Ravenglass & Eskdale Railway and Museum

Resources and activities for Primary Schools

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Theme 3: Energy and power

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Introduction

This topic allows children to explore energy and power in the context of generating movement on the railway and also the generation of electricity in Cumbria. By widening the topic, it allows children to consider issues such as the history of power generation, sustainability, their own use of energy and the environmental impacts of power generation.

Energy in the Esk Valley: video presentation

This activity, in addition to learning about history, science and geography, will give children the opportunities to work collaboratively, develop skills in team working, organisation, leadership, presentation, problem solving and negotiating.

The Esk Valley and West Lakes is a living timeline of energy production from Eskdale Watermill at the top of the valley, through steam power, nuclear power and on to renewable energy in the form of solar and wind turbines.

Records show that a watermill was already established in Eskdale in 1294. It is believed the current buildings have been on site since 1578. The energy industry has brought jobs and hi-tech industries to the area but can be controversial in terms of its impact in such a beautiful part of the world. Children's parents, carers or family members may be employed in the energy industries or they may be worried about further developments and the impact on the natural environment.

These resources focus on the community display area in the Ravenglass Railway Museum. This section supports local schools to explore the stories of energy and to present ideas in a video to display at the museum. The videos can be as simple as exploring a timeline of energy, looking at the pros and cons of different types of energy or explaining how different types of energy can be generated.

These websites may be of interest:

- Industrial history of Cumbria
  http://www.cumbria-industries.org.uk

- Sellafield has a bank of information aimed at schools
  http://sustainability.sellafieldsites.com/resources/energy-coast

- Britain's Energy Coast
  http://britainsenergycoast.co.uk

Also useful in terms of searching online for research, is NSPCC's guidance on staying safe online, available at their web site:
www.nspcc.org.uk/preventing-abuse/keeping-children-safe/online-safety/

Session 1: Making a video - research				**School**
The aim of these sessions is to research the importance of energy to the local area. The children will do this by making a short video using tablets.				
Introduction	**Activities**			**Share**
Explain The area is known as Britain's Energy Coast. The museum would like the children to create a short video about the different types of energy in the Esk Valley and the West Lakes. Working in groups of 4 or 5, start by asking the children what they already know about different types of energy made in the valley. If they struggle with this, suggest walking through a day and looking at where they use energy. Ask them to list the different types of energy.	**Sources** How can the children find out more about different types of energy? Ask them to list potential sources of information. Explore the children's ideas for sources of further information. Discuss primary and secondary sources. Discuss how to check sources.	**Further research** Ask the children to plan how they will research the subject so that they have enough information to make a short film.	**Information Technology** Explain how the technology works, showing the main features of videoing, green screen etc. Give the children the tablets and let them play with the video function until they are confident. Allow the children time to experiment with green screen doing short pieces to camera. They can upload their videos to sharing apps approved by the school such as Showbie.	**Next steps** At the end of the session make sure the children have a plan. This should include a subject or working title for their video Allocation of roles: presenter, script writer, camera operator or they could share all of these roles) Ideas on how to gather content How they will plan the video (storyboard and script)

Supporting information for teachers

The museum has an extensive archive. This is an opportunity to discuss sources in some detail. With the Internet providing so much information it is very important for children to understand what might be a reliable source and what might be an unreliable source.

The archive at Ravenglass Railway Museum contains historic documents, photographs, posters, diaries, records and paintings.

These are generally primary sources, created at the time of an event. For example one of Mary Fair's photographs is a primary source, however a biography written about Mary Fair today would be a secondary source. All researchers have to check their sources carefully for accuracy and authenticity. Anyone can put anything online and it doesn't have to be accurate so researchers have to be very careful to find sources they can trust.

Discuss the main ways to tell if a website is authentic. Sites that end org.uk or gov.uk tend to be good sources of information. For the purposes of this project use an online app such as Showbie so that the teacher has complete control over what the children can search. Talk about which images are safe to use in terms of copyright issues. If using Google Images for example, click Tools, this will bring up a menu which includes Usage rights. Children should only use images 'Labelled for reuse' otherwise they will infringe copyright law.

Populate Showbie with photographs, text and documents that are safe for children to look at.

Discuss how children will gather information. If they are going to speak to people working in the industry, what sorts of questions might they ask? Will they record the interview on video? Will they report what the interviewee said?

Session 2: Making a video - planning, creating content and creating a storyboard				**School**
The aim of these sessions is to research the importance of energy to the local area. The children will do this by making a short video using tablets.				
Introduction	**Activities**			**Share**
Explain Now that children have a plan, they can put it into action. The first thing to do is focus on the main themes and topics that they need to research**.** They can now gather more information. This may be by inviting speakers into school and arranging interviews, talking to family and friends, looking online at suitable sources or contacting local companies. We have provided basic information to act as starting points.	**Storyboard** When they have enough information on their topic that is reliable, the children start to put this information into a storyboard. Now they can write the script. This should include stage directions about what will happen in the scene and the words to be spoken. The children should also think about how the presenter will read the script. Suggest large text on sheets that can be easily read from a distance.	**Setting the scene** Let the children then experiment with filming, reading scripts, presenting. They can refine their ideas until they are ready to shoot their video.	**Plenary** Share the work from the session and ask for feedback from the other children. Ask what worked for them and what might be improved. Keep the feedback constructive. Ask children to suggest ways to improve rather than simply pointing out things that haven't quite worked.	**Next steps** Armed with this feedback children can now plan their final shoot. In the next session suggest they have a final run through before filming.

Supporting information for teachers

Planning is crucial to success when creating a video. Most professionals create a storyboard.

A storyboard allows children to draft out ideas for scenes along with any text to go with images.

The format is very simple. The children should plan no more than five scenes.

Scene 1	**Scene 2**	**Scene 3**
Overview	**Overview**	**Overview**
Script	**Script**	**Script**

Using their research findings, children will write scripts for their videos. A script should be structured around an introduction, a description/representation of energy in the area, and perhaps a view of the future of the area. These can be presented in the video using green screen, animations, and other means. Start to establish the apps that the children can use in their films.

Session 3: Making a video – filming and editing				**School**
The aim of these sessions is to research the importance of energy to the local area. The children will do this by making a short video using tablets.				
Introduction	**Activities**			**Share**
Explain The final session is for children to refine their videos and think about what they want them to look like. The films can be edited using iMovie, Windows Movie maker or similar. Children may well be familiar with these software packages. Explain how the editing tool works. Explain how to add music.	**Refining** Give all the children time to work on their videos, to refine them until they are happy. Next invite the children to share their videos with the class for constructive feedback before any final edits.	**Celebration** A great way to end a video project is to have a premier where family and friends are invited. This allows family and friends to see their children's work and celebrate their achievements. One outcome may be to share the videos in displays at the Ravenglass Railway Museum. Invite staff from the museum to the premier. Award Oscars for best script, best film, best music etc.	**Plenary** There will be a lot of learning around this type of project. Allow children the opportunity to feedback on what they enjoyed, what they learned, what they would do differently.	**Next steps** The children can use their video making skills to create videos on a number of subjects linked to the area and the museum.

Using energy: trains, turbines and power

In this series of activities, children start to think about how a steam locomotive generates power to pull the train. They also consider where energy that they use comes from and research different methods of electricity generation.

Starting Synolda – a steam locomotive

Children watch a short video that shows how one of the locomotives at the railway is prepared for use. After watching the video, children complete a card-sort activity to put the different parts of the process into sequence.

Two card-sort activities allow children to compare steam engines with petrol and diesel engines (internal combustion engines).

Session 1: Starting Synolda				**School**
Children look at a short video clip and then, using cards, define the sequence of events in the preparation and start-up of a steam locomotive.				
Introduction	**Activities**			**Share**
Explain Set the scene by telling children that the steam locomotives at the railway need to be started each morning.	**Starting a steam engine** Watch the short video clip (3 minutes) which shows Synolda, one of the museum's locomotives, being prepared, fired-up and driven. Have children work in small groups and complete the card-sort activity and put into sequence the process for starting Synolda and how a steam engine works. What fuel does the steam engine require? Why does the engine need water as well? Could the engine run if either of these ran out?	**How steam engines and petrol engines work** Complete the card-sort activity that shows how a combustion engine is fuelled and works. Compare with a steam engine. Whilst children may not have any experience of these, the cards are devised so that they can have a good attempt at getting the sequence correct by reading the information and thinking logically. Have children compare the similarities and differences between steam engines and a petrol (or diesel) engine.	**At the railway** Synolda, the locomotive in the video, will be on display in the museum. Use this, and the interactive that explains how a steam engine works. Have children observe the different types of train locomotives. Both steam and diesel locomotives are run at the Ravenglass and Eskdale Railway.	Pose a question for children to discuss in groups. Extend by having them produce a story that answers the question: **What would your day be like if all cars, buses and vans were powered by steam?** Children may consider the convenience of diesel or petrol engines over steam. Others may talk about air quality. We can 'see' smoke from a steam engine but not the emissions from petrol and diesel engines. **What is a good power sources for transport of the future?**

Starting and running a steam engine

Copy and cut out the cards. The sequence on the left describes preparing the boiler and the right column describes how the steam engine drives the wheels.

Check that there is water in the boiler and add water to the tank (tender).

Clear out the cold ashes from the firebox.

Light the boiler with a burning rag. Add wood and coal.

Coal burns in the boiler and heats the water. It gets very hot and the water turns into steam.

The hot steam builds up a high pressure. This can be used to drive the train.

The train driver operates the throttle.

The throttle sends steam into the cylinders.

Steam in the cylinders push the pistons forward and back.

The moving pistons make the train wheels turn.

The train wheels turn and push the train forward along the track.

Starting and running a petrol / diesel car (internal combustion engine)

After the children have sequenced the starting of the steam locomotive, use these cards to do the same for a petrol / diesel engine (diesel locomotive).

Have children compare and contrast both processes. Which is quickest? Which is simplest?

Check there is petrol in the petrol tank before starting the engine.

The moving wheels push the car forward along the road.

Use the key to start the engine.

Petrol goes into the engine and into the cylinders.

Petrol explodes in the cylinders and pushes the pistons forward and back.

The moving pistons are connected to the wheels. They make the wheels move.

Locomotion and moving a train

This activity can be used to revise forces and movement or introduce the idea that forces can change the movement of an object.

The context is the pulling force that the steam locomotive exerts on the train carriages it is attached to. The force will need to be enough to overcome the friction of the wheels and get the train increasing in speed (accelerating).

Children can also investigate the effects of the pulling force needed if the train is moving up an incline or down a descent (remember here that a breaking force may be required). By adding plasticine (or similar), children can see the effect of changing the weight of the train as if it were loaded with passengers or empty.

The data gathered offers opportunities for the production of results tables, calculating averages and graphically presenting data.

Resources

Attach a piece of string to a model train and attach the other end to a force meter (up to 5 newton should be sufficient).

Plasticine or other weights to be added to the train.

A piece of wood to act as an incline (alternatively add blocks under two legs of a table to produce a slope).

Session 2: Locomotion and moving a train				**School and museum**
Children use force meters to investigate the forces needed to move a model train over flat surfaces, inclines and descents.				
Introduction	**Activities**			**Share**
Explain Ask children what they think causes a train to move. Have them consider the pulling force that the engine exerts. In pairs have children hold hands and gently exert push and pull forces on each other. How can we measure these forces? Introduce the idea of a force meter and demonstrate how one works. Remind children about the force of friction, which acts to slow down any movement.	**Using force meters** As a practice, have children attach string to the force meter and suspend a range of small objects to see what force gravity exerts on them (their weight). Have children suggest ways in which they could measure the pulling force required to move a model train.	**Force and movement** Children should work in groups of two or three. Attach the force meter to the front of the train and pull it at a steady speed across a surface. The observers read the scale to see the force. This is tricky and likely to lead to a lot of variation in results. Take an average. It is a good example of where observations need to be repeated to be reliable. Have children investigate, tabulate and report on how the force needed to move the train changes if its weight is increased, if it is pulled up a slope, or down a descent.	**At the railway** Look at the wheels on the locomotives and carriages in the museum. These help to reduce the rolling friction and so make it easier for the train to move.	Have children think about and discuss this problem. The wheels on the carriages and locomotive are designed to minimise friction (which slows them down). What problem does this make for the steam engine? Could the engine pull the carriages if there was no friction between its wheels and the rails? Sand is sometimes dropped in front of the driving wheels to increase friction and reduce them slipping.

Which turbine is best?

In this activity, children investigate how changing the number of blades on a turbine influences how well it turns. This is related to the generation of electricity from the wind turbines that children will have seen in the area.

A template is provided which can be copied on to thin card so that children can make model turbine blades. They will need to go on to an axle. Use a hole punch to produce a centre hole and a thin dowel to make the axle. Build up the axle behind the blades with sellotape so that the blades spin, rather than just get pushed back by the airflow.

Children can also experiment with different shapes of blade and can gain inspiration from windmill and blow-toys.

Safety

A risk assessment should be performed before any practical activity. In this case, possible hazards include the use of a fan to generate the moving air. Make sure it has a guard and that children are instructed not to put fingers into the moving fan.

If a hair dryer or other form of heater is used, it should be set to blow cold air rather than heating up.

Session 3: Which turbine is best?				**School**
Children make turbines, with different numbers of blades, to see which spins the best in a constant flow of air.				
Introduction	**Activities**			**Share**
Ask children if they have seen wind turbines and if they know what they are for? Relate the moving of the turbine to the generation of electricity. It is almost like an engine in reverse. Rather than taking in energy (coal / petrol) to generate movement, the turbines take movement from the wind and convert it into electrical energy. Set the scene that they are going to investigate the best number of blades for a model wind turbine.	**Turbines and windmills** If wind-powered toys are available, demonstrate how they are turned (powered) by moving air. Windmills have been used for centuries to harness the energy in moving air.	**Investigating turbines** Use the three-bladed turbine on the template sheet and have children make a wind turbine. Fold the blades back slightly along the dotted lines. Use a fan to see how well they work. What could children measure to be able to compare different designs of turbines to see which was the best?	**Number of blades** Use the single blades on the template sheet. Have children make up their own turbines with differing numbers of blades (glued or taped at the centre). How does changing the number of blades affect how well the turbine spins? Are there any patterns to their observations? For class results, different groups can be assigned different blade numbers to construct. If all groups use the same test and measurement (keep the same) then class results can be compared.	Turbines are a form of renewable energy. This activity can be part of the video-production activity or as a stand-alone activity. Working in groups, children research and explain forms of electricity generation. • Fossil fuel-powered stations (coal, oil or gas) • Nuclear power stations • Tidal power • Wind turbines Information can include how the power is generated, environmental impacts and the advantages and disadvantages of each form of generation.