PUTTING THE HOPE back into Hope Hill

1. Technology Justice
- technology needs and wants

Pupil Activities:
1. Starter: pupils are to write down words that they associate with 'technology'.
2. After a small discussion that defines 'technology' pupils are given four pieces of paper and asked to name four technologies that they need most in their life. They compare these with peers needs in groups.
3. Pupils add their own need cards to a pack of cards dealt by the teacher. In groups they have to decide which of the technologies are 'needs', 'wants' and 'luxuries', using the table to help them.
4. Pupils watch the video *'Energy brings Rosa from Mount Kenya a better life'* and are asked to think about the differences between her technology needs and their own. What technology doesn't she have access to?

Teacher input:
1. Teacher facilitates class discussion and helps the class to define technology needs, wants and luxuries.
2. **Plenary**: at the end of the lesson the teacher introduces the brief for the new project, ***putting the hope back into Hope Hill - designing a sustainable town*** and asks the class to think of the residents technology needs.

Resources:
Technology needs and wants board and cards taken from www.practicalaction.org

2. Sustainability
- moral choices & renewable energy

Teacher input:
1. Q&A session about sources of energy (fossil fuels and renewables).
2. Teacher asks the class to think of as many sources of energy as possible and writes a list on the board, then categorises the list into renewables and fossil fuels.
3 Teacher introduces the idea of moral choices and the three pillars of sustainability as part of a discussion after the belief statements activity.

Pupil Activity:
1. Belief statements - whole class activity. Statements appear on the board and the pupils are asked to stand near the board if they agree and at the other end of the classroom if they disagree. A teacher led discussion follows in which pupils should try to justify their decisions.
2. Pupils work in table groupings and are given a map of the new town which shows the topography and location of key infrastructure,existing housing and farmland. Pupils are also given a pack of information cards about renewable energy sources. They are asked to examine the cards and choose which source of renewable energy is the most viable and calculate how they are going to power 200 new homes. They will have to debate the pros and cons of each source and think about the impacts or benefits to society, the environment and economics.
3. Pupils then feed back their group decision to the rest of the class and mark on where they are going to place their renewable energy sources on the map, including the calculation of how man homes they can power.

Resources (based on 5 groups of 4 pupils)
- Belief statement cards (practicalaction.org)
- Renewable energy cards (x5)
- A3 maps of the new town (x5)

Meanwhile in history...
Young people learn about and debate the impact of Industrial changes in Scotland, (including the Shale Oil industry).

SOC 3-05a
I can describe the factors contributing to a major social, political or economic change in the past and can assess the impact on people's lives. SOC 3-05a

SOC 4-05b
I can evaluate the changes which have taken place in an industry in Scotland's past and can debate their impact.

Field Trip Subject Areas
experiences & outcomes

Design Technology - TCH 3-01a
From my studies of technologies in the world around me, I can begin to understand the relationship between key scientific principles and technological developments.

History - SOC 4-05a
I can present supported conclusions about the social, political and economic impacts of a technological change in the past.

Biology - SCN 3-02a
I have collaborated on investigations into the process of photosynthesis and I can demonstrate my understanding of why plants are vital to sustaining life on Earth.

Meanwhile in physics...
Young people learn about energy sources and create experiments to test sources of renewable energy including hydroelectric, biomass, solar, tidal & wave power.

SCN 3-04b
By investigating renewable energy sources and taking part in practical activities to harness them, I can discuss their benefits and potential problems.

SCN 4-04a
By contributing to an investigation on different ways of meeting society's energy needs, I can express an informed view on the risks and benefits of different energy sources, including those produced from plants.

3. Interdisciplinary Field Trip
- Shale Oil Museum & Addiewell Bing

Pupil Activities:
S2 are taken out of classes for the day to go on a field trip to see the Shale Oil Museum at Almond Valley Heritage Centre and the nature reserve at Addiewell Bing, West Lothian.

Oil Museum
Pupils learn about the history of the shale oil mining industry in West Lothian. They learn about the processes that James 'paraffin' Young developed to produce and refine shale oil which led to the world's first oil refinery. They also learn about the boom that shale mining brought to West Lothian and the housing and infrastructure that was built up to support the mines and its subsequent decline.

Addiewell Bing Nature Reserve
Pupils see first hand the enormity of the waste produced from the shale mining industry that cannot be treated or removed. Pupils learn about how sites like this have become nature reserves home to rare species of plants and animals. They also learn about biological cycles as a means of waste remediation and photosynthesis and carbon capture in the woodland surrounding the bing.

4. Windpower Challenge (2hr activity)
- design and test the power of a windmill

Teacher Input:
1. Q&A session to recap on learning from the field trip and the need for renewable energy, including a definition of renewable energy.
2. Introduction to wind power and its use as a form of renewable energy, including different designs for wind turbines.

Pupil Activity:
1. Pupils are given a pack of information cards showing different wind turbine designs. In groups they are to select which turbine design is the most appropriate for powering homes in Hope Hill. They are given a worksheet to enable them to sketch out their design and define what form of turbine they are going to design.
2. With 3mm wooden sticks, scrap card, straws, a glue gun and a motor and gear set pupils are to design and construct their own wind turbine in groups. (*Pupils may need some help with understanding structure if they haven't previously learnt about this).*
3. Pupils test out their designs in front of the class using a hairdryer to simulate wind. The gear connects to voltmeter that measures the power generated by the turbine. Pupils can then calculate how many turbines they will need to power 200 new homes in Hope Hill.

Resources
- P/P with some images and information about wind power
- Wind turbine information cards (x5)
- A3 maps of the new town (x5)
- Worksheets (20)
- Turbine design materials (3mm sticks, straws, glue guns and mats, card, motor and gear sets (x5), voltmeter and hairdryer.

5. Housing Challenge (2hr activity)
- sustainable materials, economics and design

Teacher input:
1. Materials quiz - whole class activity with images on a Powerpoint. Questions focus on learners knowledge of building materials, where they come from and technologies that can help to power homes.
2. Teacher introduces sustainable house design challenge and sets rules. The teacher (or technician) manages the 'building supplies store' of modelling materials (acrylic, metals, mdf and wood). Pupils are given tokens that have a monetary value and with these tokens they can buy supplies from the store.
3. A score chart is kept on the board at the end of the activity demonstrating the cost of each teams house and it's sustainability rating. The group with the cheapest, most sustainable house wins the challenge.

Pupil Activity:
1. Pupils are to work in their teams of 4 to design and model a sustainable house. They are given a list of possible materials they can buy with their tokens from the building store. Pupils are given a fact sheet with information on the materials that they can buy including the price and a sustainability rating. The materials they can buy are modelling materials but are used to represent real life materials. The challenge is to design the most sustainable house for the cheapest budget.

Resources *activity ideally takes place in the workshop
- Powerpoint with images of different building materials and technologies
- Materials fact sheet and price list (x5)
- Tokens (x5 sets)
- Modelling materials cut into appropriate sizes (acrylic sheets, metal sheets, mdf, plywood, pine, glue)
- A5 mdf bases (x5) for the models to sit on.

6. Waste
- the circular economy & the 6R's

Teacher input:
1. Class Q&A 'What do we get rid of/throw away regularly?' Teacher asks pupils to write item on the board. 'Does any of this get recycled?'. Teacher asks class to think of items that do or could get recycled. Teacher then asks class where the other items go and explains what land fill is, showing some images on the board.
2. Teacher shows the class the video 'Re-thinking progress: The Circular Economy'.
3. Q&A session to get class to think of what we can do to our waste to reduce the amount of things we throw away, bringing class around to thinking about 6R's.

Pupil Activity:
1. While watching the video pupils are to fill out a work sheet that asks for definitions of some of the terms used in the video. The teacher stops the video at key points to enable the learners to fill in the worksheet.
3. Pupils do the 6R's matching activity in pairs
2. Pupils then go back to their technology 'needs and wants' activity and select 1 technology need, 1 technology want & 1 technology luxury. In pairs pupils decide whether these items can recycled, reused, repaired, reduced, refused or rethought.

Resources
- Video link: https://www.youtube.com/watch?v=zCRKvDyyHmI
- Video analysis worksheet (x20)
- 6R's match cards (10 sets)
- 6R's worksheet

Meanwhile in biology...
Young people learn about climate change, pollution and how biological cycles can be used to remediate the effects of waste.

SCN 4-05b
Through exploring the carbon cycle, I can describe the processes involved in maintaining the balance of gases in the air, considering causes and implications of changes in the balance.

SCN 4-18a
I can monitor the environment by collecting and analysing samples. I can interpret the results to inform others about levels of pollution and express a considered opinion on how science can help to protect our environment.

7. Evaluation
- Have we created a sustainable town?

Teacher input:
1. Teacher recaps on the activities completed within the unit and uses a short Q&A session to refresh on the knowledge learnt.
2. Introduces the evaluation task and sets the success criteria (below).
3. The teacher asks each group to speak for a couple of minutes about their design for Hope Hill and explain the content of their poster (time permitting).

Pupil Activity:
In groups pupils create a poster to consolidate their learning during this project. The poster must include the following information:
1. A map of the town (supplied by teacher) with the location of the new housing and location of energy sources (including number of turbines etc.)
2. Photographs of the groups house design and an explanation of what materials were used and why the house is sustainable, including it's sustainability rating from the challenge and it's cost of construction.
3. Photographs of the groups wind turbine challenge model, a description of the design and why it was chosen. How much power the windmill generated and how many homes one wind turbine will be able to power.
4. A short answer to the following questions:
- "what are the technology needs and wants of the residents of Hope Hill?"
- "how can these needs be met by your design for housing?"
- "how can these needs be met by your design for renewable energy?"

Resources
- A1 card (x 5)
- Printed photographs of the groups designs for housing and wind turbines
- Group folders of work throughout the unit including all completed worksheets
- A3 copies of the town map (x5)

The Design Context - the story of Hope Hill...

Hope Hill is an old mining town between Edinburgh and Glasgow in Scotland's central belt. This area was once home to a thriving Industry because of the number of coal and shale mines that operated between 1850 and the early 1900's. At this time Scotland was the world's largest oil producer and plentiful jobs brought men and their families to West Lothian from all over Scotland and Ireland.

However, the Industry only lasted for a hundred years and after the Second World War, the mines started to close because they couldn't compete with the price of oil that was brought in from overseas and refined at Grangemouth. Towns like Hope Hill have been in decline ever since and suffered from a lack of industry, unemployment and consequent population decline. These towns live in the shadow of the enormous red shale 'bings' or tips that are scattered throughout the area and are taller than some of the local hills. The process of mining shale left huge amounts of waste that was dumped on 19 sites throughout West Lothian.

Whilst over time, some of the 'bings' have become heritage sites and are home to a variety of rare plant and animal species, they are still a legacy of a linear economic process that resulted in huge amounts of waste that cannot be treated or removed.

The residents of Hope Hill want a new future, whilst they are proud of their industrial heritage; they recognise that using the planets resources for fuel is not sustainable. Despite the fact that shale mining ceased 50 years ago, they are still living in a linear economy and they are tired of this. All the processes that contribute to how they live and power their homes are linear and result in waste accumulating somewhere. Inspired by the way that nature is starting to take over the 'bings' and reclaim the post-industrial landscape as a home for a wide variety of birds, animals and plants that are rectifying the damage done by human industry, the residents of Hope Hill want to learn more about how they can use a biological cycle to guide the way that they live.

Recently, there has been a population increase in some of the neighbouring towns as families from the neighbouring cities of Edinburgh and Glasgow are starting to settle in the area because of cheaper house prices and the proximity to the countryside. The residents of Hope Hill see this as their chance to try and turn around the fortunes of the town and create a sustainable future for the next generation.

Hope Hill is a fictional town in West Lothian but it's existence is based upon many similar towns in this area which have started to see an increase in development in recent years, namely the story of Hope Hill is based upon the new Heatlands development adjacent to Whitburn, West Lothian.

The Big Task

Technology justice

Renewable Energy

The Circular Economy

Sustainable materials

CfE BGE 3rd-4th Level (2nd year)

making living, power and waste a circular process

The Big Task asks learners to explore ways that Hope Hill can use **renewable energy** and **sustainable building materials** to encourage people to settle and stay in the town. Pupils are given a map of the town which highlights some of the key features to investigate, including the **'bings',** the **town centre,** existing **housing** and the neighbouring **farmland available for development**. In groups they must decide what the most appropriate form of renewable power is for the town and where the sources of power are going to be sited. The groups investigate wind power and engineering by designing and testing their own wind turbine. Young people also investigate sustainable building materials as they are challenged to design and model their own sustainable house using a tight budget. As part of this unit learners will take part in many small tasks to teach them about technology justice, the circular economy and the three pillars of sustainability as well as taking part in an interdisciplinary field trip to Addiewell Bing Nature Reserve and the Shale Oil Museum in West Lothian.

Rationale

This unit of work engages young people in a project that is rich in scope but also grounded in a real world, authentic context that will be tangible to Scottish school children. Set in a fictional town in West Lothian, the project exposes learners to issues of sustainable development. This context will be pertinent to many living in towns that have suffered from industrial decline and are now seeking new identities as they expand with new housing and associated infrastructure. Based loosely on the new Heartlands development adjacent to Whitburn in West Lothian, which is one of the largest regeneration projects in Europe; young people will learn about how the provision of power, housing and the treatment of waste can be a sustainable process.

One of the key learning theories employed in this unit is the use of an authentic learning context that has tangible links to life beyond school, particularly with regards to the world of work and global citizenship. Authenticity in education is the provision of learning experiences that relate to the lives of pupils and experiences that they are likely to encounter later in adult life (Hennessy and Murphy, 1999). It is argued by Snape & Foz-Turnbull (2013) that authentic projects which have 'real-world' contexts expose learners to a wider range of experiences that are transferable to the situations that they are likely to encounter in the workplace, therefore fostering a sense of responsibility for life beyond the classroom.

This unit enables young people to learn across the curriculum in an interdisciplinary project that combines the specialisms of each curricular area in a real world context that emulates the work of subject specialists in the world of work. This is concurrent with the aims of the Scottish Government who define education for sustainable development as teaching young people: "how best we can participate in building stronger communities and developing a sustainable economy; how best we can reduce our impact on the environment". (The Scottish Government, 2010).

Providing an engaging means to explore issues of sustainability that includes the development of engineering skills is paramount to the Scottish Government who estimate that over the next 10-15 years 95,000 new jobs will be created in the energy sector (The Scottish Government, 2014). The Scottish Government also have a vision of becoming a world leading low carbon economy and need a new generation of scientists and engineers to help create sustainable communities powered by renewable energy. This unit provides learners with an opportunity to think critically about sustainable development and work in a realistic interdisciplinary nature. The activities contained within the units tasks not only seek to foster the skills and knowledge that learners need to work creatively in this field, but also aim to ignite an interest in sustainability and contributing to Scotland's future low carbon economy.

Learning Purposes - In this unit of work young people will learn to:

1. Identify our technology needs, wants and luxuries and describe why our technology needs may be different to those of people elsewhere in the world.
2. Debate the impact that our decisions as designers will have on the environment, society and the economy.
3. Recognise the impact of technological change and industrial development on the environment, society and economy of Scotland at different points in history.
4. Use our knowledge of structure and how wind turbines generate energy to design and test our own wind turbine and calculate its potential to power homes.
5. Design and make a model of a house using sustainable building materials while managing a tight budget and conserving resources.
6. Identify the principles of the circular economy and apply the 6R's to our technology needs, wants and luxuries to become more sustainable citizens.

Technological developments in society

TCH 3-02a
From my studies of sustainable development, I can reflect on the implications and ethical issues arising from technological developments for individuals and societies.

TCH 4-02a
I can examine a range of materials, processes or designs in my local community to consider and discuss their environmental, social and economic impact, discussing the possible lifetime cost to the environment in Scotland or beyond.

Engineering Science Contexts

TCH 3-12a
By applying my knowledge and skills of science and mathematics, I can engineer 3D objects which demonstrate strengthening, energy transfer and movement.

TCH 4-12b
I can use my knowledge and skills of science and mathematics and can apply the basic principles of control technology in solving practical problems.

Craft and Design Contexts

TCH 3-13b
I can practise and apply a range of preparation techniques and processes to manufacture a variety of items in wood, metal, plastic or other material, showing imagination and creativity and recognising the need to conserve resources.

TCH 4-14b
I can apply skills of critical thinking when evaluating the quality and effectiveness of my own or others' products or systems.

Literacy & Numeracy across learning

LIT 3-09a
When listening and talking with others for different purposes, I can:
• communicate information, ideas or opinions
• explain processes, concepts or ideas
• identify issues raised, summarise findings or draw conclusions.

MNU 4-03a
Having recognised similarities between new problems and problems I have solved before, I can carry out the necessary calculations to solve problems set in unfamiliar contexts.