



tees valley arts

# eNERgise

Promoting creative learning in science through the arts.

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# Foreword.

## Tim Coyte – Education Officer Tees Valley Arts

The Energise Project has been developed by NEPIC (North East Process Industry Cluster) and Tees Valley Arts (TVA) with support from Stockton Borough Council's Secondary Enrichment Consultant: Stella Cutland.

Energise is part of the EASI Programme – exciting and innovative projects which push the boundaries of science and arts collaboration. These projects address a national need – that there are not enough people going into the science industry. The EASI programme tackles this by engaging students in science through stimulating, enjoyable and meaningful arts projects.

Energise has enabled Gifted and Talented pupils and delegate teachers to work with artists and industry partners to explore the Fuels of the Future agenda through the arts. This process has encouraged pupils and teachers to discover their own inspiration and creativity, and to use this process to gain a deeper understanding of the environmental issues inherent in the Tees Valley and the wider world. The project has featured site visits with industry partners looking at biofuels and the hydrogen fuel cell, giving students an insight into renewable energy solutions that are being developed by the science industry.

This booklet contains a selection of the work produced by pupils from Our Lady & St. Bede RC, Northfield and St. Michael's RC Secondary Schools and is intended to be a peer teaching resource. The work detailed here is the result of exploring creativity in cross-curricular ways and provides examples of how young people can utilise creative writing and sculpture to explore science and related issues.

It is hoped that this booklet will build upon the experience of the students and teachers who took part in Energise by helping other young people to engage in science and to explore the Fuels of the Future agenda through the arts.

## Bob Beagrie (writer) & Andy Comley (sculptor)

The series of workshops was very much a journey of discovery, for us as well as for the pupils. We all learned a lot, and in the process produced some very powerful creative writing and art work. We hope you enjoy the journey through this book and can make use of it as a resource for your own exploration of science through the arts.



# Energise.

'Energise' was a project we did in our science lessons in school to raise our awareness of the energy crisis, pollution, global warming, climate change, renewable sources of energy and what we can do to make a difference and help save the world.

We flick a switch and 'hey presto' there is light, we turn on the T.V. and images flicker onto the screen, we take a hot shower, we plug in our hair straighteners and they heat up so we don't have to go out with frizzy hair, we pour cool milk from the fridge onto our cereals or eat toast heated in a toaster before riding in a bus or a car to school, but we do all these things without thinking of where the energy comes from and how it is produced.

As part of Energise we went on trips to CPI (Centre for Process Industry) and North East Biofuels at a farm specialising in rapeseed production for biofuel, to learn about 'Fuels of the Future' that are less harmful to our environment. We worked with sculptor Andy Comley and writer Bob Beagrie as well as our science teachers to express ourselves through poetry and art and explore the subjects in creative ways. We have made many sculptures and have written many poems about lots of things connected to the environment and renewable fuels. We have learned that there are many different aspects

of energy use and environmental control which we have never come across before in text, news or on T.V. Using arts to explore science makes the subject more fun, it keeps you focused and it can make people who think science is boring start to enjoy it more. This book contains lots of our ideas through creative writing, drawings and photos of our sculptures. We hope you enjoy it. Next time you flick a light switch, think about where the power comes from, and remember when you have finished, 'SWITCH IT OFF AGAIN!'

By pupils from Northfield, St Michael's RC and Our Lady and St Bede RC Secondary Schools.

# The Big Problem.

Will hydrogen fuel cells take over from oil in our lifetime?

A petrol engine is 13-15% efficient.

The hydrogen cell is 45-80% efficient.

A catalyst takes the electron from hydrogen and oxygen to create a current of electricity, leaving only excess water.

It needs a very high compression tank or you will need to fill up often.

We'll need hydrogen fuel stations.

The fuel cell is a simpler design than a petrol engine.

The waste of the hydrogen fuel cell is water, not toxins.

Could we re-oxigenate the water and make it perpetual?

I learnt a lot of things but two things I remember were that Sir William Grove invented the fuel cell in 1839 and that NASA used fuel cells to help launch Apollo space crafts. I thought it was quite interesting, but then again, I'm a nerd.

Emma Reilly – Northfield Secondary School

## It's All About Energy

Energy is what makes things work,  
Energy is petrol, diesel and electricity,  
Energy is what runs our homes,  
Energy is heat.  
Energy is what gives us light,  
Energy is power.

Maisie Fraser – St Michael's RC School

## Global Warming

Creatures are dying  
The earth is getting warmer  
Bye Bye polar bears  
The earth is getting warmer  
See ya later penguins  
The earth is getting warmer  
Ice caps are melting  
The earth is getting warmer  
Lakes are dwindling  
The earth is getting warmer  
Islands are sinking  
The earth is getting warmer  
Trees are falling over  
The earth is getting warmer  
See ya later human race  
The earth is getting warmer

Just think before breaking  
the earth's thermometer  
The earth is getting warmer  
Just think 'recycle your waste'  
The earth is getting warmer  
Just think before driving your car  
The earth is getting warmer  
Your thinking can save the world  
before it's too late.

Catherine Fenby – St Michael's RC School

## Energy is Never Created or Destroyed, But Just Transformed

As the desert wind whips my lonely soul,  
Like a weathered flower,  
Only one thing may warm the blackness,  
Shining high up in the sky,  
Melting away the evil to show,  
The beauty underneath.

Chopped down in my colourful world,  
Day becomes night once again,  
Only now it will never arise,  
The dawn of a brand new day,  
A flash of light, the nightmares over,  
I've returned back again.

Scott Alexander – St Michael's RC School

# Other Sources of Energy.

There are many other sources of energy. Some more powerful, practical and popular than others, some are more economical and some are more environmental.

- **Nuclear power** – is produced by a controlled nuclear chain reaction using uranium and creates heat, which is used to boil water, produce steam, and drive a steam turbine. The turbine generates electricity. Nuclear power provides 6.5% of the world's energy and 15.7% of the world's electricity. Many environmentalists claim that nuclear power is an uneconomic and potentially dangerous energy source with a limited fuel supply, especially compared to renewable energy.
- **Solar power** – uses panels of "photovoltaic" or "photoelectric" cells that absorb the sunlight and convert it into electricity.
- **Wind power** – uses turbines to harness the ecologically friendly power of the wind and converts the energy into electricity. Some people think wind farms are an eyesore on the landscape.
- **Hydroelectricity** – harnesses the potential energy stored in water. This comes from the damming of rivers and releasing the water at high pressure, its kinetic energy is transferred onto turbine blades and used to generate electricity.

- **Tidal power** – utilises the natural motion of the sea's tides to turn electricity-producing turbines.
- **Geothermal energy** – is obtained from the internal heat of the planet itself and can be tapped into to generate steam to run a steam turbine. This in turn generates electricity, which is a very useful form of energy.
- **Biofuels** – are gas or liquid produced from biomass rather than from fossil fuels, these can be sugar cane, vegetable oil and renewable wood. The fuel produced can run motor vehicles. The main reason for using biofuel is to reduce the greenhouse effect.
- **Hydrogen Fuel Cells** – these are devices used to produce electrical power through an electrochemical reaction and an electrical charge that occurs within the fuel cell. This is very similar to the way a battery produces electricity. However, unlike a battery, a fuel cell only produces electricity while fuel is supplied to it. It is dependent on an external supply of fuel.
- **Landfill sites** – the methane produced and burned off as waste from dumps and landfill sites should be captured and stored as a source of energy.
- **Treadmills** – All gyms in the country have running machines and rowing machines. These should be wired up to a turbine to produce the heat and lighting for the gym itself.

### In A Nut Shell

No more soft white snow, crunching under your boots.  
CO<sub>2</sub>, methane, and sulphur are heating up the earth.  
Next winter will you build sandcastles instead of a snowman?

Catherine Fenby – St Michael's RC School

### The Future Is...

The Future is...  
Warmer,  
Looking bad,  
Is in danger, great danger,  
Our only hope,  
A softer carbon footprint,  
Renewable energy,  
Alternative fuels, biofuels,  
A future with...  
Less emissions.

Catherine Fenby – St Michael's RC School

### Get The Message

Climate change will affect us all  
So do your bit to help  
Use energy saving light bulbs  
Don't leave your TV on  
Recycle paper, glass and tin.  
Help to solve the mess we're in.

Catherine Fenby – St Michael's RC School

### A Note From My Future Self

The sea has eaten our homes,  
Our lives turned into a watery hell.  
Everything is dying,  
We live under a blanket of fumes.  
Now we sail our houses to work,  
Wear face masks to pop to the shops.

Greenhouse gases from fossil fuels,  
From millions of years ago.  
Carbon dioxide from coal,  
Making black clouds in a clear blue sky.  
Hydrogen fuel cells are useful,  
William Grove invented them  
A long, long time ago.

Sea levels rising so fast,  
Sinking our towns and our cities.  
Drowning our livelihoods too,  
Leaving our valleys as reservoirs.  
Sulphur in the atmosphere,  
Falls to earth as acid rain

Catherine Fenby – St Michael's RC School

# Fossil Fuels.

## Where Fossil Fuels Come From

There are three major forms of fossil fuels: coal, oil and natural gas. All three were formed many hundreds of millions of years ago before the time of the dinosaurs – hence the name fossil fuels. The age they were formed is called the Carboniferous Period. It was part of the Paleozoic Era. 'Carboniferous' gets its name from carbon, the basic element in coal and other fossil fuels.

The Carboniferous Period occurred from about 360 to 286 million years ago. At the time, the land was covered with swamps filled with huge trees, ferns and other large leafy plants. As the trees and plants died, they sank to the bottom of the swamps of oceans. They formed layers of a spongy material called peat. Over many hundreds of years, the peat was covered by sand and clay and other minerals, which turned into a type of rock called sedimentary.

More and more rock piled on top of more rock, and it weighed more and more. It began to press down on the peat. The peat was squeezed and squeezed until the water came out of it and eventually, over millions of years, it turned into coal, oil or petroleum, and natural gas.

Coal is made up of carbon, hydrogen, oxygen, nitrogen and varying amounts of sulphur. There are three main types of coal – anthracite, bituminous and lignite.

Natural gas is lighter than air. Natural gas is mostly made up of a gas called methane. Methane is a simple chemical compound that is made up of carbon and hydrogen atoms. Its chemical formula is CH<sub>4</sub> – one atom of carbon along with four atoms hydrogen. This gas is highly flammable.

Some scientists say that tiny diatoms are the source of oil. Diatoms are sea creatures the size of a pin head. They do one thing just like plants; they can convert sunlight directly into stored energy.

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We have to cut down on the use of fossil fuels. Carbon emissions from burning oil and coal are causing the CO<sub>2</sub> count in the air to soar beyond anything the Earth has experienced before.

## Coal

As black as a tyrant's heart,  
But as light as a saint's.  
Though not as valuable as a diamond ring,  
It's just as beautiful.

Reminding us of the morning sun,  
Due to its toasty smell,  
Smooth as a sheet of silk,  
Eroded by a thousand rocks.

Once among the living,  
As alive as you and I.  
But now it lies beneath the ground,  
Waiting to be discovered.

Christopher Jenkins – Northfield School

## Coal

The sun produces energy,  
Sharp rays puncturing the earth.  
Plants take that energy,  
Stretching out for every last drop.  
Plants change to coal,  
So slowly, slowly, slowly.  
Coal is mined from fathomless pits,  
Carted out tonne by tonne.  
The coal is burnt in oxygen,  
Flames licking the black stone.  
Expelling energy the plants absorbed,  
Millions of years ago.

Maisie Fraser – St Michael's RC School



## Coal

Extracted like a dog  
Digging up a bone.  
The remains of what was before.  
Whether it is alive or dead  
I will leave you to decide.  
Black like outer space,  
Once soft like sloppy mud,  
Now crumbling like bread crumbs,  
Older than Grandma,  
Useful like me.  
If I was in a deep mine shaft  
It would be all that I could see.  
This substance is very useful  
Useful like me.

Whether it will be around for much longer  
I will leave you to decide.  
The powers of other things  
are much stronger alternatives;  
Things like solar, wind and wave.  
The men who mined the coal  
Where very brave.  
Many went to an early grave.  
Where as with hydrogen fuel cells  
There will be less funeral bells.

Elliott Bradburn – Northfield School

## Crude Oil

Under the churning sea,  
I was squashed for a million years.  
I am a black, mighty liquid,  
So gritty, so cold.  
I smell of paint and machines,  
I am ancient, yet reborn, dug up and renewed.  
I seep outwards, from under a layer of natural gas.  
From under the sea, I am dug up, brought to earth.  
I am used, a danger to humans,  
Am I really worth it?  
I cause global warming, for I am a fossil fuel,  
The animals of days gone by.  
I was lonely under water,  
So long, so dark, so crushing.  
Willing for the sun, to be used for fuel,  
My imminent death, but death was long ago.  
I was once a creature, a dinosaur, in ancient times.  
I am silky black.  
What am I?  
I was animal.  
I am Oil.

Emma Reilly – Northfield School

## Oil

Liquid night  
Smoother than silk  
Flees from water  
Destroyed by flame

Jonathan Coates – Northfield School

## Riddle of Natural Gas

If I'm in a room with you,  
You can't see me,  
You can't smell me,  
but woe betide the person  
to light a match.

Frederick Quinn

St Michael's RC School

## Global Warning

The sun is hiding behind  
Clouds of carbon dioxide and sulphur.  
Because of fossil fuels,  
From underground, from years ago.  
Greenhouse gases all around,  
Wearing masks outside or falling down.

Paige. A. Turner – Northfield School

## Natural Gas

I was formed underground 100 million years ago.  
I am lighter than air.  
I am colourless and odourless.  
I am mined out and used for many things.  
I change into a liquid if cooled 260 degrees below zero.

Emily Dwyer – St Michael's RC School

## Where it all comes from

I pulled the switch, and without thinking  
electricity courses through the filament,  
makes it glow hot.  
It has flowed over our heads,  
Generated by steam turning and twisting a turbine,  
A giant whirring fan,  
hissing,  
creaking.  
Black, soot, crumbling rock  
being incinerated to produce that steam.  
The heat and magnitude knocks your mind  
flying,  
spinning.  
It's hard to think that this coarse piece of nature  
was once the very essence of LIFE.  
Created by a single object we all know:  
Its immense size engulfs us;  
its bright light blinds us; its burning heat  
energises us!  
Yet, the sun created all this,  
and without it, life would perish.

Sam Gilbert – St Michael's RC School

# The Carbon Cycle.

Carbon transforms from form to form, travelling on a journey known as the Carbon Cycle, from the air it is breathed in by plants, emitted from decomposing dead matter of plants and animals, through the burning of coal and oil, absorbed by the ocean, breathed out by animals.

## Song of the Carbon Cycle

Within the fire  
that makes the billowing steam  
that turns the turbine  
that produces and pours  
electricity through  
a labyrinth of wires  
there burns the coal.

Within the coal  
there lies a past  
a past of turmoil  
of Jurassic seasons,  
a past compressed  
into a shiny black stone,  
carbon in its solid form.

Within the flame  
there lies the heat  
to release the carbon  
from its pitch dark cell  
and let it rise in coils  
of thick black smoke  
to float on a breeze  
like a silent assassin.

Within the air  
it forms a blanket  
that warms the world,  
absorbing radiation,  
slowly suffocating  
Earth's inhabitants like  
a pillow over a sleeper's face,  
Unless it's photosynthesized  
by a bright green leaf.

Within the leaf  
there lurks chloroplasts  
creating glucose  
to build up biomass  
and the plant grows and grows  
until the harvest.

Within the harvest  
there lies the key  
to fermentation  
turning biomass into fuel.  
The fuel is burnt  
within the fire  
and the cycle  
begins  
again....

Group Poem – Northfield School

# The Electromagnetic Spectrum.

We looked at the Electromagnetic Spectrum. These are waves of radiation that travel through the universe. There are different types with different frequencies of waves and they carry packets of energy called photons. Different types of wave carry photons of differing strengths. We can only see a small part of this spectrum, though some are very dangerous and we use them in different ways. They include Gamma Rays, X rays, Ultraviolet, Visible Light, Infrared, Microwaves and Radio Waves.

## U.V. Light

Ultraviolet, burning from the sun  
It gets rid of flies but it's not all fun.  
These waves can cause cancer,  
So remember to use sun cream  
To act as a perfect sun screen.  
Ultraviolet is also called 'Black Light'  
We work hard through the day and night  
To save ourselves, to save our skin  
So Ultraviolet can not get in.  
It can damage the immune system  
Alter your DNA, harm your eye.  
It snakes through the atmosphere  
It comes in waves through the sky,  
UVA and UVB  
Can hurt your family,  
So remember to use sun cream  
To act as a perfect sun screen.

Emma Reilly – Northfield School

# A focus on two Alternative Fuels.

- i) The Hydrogen Fuel Cell
- ii) Biodiesel

## The Hydrogen Fuel Cell

On the 23rd of March 2007, we went to CPI, (which stands for Centre for Process Industry), at the Wilton Site. We travelled there by minibus (though it was sadly powered by fossil fuels).

When we arrived, we were overcome with a sudden feeling of importance, due to the building's fancy decoration. There were notice boards, desks and a fancy garden (with several magnificent statues), with people in suits bustling around. After we had sat down for a bit in the foyer, we were led through a series of corridors to an impressive conference room.

When we were all in the conference room, we were given an informative introduction to the concept of hydrogen fuel cells. We then went to an incredibly interesting laboratory, with loads of things going on. We were split up into groups of four, and shown three experiments. The first one was using citrus acid obtained from a lemon to power a digital clock. The second experiment showed us a fan that was powered by a catalyst. And the third experiment was using a hydrogen fuel cell to race cars. After that we went back to the conference room for refreshments, and to talk about hydrogen fuel cells. Sadly, after that we had to leave, and return to school.

**We all learned from this trip that we can still save the planet, but we have to act now.**

James Gamblin, Chris Jenkins and Matty Wilson  
Northfield School

# Biodiesel.

## Photosynthesis

Photosynthesis is 'proper mint'. It is an old Greek word that means 'mixed together with light' and is the process in which green plants transform sunlight and carbon dioxide into biomass. To do this they use chlorophyll. This is another old word which translates as 'Green Leaf', it is a special liquid stored in chloroplasts hidden inside their leaves. When a plant is photosynthesising it uses its stomata (little pores in its leaves) to breathe in carbon dioxide and breathe out oxygen. We need plants to absorb the carbon in the atmosphere, so the carbon emissions produced in burning biodiesel can be offset against the amount that was absorbed as it grew, which is better than using fossil fuels.

## The Father of The Fuel Cell

William Grove, Professor of Physics,  
Chemist from Swansea,  
Judge and barrister of a court,  
Moves around his laboratory  
Among jars and measuring jugs,  
The acids and alkalis,  
Charts and notebooks,  
The noxious fumes and crazy ideas  
He sends a current of electricity through water,  
Splits the molecules into component parts;  
Hydrogen and oxygen, and the reverse.  
He creates a 'gas voltaic battery' –  
An innovation that was shelved  
For over a hundred years.

Chris Horsely – Northfield School

## The Hydrogen Fuel Cell

A hydrogen fuel cell powered bus was developed in 1993 and uses a 250 kilowatts fuel cell. Its consumption is 14kg of hydrogen per 100km. The capacity of the bus is 90 passengers, and is 12 metres long.

There are now many hydrogen powered cars being developed in Europe and the United States and they mostly use a 100 kilowatt fuel cell.

The most powerful hydrogen fuel cell is over 300 kilowatts, and lasts for over twenty years!

Matty Wilson – Northfield School

## 3ch3oh - fuel of the future?

Fields upon fields of rapeseed oil plants dancing,  
Yellow heads,  
And the hidden pheasants of the land  
chatter in crow-like language.  
About the roots, stamen, pollen, petals,  
leaves livid with colour.  
The fields upon fields of gold  
rapeseed oil plants sway in the wind.  
And the heavy rusting machinery stands silently,  
covered in mud, unnoticed by all.  
The temperature was warm like summer  
but the cold bitter wind felt like knives on your face.  
Danger lurks in every corner,  
So keep your eyes open.  
You feel no emotion as you stand there,  
transfixed by the beauty of nature.  
Meanwhile, the flowers  
are crushed, smashed and shredded.  
All that is left is rapeseed oil.  
How are the rapeseed oil plants made into oil?  
How are the rapeseed oil plants made into oil?  
I don't know, ask the machines when they wake.  
You will most remember the rustle of the wind,  
the pheasants chatting  
and the yellow heads of the dancing flowers.

Hannah Brown – Our Lady and St Bede RC School

## Making biodiesel

One lesson we learned how to make biodiesel. You need to wear goggles, and suits. You need to measure out 1 litre of veggie oil from your local chippy, then boil it to 55 degrees on a Bunsen burner.

While doing this your other group should have measured out 200ml of (meths) methanol and poured it in a HDPE container using a funnel (do not fiddle with after). Put on a lid (do not sniff), weigh up 5.3gm off sodium hydroxide. Swirl the mixture for a minute, make sure the lid is secure or you will spill it.

Mix it up with a magnetic stirrer for 20 minutes, then take off and let it settle for 12-24 hours.

Frederick Quinn – St Michael's RC School

## Amongst the Yellow Sea

Sea of Yellow.  
The golden rapeseed plants reach for the sun  
Life! Tiny flowers, hairy stamen, petals,  
Stem, leaves, seeds, pollen  
Insects buzzing, flying about,  
Taking pollen, fluttering, grabbing  
And the people were still; listening, watching  
Rooted to the spot.  
Pleasant warmth, with a cool refreshing breeze,  
Sometimes making you shiver  
Farmer John exclaimed,  
"Don't walk over the rapeseed - it could kill them!"  
Here, crops are cut down  
To burn, to make biodiesel  
Lose yourself in thought  
Lose the group you are with.  
Rapeseed is grown and cultivated.  
The seeds are crushed and broken down  
To make the golden oil.  
What is GM?  
WHAT IS GM?  
A technical term they used:  
Genetically Modified.  
But I remember using the notepads to write down info,  
On the shore of the Yellow Sea  
And I drew a WONDERFUL TRACTOR!

Nina White – Our Lady and St Bede RC School

## Ode to Rapeseed

Your petals are tiny suns,  
Butterfly wings  
Pinned to a green stem.

You need flowing water  
like I need chocolate.

Your stigma is powdered  
With gold dust that floats  
with the swift breeze.

You need continuous roots  
Like I need a rhythm.

Your pores breathe with gases  
Flowing in and out:  
Oxygen, carbon dioxide.

You need sunlight like I need music.  
Grow, create glucose, Photosynthesize!

Ashleigh Hughff – Our Lady and St. Bede RC School

## Friendship for Fuel

Your soft yellow petals wave to the burning sun  
as humans do to greet each other.

Your roots dig deep to reach for minerals  
like we do to reach our goals.

Your strong green stem holds and supports you  
as our families do for us.

You help us by feeding us oxygen,  
and we help you by feeding you carbon dioxide.  
But soon, my friend, we humans will disobey,  
and you will know nothing about it -

WE WILL CHOP,  
WE WILL SQUEEZE,  
WE WILL CUT,  
WE WILL CRUSH!

We are selfish and want your oil for ourselves.  
Your cholesterol balancing mono-saturated juices  
are perfect for production of vegetable oil,  
animal feed and of course the important BIODIESEL.

Rose White – Our Lady and St. Bede RC School

## The Rapeseed Farm

The field of green, dotted with yellow, caught my eye when I first went into the farm. The yellow flowers were really small and delicate, but because they were in big clusters, they looked like one big flower. Soon there would be no green to see. A small deer pranced away between the hay bales, frightened away by our trampling. I looked closer at the plant. The stem was a green tangle, the flowers curling from the thin leaves. It has a strong smell almost like dandelions. Small pods, like a pea's, grew from the stalk, this is what is used to make biodiesel. The tall plant sways gently in the wind.

Maisie Fraser – St Michael's RC School



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