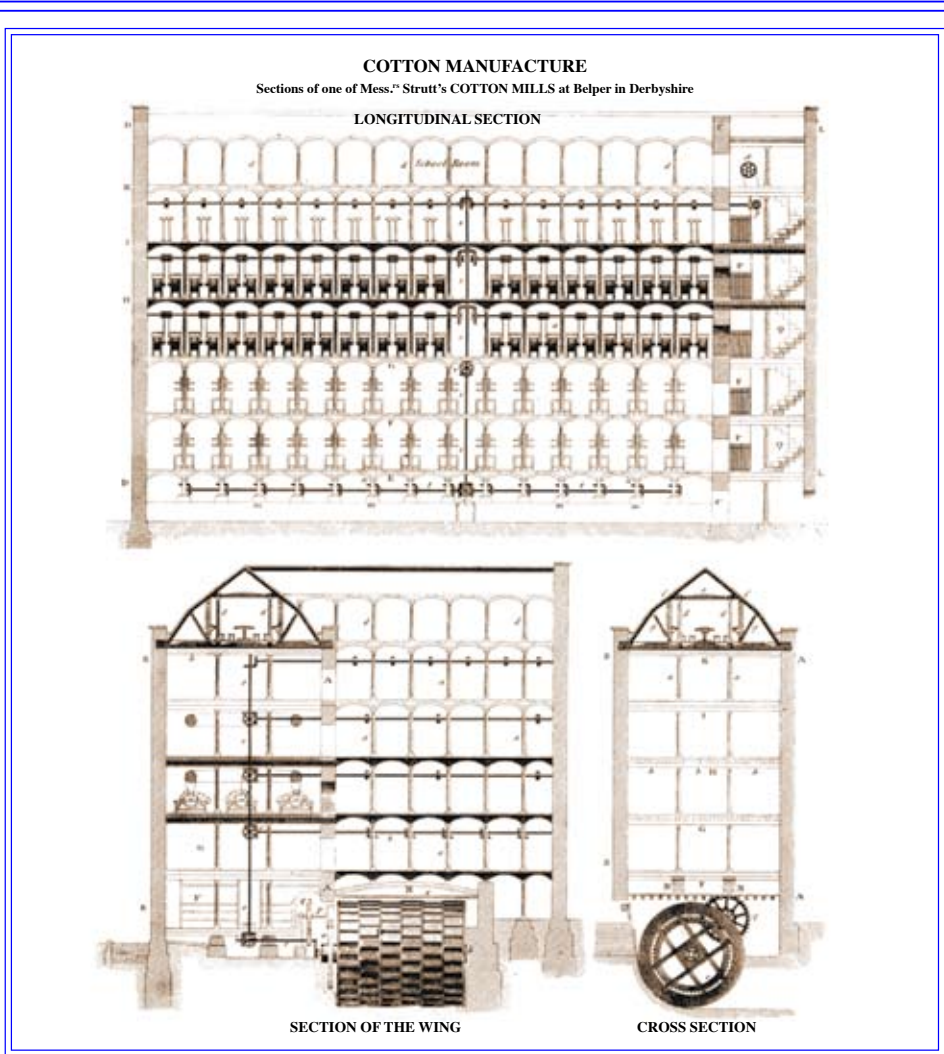
If the water-wheel was 18ft (5.2m) high, estimate the height of the whole North mill.

My Estimate.....

See if you can find out the actual height of the North mill.

Actual Height.....

How close was your estimate?



A Water Trail Around the Mill

The river Derwent was the source of energy for the North Mill and the other Belper mills. However, skilled engineering was needed to harness the river and maintain a regular flow. Now we need to see the outside of the building and see how water was directed to the wheel to provide the power for the mill.

Leave the Visitor Centre and cross the car park in the direction of the river. Watch out for cars!

The first thing you will see is the weir. The weir, which enabled the level of the water to be raised, was replaced by Jedediah Strutt with the still visible, distinctive horseshoe weir in 1797. A complicated system of sluices, holding pools and channels controlled the water supply to the mills. We will see some of these as we walk around the outside of the mill.

The first sluice gate is right beside you, what do you think its was for?

Turn right and follow the path alongside the river. From here you can see the sluice gates that let the water into the channels leading to the mill. Take care on the bridge, it may be slippery if it's wet, take care!

What do you think these sluice gates were for?

Once you reach the next car park, turn right again, and you will see another channel.

Is the water moving? If so, in which direction does it go?

Keep walking around the mill. As you approach the corner of the mill, you can see the same channel.

What do you notice about the base of the mill? Why do you think it was built like this?

Keep on going around the mill; you will reach some more sluice gates.

Can you see the small building in front of you? If you're really quiet, can you hear the humming noise coming from the building?

If it's a very still day, look at the water in front of the building. What do you notice?

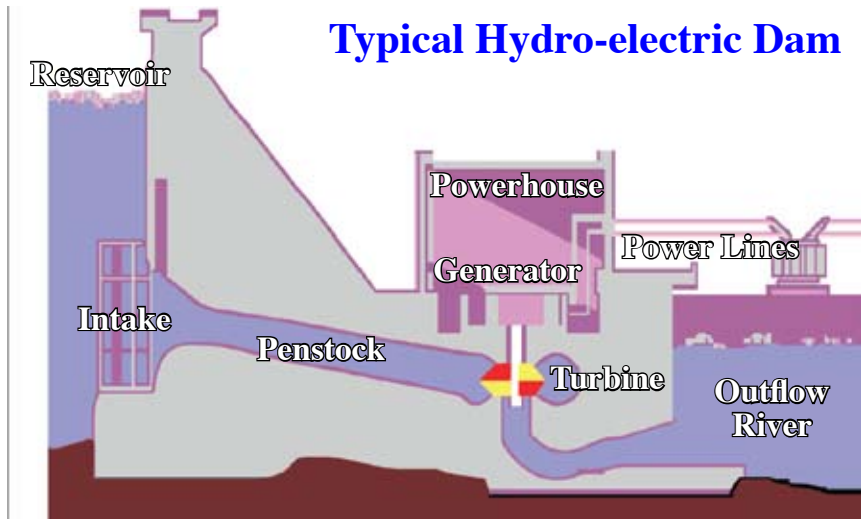
This building was not used for the same purpose in Strutt's time as it is today. Some of the original building has been knocked down.

Strutt would have been very impressed by its new use. What do you think is inside the building?

If you have time, turn around and visit the River Gardens and find another channel feeding the mill with water from the Derwent.

Use the next page to draw a picture of the mill as you can see it from the River Gardens.

Below is a diagram of a typical hydro-electric dam.



Typical Hydro-electric Dam

Use the diagram above to fill in the missing words.

Hydro-electricity works by harnessing the power of moving water. In a hydro-electric dam the water is trapped in a When the i..... gates are opened the water flows through the and through the This makes the turbine turn, which also turns the G..... in the powerhouse and generates e..... The electricity is sent to houses by the The outflow water flows off down the

Add arrows to the diagram to show the direction of water flow through the power plant.

Make a list of similarities and differences to how a hydro-electric dam works and how the hydro-electric scheme works at Belper Mill.

Similarities	Differences

Hydro-electricity works on the principle of moving water turning a turbine. Make a list of other energy resources that you have learnt about in your science lessons that also rely on a turbine turning. Also say what makes the turbine turn.

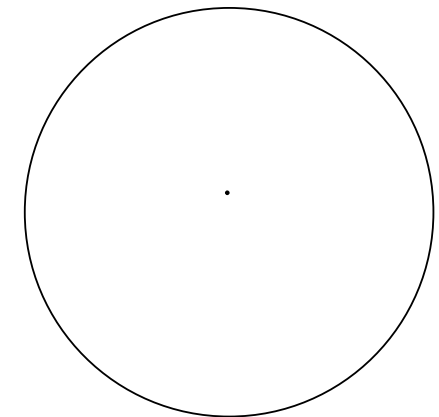
Energy resource with a turbine	What makes the turbine turn?	Is the resource renewable or non-renewable?

Research

Find an example of another hydro electric power plant in:

1. UK
2. Another Country

Find out data to fill in the pie-chart below. It shows the percentage of energy resources used in the UK to generate electricity. Make sure you fully label and colour your pie-chart.



Which of the above energy resources are renewable and which are non-renewable?

Draw a table to show the advantages and disadvantages of the energy resources shown in your pie-chart.

Optional Extension

A Final Challenge!

Try to build a working model of a water wheel like the one that would have been in the wheel pit at Belper Mill.

You can use any materials you have at home, old plastic bottles, glue, string, wood, card, anything you like.

Maybe you could get your family to help or suggest ideas.

The Wheel should be small enough for you to be able to bring into school and work from the running water from a tap in a sink.

You will need to think about the pivot in the middle of the wheel that will make it turn, what the wheel will be made from, what will catch the water and turn the wheel, and how it will stand up.

You can draw a design for your wheel and jot down ideas.

