Energy:
How fair is it anyway?

The Department of Energy and
Climate Change Youth Advisory Panel

"Young people are the most important part of the Energy mix"

An investigation into the Youth response to the UK 2050 Pathways and a call to the Youth community to let the Government know what YOU think

Thursday 2nd December 2010:
UN Framework Convention on Climate Change
Young and Future Generations Day

London, Brussels, Cancun

The DECC Youth Advisory Panel members have been supported by a number of organisations. A full list of Panel members and their supporting organisations can be found at the end of this report. The Panel has consisted of a core group of 16 young people, but other young people have stepped in to support them at times. The Panel is very grateful to all those who attended meetings or visits on their behalf.

It is important to note that whilst the members of the Youth Advisory Panel have been supported by their organisations, the views expressed in this report are of the Panel members in their individual capacities. The recommendations and discussions in the report are not to be seen as the positions or views of DECC or the supporting organisations.

The lead editors of the report were Carol Sherriff and Kirsty Schneeberger.

Please do use the material to start a debate in your school, university or work place. If you are from another country, please do consider setting up your own Youth Advisory Panel with your Government. You will see details of how to contact the Panel at the end of the Report. Please do send your thoughts, reflections and questions to the Panel and join the debate.

The Panel is very grateful for the images supplied in this report by the following people:

Bill Ditcham, Scroby Sands visitor centre
Hannah Thompson, Octavia Housing
Nic Seton, Youth Panellist
Rich Lott, Shared Planet conference
Sam Smith, BioRegional
Roger Donovan, British Gas visit
Thomas Youngman, Youth Panellist

Special thanks are to be given to COI for formatting and printing this report.

Acknowledgements

The Youth Advisory Panel (Panel) has been supported by a number of different organisations in a number of different ways and would like to acknowledge all the support it has been given.

Significant thanks go to the current Government and the administration of the **Department of Energy and Climate Change (DECC)** in particular. Since the election this year, it was made clear that the Coalition Government valued the input of the youth perspective and was keen to continue working with the Panel.

Thanks are also given to the Minister for Energy, the **Rt Hon Charles Hendry**, for discussing key issues relating to energy in this country and his Ministerial support. The logistical support that has come from the admin in DECC has been invaluable and we would like to thank all those who have supported us. **Hilda Carr** has been a dedicated fire-cracker who has used her energy, experience and inspired thinking to develop the Panel. Without her this really would not have even been possible. **Nichole Mockeridge** has offered valuable time and support to help with booking rooms for meetings and train journeys for our visits! **Jan Kiso** has been our distinguished energy boffin and helped us with technical questions along the way. **David Armstrong** has kept our online presence alive and **Jonathan Farr** has supported with the press work. **James Clarke** has made sure that were all reimbursed our travel expenses on time – something that is crucial to young people on very limited budgets! **Chris Morris** swooped in with some last minute help with the design, and **Andrew Greenway** and **Becca Downing** helped with fact checking. Finally, **Jon Hood** helped forge the initial connections between the youth organisations and DECC and for the last 18 months has been a true and committed champion of the youth stakeholdership. To all of you, thank you for making this journey happen, and for offering your lively and welcomed input during our meetings.

It is also proper and right to thank the previous Government for all the hard work that the then Secretary of State for Energy and Climate Change, the **Rt Hon Ed Miliband**, did to champion the idea of establishing the Panel. After Copenhagen DECC consulted with many youth organisations, the result of which was the establishment of the Pilot Panel in February. The Panel is grateful for this initial support and the vision that was shown in taking the steps to establish what we have become today.

In order to bring this report together we had the brilliant **Carol Sherriff** join us to facilitate the final few meetings and assist us with our consultations. Carol brought a wealth of experience and knowledge to the process and was wonderful to work with. **Saci Lloyd** offered her straight talking no-nonsense words of advice and reflections on our work, which we have found immensely useful.

Dustin Benton (CPRE), **Joss Garman** (Greenpeace) and **David MacKay** (DECC chief scientist) took the time to meet with the Panel and offer presentations on various issues, which helped better inform our deliberations and discussion. Thank you also to **Dustin Benton** for his amazing work on designing the contents and youth panel pages!

Each of those on the Panel received tremendous 'behind the scenes' support from their own **organisations** and this has been particularly useful and valued. You will see the full organisation list at the end of this report. It is also important to reiterate that the views in this report are that of the Panel members in their individual capacities; they are not the views of the supporting organisations.

The Panel members themselves have volunteered their time to meet as a group and tour around the country to learn more about energy in the UK. They have been a constant inspiration to me and a pleasure to work with, They are all bright and brilliant young people and this report is testament to their dedication.

The Panel was able to **visit** many exciting and brilliant places, learning about

energy issues and I am completely appreciative for all those who made the visits successful, informative and eye-opening. In no particular order, we thank: **Guy Shrubsole**, **Sylvie Winn**, **Sam Smith**, **Sophie Moeng**, **Ann Gray**, **Melanie Wedgbury**, **Gordon Bell**, **Richard Earp**, **Hannah Thompson**, **Leonie Edwards**, **Sian Callaghan**, and all those whom we met on the visits – thank you. Your insights into your projects or industry were invaluable.

At the very last minutes **Louise Dean**, at COI, offered a huge amount of support to the designing and layout of the report and helped us to bring it all together.

Finally, and most graciously, we thank **Sciencewise-ERC** and **BIS** for the funding that supported the programme from July – December 2010. **Daniel Start**, Dialogue and Engagement Specialist, has offered us an opportunity that had hitherto not existed before. This project has taken a pioneering approach to embedding the principle of intergenerational equity with Government decision-making and we hope it will be replicated elsewhere.

On behalf of all of us, thank you for doing all you can to safeguard our future. I have every confidence that we will remember you fondly and kindly in the year 2050 and we will hail your courage, leadership and moral awareness that brought our voices to the decision-making table when it was needed most.

Kirsty Schneeberger, MBE
DECC Youth Advisory Panel Coordinator

Foreword

We hope that some of the views shared below will offer a reminder of the importance of safeguarding the world for young and future generations.

From East Park Junior School:

"If people keep using electricity it is going to melt the ice at the North Pole and it's going to flood"
– Jade, will be 47 in 2050.

"I'm scared because the air might be polluted"
– Sam, will be 47 in 2050.

"Climate change might make our planet like Mars"
– Isabel, will be 48 in 2050.

From Brighton and Hove High School: In the future...

From Year 2, children who will be 46 in 2050

"No one will cut down trees anymore"

"There will be changed habitats for animals"

"New volcanoes formed and exploding"

"More animals in danger"

From year 3, children who will be 47 and 48 in 2050

"Cars won't have petrol"

"Everybody will be friendly"

"No plastic bags – cardboard ones"

From year 4, children who will be 48 and 49 in 2050

"Polar bears, pandas and tigers might be extinct
by the time we grow up if we don't act quickly now."

"In the future all cars will be electric and fossil fuels
will not be used for transport."

"We need much cheaper buses and trains so that
we are all encouraged to use them."

"We will not have any rainforests when we grow up,
if we don't stop deforestation now."

"We do not inherit the Earth from our Ancestors;
we borrow it from our Children."
Proverb

Background to the Panel

Young people's views on climate change are incredibly important: it is we who will live with the effects of decisions taken today. But getting our opinions heard where it matters – at the UN negotiations and in Government – is very difficult.

Why the panel was set up

In the build-up to the Copenhagen conference (COP 16), young people in the UK made a number of approaches to the Department of Energy & Climate Change (DECC), requesting their views to be fed into the negotiations. In particular, we asked for a youth panel to be created in DECC so we could contribute young people's views into the actual process of how climate change policy is developed. Because without a formalised channel of communication and interaction between the Government and youth groups, our views would be left on the sidelines and closed off from the vastly important decisions being made.

The Panel's role and purpose

Role

The Youth Advisory Panel has a dual role; the Panel will advise DECC on the thoughts and proposals of the youth community, whilst also relaying information from DECC out to the wider Youth communities and organisations that support the Panel.

Purpose

Intergenerational equity is a vital component of democratic and responsible governance. As such, DECC's Youth Panel is a body that advises DECC on climate change matters relating to young and future generations, in particular on how the UK will reach its 2050 target of an emissions reduction of 80%. The Youth Panel will have the interests of safeguarding their future at the heart of their work, and will ensure that DECC and wider Government proposals made on behalf of young and future generations stand up to scrutiny.

The Panel's structure

The Youth Panel is composed of a core group of 16 members of youth organisations, as well as other engaged youth advocates and individuals from the UK. It was agreed that the Panel would be coordinated by an 'independent' individual who has been involved with DECC's youth engagement work but who is not representing one particular organisation.

How the members were selected

To begin with, there was a 3 month period where DECC convened a "pilot" Youth Advisory Panel to work out the finer details of the role, functionality and structure of the actual Youth Advisory Panel. The pilot Panel was selected to represent the many different youth stakeholders and groups that DECC had worked with on the 2009 Act on Copenhagen campaign. The scope of the membership of the Panel was extended once the Pilot developed into the functioning Panel and the different organisations nominated young members to sit on the Panel.

How the Panel performs its role

The Panel meets at DECC on a monthly basis and discusses key issues relating to young people and energy and climate change. This particular project has had a specific focus on pathways to 2050, and this report is the culmination of five months' work. The Panel uses these meetings to question DECC policy officials, as well as discuss and debate between themselves. The members of the Panel take this knowledge and information back to their various organisations. Each organisation that supports a member of the Panel can then submit a response back to DECC; this is to ensure that the youth voice is heard – and responded to – by the government.

Contents

Case studies

Introduction

We are a group of young people from a range of youth and environmental organisations and networks who have been on a journey investigating the UK's current and future sources of energy. In particular we have focussed on whether or not the different ways of generating energy are, in our view, fair to young and future generations.

When the Department of Energy and Climate Change (DECC) established the Youth Advisory Panel (Panel) as a pilot in February this year it was a pioneering project: young people have been missing from the decision-making table in relation to energy up until now. The Panel aims to change that and enable the voice of young people to be heard – and formally responded to – in the process of making decisions about energy and climate change.

In July 2010, we began looking at the energy mix[1] of the UK, and concentrated on working out an 'energy pathway' that will lead this country to a carbon reduction of 80% by 2050. As a panel of 15 – 26 year olds, the eldest of us will be 66 in the year 2050, and the youngest only 55. Decisions made between now and 2050 (and beyond!) will be with us for the rest of our lives. So it is important that young people have a say in what the energy mix should be.

DECC itself has a hard working policy team that is already focussed on the 'energy pathway' of the UK, and this team has created something called an 'Energy Pathways Calculator.'[2] The Panel has used this tool to develop an understanding of how a 'mixture' of energy will be needed to power this country and the calculator helped the Panel's discussions on which type of energy to support. This neat tool will also help members of the public to work out what their preferred 'energy pathway' would be. The Panel is especially keen to encourage other young people to talk about the energy mix and the calculator, in addition to this report, so that young people better understand that energy is an important part of our lives – and future.

Our approach to this investigation has been to find out for ourselves about the different types of energy that currently exist in the UK, as well as proposed ideas for new technologies. The Panel travelled around the country (in small groups) to visit places, such as power stations, community owned energy as well as projects that work towards reducing energy demand. We have also asked young people from different organisations and Universities what they think about energy. We have run two online surveys as well as a face-to-face workshop, which have gathered the views of nearly 700 young people to help us with this report.

As you will see, we haven't always agreed on what is fair to our and future generations. And so we want to stress that this report is not the definitive guide to what young people think about energy. Rather it is a catalyst for discussions, a platform for influencing Government decisions and a call to action.

How to use this report

We have designed this report to be used in different ways.

- If you want to know more about the different forms of energy, you can start at the section 'on what is energy' and progress through the report section by section;
- If you understand the different types of energy and want to follow our journey starting with ways of reducing demand and moving on to generating energy, you may want to start on page 13;
- If you are interested in our views on a particular form of energy go to the appropriate section where you will find a report on our visits, our thoughts on that topic and requirements;
- If you want to begin with our requirements then the summary section is the place to start.

Summary

In order to better understand how the different types of energy are produced in this country, the Panel travelled around the country to visit places such as power stations and community owned renewable energy projects. What's clear from the different calculator outputs (at the end of this report) is that we haven't always completely agreed on what is best for young people! But this is to be expected when dealing with such a varied group– we want to emphasise that the pathways we suggest are illustrative of the kind of effort that needs to be made to achieve the necessary reductions of 80% by 2050. These pathways are up for debate and the Panel would very much like to hear your responses to the proposed scenarios, as well as encourage you try out the calculator on your own.

A strong impetus for developing new ways of generating energy in this country has been reducing carbon emissions. This is absolutely vital in a world that is already suffering from impacts of climate change. As young people, we will inherit the legacy left to us by decision-makers and this will significantly affect the rest of our lives, as well as the lives of future generations.

It is also important to ensure that there is enough energy to go around and that everyone has equal and fair access to it, however it would be irresponsible to only focus on providing energy to keep us living the same way that we are today. We must also consider what efforts need to be made to reduce the amount of energy we need in the first place.

How fair is it?

Fairness between the generations is a fundamental Guiding Principal for the panel.[3] This is something that we call 'intergenerational equity' and it is important to think about the impacts that a decision made today will have on people tomorrow, and in the future. We know that history informs us, but we also want the future to inform our decision-making and actions. We look to the future well-being of our older selves and future generations when we have debates about the ethics of making a decision and we hope that in doing so we have made, and continue to make, morally responsible decisions.

We have judged the fairness of the different types of energy developments based on the guiding principles of the Panel as well as the responses to the surveys. In an age of economic uncertainty and Government spending we urge the government to think hard before further cutting investment in renewables. We believe that no deficit is so large that our future should be gambled.

Requirements

In this report you will read that we have outlined 'recommendations'. But in order for young people to have a safe, clean and healthy world to live in from now until 2050 we **require** the Government (as well as other business leaders and energy producers) to work hard to help us safeguard our future.

Overall, however, the Panel believes that the arguments laid out in this report and the recommendations that we submit are morally appropriate. The Panel believes that in the interest of intergenerational equity any decision made today **must** consider the impacts that will be felt in many years to come. To this end, we challenge decision-makers to guarantee young people that we will have a liveable planet in 2050. Anything less would be morally irresponsible.

Summary of Recommendations

Above all we believe that the Government must:

- Ensure a fair deal for young people in the decision-making process;
- Actively work hard to ensure that Government does not lock young and future generations into ecological debt;
- Continue engaging in dialogue with the youth constituency and stakeholdership to ensure that the youth perspective is heard, and responded to, by Government.

How we use energy

Housing and Building sector

- Focus on reducing demand for energy in the homes, schools and other buildings;
- To meet the target set that all new build homes should be zero carbon by 2016;
- Set PassivHaus as a minimum standard for 30% of new homes by 2016 and 60% of new homes by 2025;
- Maintain incentives for home owners to retrofit their houses by committing to continue the 'warm front grant' for insulation;
- Offering specific grants for students to retrofit their accommodation that are not owned by themselves;
- Zero rate VAT on home improvements that deliver a measurable reduction in energy consumption and carbon emissions;

Transport

- A rapid roll out of electric cars;
- More public transport incentives and infrastructure whilst phasing out petrol powered vehicles;
- Greater incentives and infrastructure for cycling;
- Affordable alternatives to transport, including increased high-speed broadband and telecommunications' infrastructure to replace the need for travelling long distances for meetings;
- Greater regulation and accounting for the true costs of aviation and shipping and including aviation and shipping in the energy pathway calculator.

Producing energy ourselves

Micro-generation

- Demand side energy reduction is possible and essential. The Government must continue with the Feed in Tariff (FiT) scheme to develop micro-generation;
- In addition to the FiT as it is currently, financing options for less wealthy families must be investigated. We recommend a commissioned report to find out how the FiT could be used to benefit the least wealthy members of society to ensure equity within the system;
- Some charities are now using the FiT to secure funding – the Government should facilitate the process of community led groups working together to develop micro-generation and benefit as a community from the FiT;
- The British Gas **Green Streets** programme is an excellent example of a business supporting community led renewables projects. The Government should introduce a scheme to encourage business led 'social enterprise' support to other community projects.

Connecting people to energy

National Grid

- The Government should facilitate a more joined-up approach to realising the most efficient delivery of new technologies, notably off-shore wind, to the main Grid system;
- The government should take a leading role in facilitating the pan-European SuperGrid, so the immense export potential of the UK wind resource can be optimised;
- The government must further support current work upgrading the Grid to allow localised electricity micro-generation to be delivered, and developing a SMART Grid, including Smart appliances and meters to manage variability in demand and supply;

Producing renewable energy on a large scale

Offshore wind

- To facilitate the development of electricity connections between the UK and Denmark. This will allow the UK to export electricity from the offshore wind developments, as well as receive electricity from other countries in Europe if the UK needs more;
- To assist with financing and facilitate the development of the 'floating turbine' technology that is proposed in the offshore wind valuation;
- To establish and set the Regulations for the offshore wind industry to give certainty and clarity in the rules surrounding the development of the technology;

- Lower up-front costs of offshore wind development – by directing innovation support – so mitigate the risk that deters investors;

- To commit to making the UK the leader in offshore wind by 2020. this will safeguard electricity supply to the UK and also provide needed income to the country that has relied on oil and gas reserves which are now massively depleting;

- The DECC Calculator needs to include the recommendations from the Offshore Valuation about what is possible to achieve for offshore wind.

Bioenergy

Biofuels

- To apply a holistic approach to decision making surrounding biofuels and ask "before I decide that a biofuel should be used I must first consider the butterfly effect of that decision";

- To not allow biofuel palm oil to be used as an energy crop;

- To not allow any biofuel crop to be grown where a (rain)forest has been cleared or agricultural land used;

- Biofuels must only form a small part of the energy mix and comes from sustainable sources.

Biomass

- To develop a sustainability certification process for biomass material;

- Forest Stewardship Council (FSC) should be the absolute minimum certification and the Government should not allow importing of non – FSC material for biomass;

- Biomass co-firing in coal power stations must not be an excuse to extend the life of coal power stations and allow unabated coal to be burned. The Government must introduce regulations to ensure that co-firing is used only to reduce carbon emissions as coal is phased out.

Biogas

- DEFRA should continue to help landfill sites install gas generation and user facilities, and the implementation of biogas production facilities using landfill waste should be investigated;

- Efforts to reduce the amount of waste going into landfill should be ensured to take precedent, however.

Producing energy from power stations

Coal

- To ensure that unabated coal fired power stations are **phased out** within the next five years;
- To invest in CCS technology to find out if CCS is viable within the next 2 years. If it is not technically feasible to be rolled out by 2015, then coal must be phased out as above;
- Any CCS technology funded by public money should be open source;
- Biomass co-firing in coal power stations must not be an excuse to extend the life of coal power stations and allow unabated coal to be burned. The Government must introduce regulations to ensure that co-firing is used only to reduce carbon emissions as coal is phased out.

Gas

- Gas should be given priority over other fossil fuel forms of energy when looking at applications from new power stations;
- The use of Carbon Capture and Storage technology on gas-fired power stations be investigated fully, and if feasible be used widely;
- Ultimately gas-fuelled power stations be phased out in favour of renewable technologies;
- The development of a SMART grid and energy storage infrastructure to handle the peak load that gas is currently required to cover;
- Home insulation and thermal efficiency programs, education and subsidies must be offered across the country to reduce the use of gas for heating in the home.

Nuclear

While opinion on nuclear power will remain divided, there are certain actions that we believe must be taken for the good of future generations:

- The government must develop a transparent and viable long-term strategy for dealing with our legacy of existing nuclear waste. This long-term strategy must forecast beyond the current Parliamentary term to at least a minimum of 150 years;
- The government must make sure that adequate funding for the decommissioning of current and any future nuclear power plants is assured in the long-term, and that this financial burden is not unfairly placed upon future generations;
- Any funding or governmental support for further nuclear power development must not detract from any funding or support for alternative, renewable forms of energy.

What is Energy?

Most of our energy in the world originally comes from the Sun. When the sun shines down on the earth, plants and trees soak up the rays, the leaves suck in carbon dioxide and photosynthesise.

As a result of this two very brilliant things happen that we rely on:

- firstly, the leaves breathe out oxygen into the atmosphere, keeping our air clean and in balance so the air we breathe is the perfect mix;

- in addition the plants and trees store carbon and light. When they do this they act as mini 'sun catchers' and store the **energy** from the sun. This energy can then later be released when the trees are burned, giving off light and heat.

The second of these points is a corner-stone to this report and we focus attention on the important issues of how **energy** is used. Not all types of energy stores are the same and we draw comparisons between the different ways that energy from the sun is trapped and then used again by people. In particular we look at two different types of energy stores: the ancient stores called **fossil fuels** and alternative stores that are termed **renewable**.

Fossil fuels

When trees stop growing and eventually die, some of the carbon that they stored is released into the atmosphere, but most of it remains stored in the plants. After many thousands of years these trees and plants are turned into fossils because they are put under lots of pressure and heat underground.

Then, just a couple of hundred years ago, it was discovered that these old trees – in their new fossil forms – could be burned as fuel. When such fuel is burned all the energy from the sun that was stored all those hundreds of thousands of years ago is released again. This is why we use the term 'fossil fuels'. The following are fossil fuels:

Coal

Coal is a **solid** fossil fuel. It is mined from under the ground and is dug up in the form of small rock-like shapes. These pieces of coal are then burned and because it is so old, thousands upon thousands of years old, and because it has been compressed and put under such high temperatures it is a potent and condensed store of the old trees' energy from the sun. When coal is burned it gives off the energy, sunlight and carbon that was once stored in the trees. Because the trees that form coal were alive many thousands of years ago and because the process of turning the trees into fossils takes such a long time, this type of fuel is **finite**. This means it is **not renewable** and there is a limited stock of it.

Oil

Oil is a **liquid** fossil fuel. It is sucked up from beneath the seabed and under the ground and pumped around the world. Oil is also hundreds of thousands of years old and has been created by the plants in the ocean that trap light from the sun and carbon from the atmosphere. These are then compressed beneath the sea and similar to coal these plants and other organic matter are fossilised. Also similar to coal – when oil is burned it gives off light and heat (that was trapped from the sun thousands of years ago) and carbon. This fossil fuel is also **finite** and once the stores of oil run out it will take thousands upon thousands of years to create again.

Gas

Gas stores are deep under the ground in caves or pockets of the earth. When organic matter is put under very high pressures and temperatures for thousands of years, it can turn into natural gas. This gas stays stored underground until we suck it up and burn it. When the gas is burned it also gives off heat and light and smaller amounts of carbon as a gas. Natural gas is also a **finite** reserve of energy.

Other forms of energy are now becoming increasingly attractive and sensible in a world where fossil fuel reserves are running out and will not be replaced in our lifetimes. And where we need to reduce the amount of carbon we release into the atmosphere.

Nuclear power

Nuclear power uses the mineral **uranium** and creates electricity from a powerful nuclear reaction. The uranium is mined in countries such as Australia and because it is a different process to burning fossil fuels, there are less carbon emissions released when the power plant is running. However, nuclear power produces radioactive waste that last for thousands of years and is highly dangerous.

Renewable energy – called this because, unlike fossil fuels, they are not finite and can be renewed.

Solar

This is a technique that traps the energy directly from the sun (like a leaf does) and converts it straight into electricity. This is done through Solar Photovoltaic (PV, electric) panels which convert light directly into electricity, and are already used to power devices from spacecraft to calculators – but are now increasingly being used to generate electricity locally and feed power into the National Grid. Traditionally they are on a South-facing roof, but low profile 'solar tiles' are getting cheaper and are ideal for aesthetically-sensitive buildings. Solar thermal (hot water) panels can be used to provide hot water by circulating liquid through efficient solar collectors (like tubes) to a hot water cylinder. Solar thermal can be used to provide hot water for homes, commercial buildings and even swimming pools. They work particularly well in combination with heat pumps.

Wind

In a roundabout way wind power also relies on the sun. It does this because when the air is warmed up (by the sun) and it meets cold air it creates a pattern of airflow that we call wind. This wind is harnessed as a form of movement and this movement is used to create energy. Wind is also a **renewable** source of energy.

Tidal and wave

This is a technique of harnessing energy from the water. Wave power relies on the movement of the seas and the creation of waves; and tidal power relies on the constant ebb and flow of the tide. These are a **renewable** form of energy because as long as the earth has a moon, then the oceans and seas will have tides and we will be able to use the power from the tides to create energy. **Micro-hydro** systems are also experiencing a renaissance, especially in wet areas and on farms.

Bio-energy

This is a method of using energy from plants and trees and gas from waste. With **biomass** the plant matter traps sunlight (as we know) and instead of waiting for them to fossilise we burn them soon after they have grown. There are places in the world that are growing these plants, sometimes called 'energy crops' just to burn them when the crops have been harvested. When waste biodegrades it produces a gas and this can be burned to produce energy.

Why we need to debate the energy mix

The Government of the UK has made it a law to reduce the amount of carbon emissions that the country creates (by burning the ancient trees or fossil fuels) so that the balance of the atmosphere is restored and we maintain a healthy balance of gases. In fact, there is a legal commitment on the country to reduce the amount of CO_2 gas released into the air by **80% by the year 2050**.

In order to meet the **80% by 2050** target we will need to think of new and innovative ways of creating energy without burning fossil fuels like we are today. If we carry on burning fossil fuels as we are then we will not meet the target reduction. If we do not meet the target reduction it will mean that we break the law. This is why renewable and non fossil fuel technologies are developing quickly so we can meet this target!

The target relates to the year 2050 and it is mostly the young generations of today who will be around in 2050. If we break the law and do not meet the carbon emissions target then it will be young people today who will be held to account for missing the target and the consequences will be severe. This is why young people are so keen to make sure the UK (and other countries around the world) meet the targets in good time!


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Wind Farm Visitor Cent
Welcome to
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Where does energy go and how can we save it?

How much energy we use is a key factor in how much we need to generate. Constructing houses and business premises, and the heating of such buildings is a large part of the energy used in the UK. In our homes we use electricity all the time: we switch on lights, boil the kettle and watch TV or use a computer. We use energy to heat our homes and keep our baths and showers warm by using gas or electric water boilers. It is easy to forget that less than half a century ago the amount of electricity we used was significantly less than it is now and that families and workers had a very different way of life.

Key Facts

- In 1970s the average winter temperature of a house in Britain was 13C! Nowadays people feel cold at 17C and are inclined to leave the thermostat at 20C. (MacKay, p 143)
- 'One kilowatt-hour per day is roughly the power you could get from one human servant. The number of kilowatt-hours per day you use is thus the effective number of servants you have working for you.(Source: Mackay)'[4]

Housing

The Panel wanted to look at ways of reducing the **demand** for energy use and to learn about different approaches to building in a more sustainable manner, both for residential and commercial purposes. We visited a number of different projects that are working on 'retrofitting' houses and developing new-builds that are more energy efficient. In particular we were very interested to learn about how building houses in a more energy efficient way can keep people warm without having to pay a lot for heating their homes. We are very concerned that there is **fuel poverty** in the United Kingdom. This is where families and individuals find it too expensive to heat their homes because energy prices are so high and because their houses are too draughty or there is not very good insulation. In the twenty-first century the Panel thinks it is very important to eradicate fuel poverty so that people can lead inexpensively safe, comfortable and warm lives. We learned about different ways that this could happen on the visits.

Case Study – Beddington Zero Energy Development, (BedZED) 25th August: Unkha, John, Rose, Helena and Kirsty.

BedZED in Sutton, Surrey was designed to create an eco-community in which ordinary people could enjoy a high quality of life, while living within their fair share of the Earth's resources (the 'one planet living' principle). The project aims to increase energy efficiency and encourage low energy consumption through the design of the apartments, the materials used and encouraging a change in residents' and homeowners' behaviour. From what we saw the development was a very exciting and creative way of building a mixture of private, affordable and social housing. There were difficulties with the combined heat and power plant, which meant that it is no longer in use, but BedZED has shared the lessons learned from that with the renewable energy sector which will improve future combined heat and power (CHP) developments.

Key Facts: from the BedZED tour

Energy: 81% reduction in heating, 45% reduction in electricity use.

Transport: 64% reduction in car mileage 2,318km/year

Water: 58% reduction in water use 72 litres/person/day

Waste: 60% waste recycled.

Food: 86% of residents buy organic food.

Community: residents know 20 neighbours by name on average.

The development demonstrated how successfully smart design and clever use of materials can reduce the energy consumption of the house. Measures such as putting large windows facing south to absorb heat during the day and triple glazing on the north side of the buildings really add to the comfort of people living in the houses. The green roof spaces help to reduce chances of drains overflowing with rainwater. This is a simple measure that could be used in many houses to collectively and sensibly use rainwater.

Reflection from Unkha Banda: "Although the prospects of replicating the project across the UK would require a new way of thinking, BedZed demonstrates the economic and technical possibility of building without degrading the environment, and even enhancing it in the process. I was very impressed by the project and left extremely optimistic about the possibility of creating green homes in the future."

Case Study – Octavia Housing: 100 Princedale Road, 27th September:
Elizabeth, Zac and Kirsty

The house in fashionable Notting Hill, London, was originally built in 1840. Over the years it has seen wear and tear and was desperately in need of a complete renovation to make it habitable. Instead of a normal makeover, Octavia Housing received government funding to bring it to PassivHaus standards. PassivHaus is a low energy building standard that requires the home to use less than 15kWh of energy to heat it per m^2 per year, compared to the UK average of 130kWh.[5] This German system uses physics-based evidence to reduce air leakage and dramatically reduce energy use. Retrofitting in this way allows us to use existing, characteristically English homes and modernise them using the latest technology. The air heat exchange, solar water heating, and very thorough insulation (15cm thick) make this an incredibly energy efficient home.

Key Facts from Octavia Housing Tour[6]

Cost: £50,000 extra on top of baseline refurbishment costs (total cost, £175,000).

Energy consumption: 94% reduction

Carbon emissions: 87% reduction

Energy lost through walls: Less than 0.1 watts per metre squared – against a 'normal' measure of 0.35 watts per metre squared

Reflections from Elizabeth: "This is the townhouse of my dreams! It's a beautiful Victorian terraced home, with space maximised by using the cellar as a kitchen. It is as energy efficient as you are likely to find anywhere in the UK, cheap to run, and totally easy to use (the heat exchanger phones you up when it – very rearely – needs the filter changed). Economics of scale mean that as more people do this, it is likely to become cheaper to renovate more houses to the PassivHaus standard."

Case Study – AECOM consortium – 6th October:
John, Amy, Hannah, Josh and Kirsty

We visited **AECOM** (an international consortium of architects, design experts and planners) to learn about the plans being made for the long-term, sustainable use of the London 2012 **Olympics** site. The site will continue to be developed for the next 40-50 years after the London 2012 Olympic and Paralympic Games. It was exciting to see that all of the plans have thought about the long-term impact of this development. The planning includes the concept of 'future proofing' the site with capacity and infrastructure for affordable and sustainable homes, to comply with current and future energy saving measures. The site has been designed to be powered by 20% onsite renewables. The site includes a biomass generator to ensure a renewable source of energy both for the Games and for the future residents and keep plenty of green, open spaces as part of the village and site. This detailed planning and consideration of the long-term impacts of the Olympics (the **legacy**) are an example of best practice in commercial development. The Panel hopes that more large scale commercial projects will follow the lead and integrate plans relating to their legacies for future developments.

Energy prices

In 2010 the energy industry regulator Ofgem announced that home owners and people who use energy will face an increase in gas and electricity bills, at an average of 7% by December 2010.[7] This means that it will become more expensive to keep our homes warm during the winter. The Panel therefore thinks it is very important that homes are made more energy efficient, either by renovating or when new homes are built.

During one of the visits to the Centre for Alternative Technology, the Panel heard a presentation on the **Zero Carbon Britain 2030**[8] report, which goes far beyond the UK's target of cutting carbon emissions by 80% by 2050 and aims to make Great Britain **carbon-neutral by 2030**.

The report calls for

- 56% cuts in energy demand;
- the generation of 55% of UK energy from offshore wind;
- 75% reduction in the amount of meat and dairy consumed;
- 10% of carbon emissions sequestered using 'biochar', reforestry and soil storage; and
- no use of new nuclear or coal plants – even those with 'carbon capture and storage'.

We also heard from Martin Kemp, lead author of ZCB2030, about how these two reports align with DECC's Pathways calculator tool. In discussing the calculator he asked us – 'do we want to just scrape the 80% target, or do we want to be more ambitious and suggest a near zero-carbon pathway?'

Is reducing demand fair to the younger generation?

This approach was supported by the majority of participants in our second on-line survey. They were asked about the fairness of addressing how much energy is needed. The vast majority of participants believed most actions to handle demand were fair. Building homes to reduce energy consumption, insulating homes and commercial offices and developing low energy lighting were supported by more than 80% of people taking part. Developing a SMART grid, asking people and businesses to reduce energy and electrifying transport were all supported by more than 60% of participant s. Reducing international shipping and aviation were regarded by more people as not so fair, unfair or a raw deal. But 50% of people thought reducing international aviation was fair and 45% supported reducing international shipping.

Conclusion – Reduce demand before increasing supply

After visiting these exciting and forward-thinking projects the Panel was able to develop a much deeper understanding of how the need for energy (demand) affects the amount of energy created (supply). The Panel soon realised that if any decisions are going to be made about how to increase the amount of energy created, a serious discussion must be had about how to **reduce the demand** in the first place. This will help people to live safe and warm lives in their homes without it costing them a fortune. Reducing the demand can also reduce fuel poverty and help people to save money – something that is increasingly important in this day and age.

Recommendations – housing and built environment

- To make every effort to reduce the level of demand on energy in this country particularly by implementing measures to facilitate the retrofitting and renovation of the housing stock to reduce energy consumption;
- To ensure that all new build properties are designed and developed to reduce energy consumption by at least 75% within the next 10 years;
- Zero rate VAT on home improvements that deliver a measurable reduction in energy consumption and carbon emissions;
- Set PassivHaus as a minimum standard for 30% of new homes by 2020 and 60% of new homes by 2030;
- Commit to continue with the 'warm front grant' for insulation for the next 10 years;
- Offering specific grants for students who are in student accommodation and not home owners to insulate their homes;
- Setting regulation to ensure that commercial premises are retrofitted to high standards and for every new commercial development to have completed a 'legacy assessment' before seeking planning permission.

How we use Energy: Transport

Transport plays an essential part in our lives, but we often take the energy that goes into transport for granted. The Panel therefore set out to investigate what fair low-carbon transport would look like and how our transport could be improved to benefit people now and into the future. We also measured our own energy use in producing this report as a way of learning more about the impact of transport choices (see Appendix D for details of the Carbon Audit)

Key Facts:

- 55.2% of people travel to work by car[15]
- A third of all our energy goes into transportation[16]

A symbol of modernity, individualism and freedom – our collective love affair with **cars** is not easily forgotten. However, today's fleet of predominantly fossil fuel powered cars has great potential for improvements in efficiency. The most promising technology demonstrated to date is the **electric car**, which can achieve efficiency standards many times greater than today's petrol powered vehicles. As we see in the National Grid section, the electric car will also play a vital role in the **SMART grid** and will act as a battery store for electricity.

Public transport provides an efficient solution to the congestion and high energy costs of private car use, servicing the greatest number of people in a relatively equitable way. Greater efficiency gains can still be made in the electrification of trains and buses, moving away from fossil fuel use. Although private transport is essential in some cases, more must be done to increase the desirability of public transport and to decrease the demand for private transport use. Some methods include: decreasing fares; giving preference to public transport vehicles on roads; and, transferring the environmental cost of private vehicle use onto drivers, such as implementing congestion charges and normalising parking fees. In order to achieve maximum energy efficiency for transport overall, public transport must become the default method for passenger transport, and incentivising the use, or continued use, of public transport is essential.

Bicycles provide people with the most cost effective and energy efficient mode of private transport at any age. But as yet, the full potential of urban cycling, as demonstrated by other European countries, has not yet been realised in the UK. Many young people use bicycles in their daily lives and this desired behaviour could be maintained and increased by addressing the main barriers to cycling, such as insufficient cycle lanes in the cities and personal safety concerns. These barriers can be addressed together by increasing the amount of designated road space for bicycles wherever congestion occurs. As a long established and most efficient form of personal transport, bicycles can not be overlooked as a great source of improved energy efficiency and equity for transport as a whole.

Aviation and shipping

In an increasingly globalised world, we have become increasingly reliant on **planes and ships** to deliver products and passengers to and from desired locations at great speed. However, aviation and shipping are the fastest growing sources of emissions in the UK, and as they participate in a global market, purchasing fuels around the world, countries have been reluctant to tax and regulate their activity. As such, the true costs of aviation and shipping should be accounted for by each country participating in their use. The use of planes in particular should be kept to a minimum, by including the true cost of flying, fuel use and carbon emissions, in the price of air services.

Emissions from aviation and shipping are included in the 2050 Pathways calculator for "illustrative purposes" according to DECC's Pathways Analysis.[17] However at the moment only domestic transport is currently included in the UK's targets because there is no international agreement on how to allocate these emissions to countries. Aviation is included in the EU's own emissions reduction target but shipping is not. We feel strongly that these emissions should not be ignored. Shipping is important because it accounted for 3.3% of global emissions in 2007 and global shipping emissions could increase by 150-250% by 2050.[18] Recent research has found there is a lot that can be done to reduce emissions in the UK- the IMO has found that many of the measures are cost-effective including introducing new energy-efficient ship designs.[19]

How fair is "action on transport?"

Electrifying transport was regarded as a fair way to manage the demand for energy by 72.5% of those participating in our survey. 24.5% thought it was not so fair, 3 % unfair and no-one thought it was a raw deal.

On reducing international aviation and shipping the result was less clear. 58% thought reducing aviation was fair, 33.5% not so fair, 5.9% not fair and 1.9% a raw deal. Similarly with shipping, 48.5% thought reducing international shipping was fair, 42.2% not so fair, 7.8% unfair and 1.5% a raw deal.

Recommendations – Transport

- A rapid roll out of electric cars;
- More public transport incentives and infrastructure whilst phasing out petrol powered vehicles;
- Greater incentives and infrastructure for cycling;
- Affordable alternatives to transport, such as teleconferencing;
- Increased high-speed broadband and telecommunications' infrastructure to replace the need for travelling long distances for meetings;
- Greater regulation and accounting for the true costs of aviation and shipping and including aviation and shipping in the calculator.


Danfoss Heat Pumps UK


British Gas
The Energy Academy
Wales


CENTRE FOR ALTERNATIVE TECHNOLOGY
CANOLFAN Y DECHNOLEG AMGEN

Producing energy ourselves: Renewable micro-generation

We often think that there is nothing we can do to generate energy in our own community, business or home. The Panel therefore wanted to explore a range of different approaches to what is called micro-generation -small scale generation of heat and power by individuals, small business and communities to meet their own needs. Over recent years micro-generation has developed to become a byword for localised, environmentally conscious, low carbon and sustainable approaches to generating electricity. A few examples are described below.

Key Facts

- Solar heating (and geothermal) currently make up 1% of total renewable energy usage in the UK.[9]
- Almost every home in the UK has the potential to benefit from the use of solar collectors to heat hot water in the boiler, which can be retrofitted with relative ease and low cost.
- The capacity of Solar PV in the UK has been increasing, from 10.9MW in 2005 to 26.5MW in 2009.[10]
- The **Feed in Tariff (FiT)** was introduced in this country in April 2010 to give renewable energy producers a guaranteed return for every unit of renewable energy they produce. Solar PV, for example, receives 41.3p per kWh of electricity produced for a minimum of 25 years.[11] A typical 2.5kW system could earn more than £900 every year.

Case Study – Centre for Alternative Technology, Machynlleth, Wales; 26th August 2010
Elle, Tom Y, Tom W, Helena and Kirsty

We began the day by seeing the brilliant **WISE Centre** (Welsh Institute for Sustainable Education), very much a model for larger sustainable buildings. Constructed with bricks of compressed earth with high thermal mass and low embodied energy, the building absorbs energy in hot weather and releases it in cold weather. These bricks are also rendered (covered) with limestone instead of plaster, and not fired to as high a temperature as plaster, saving energy in the construction process. We saw on the roof solar thermal evacuation tubes to provide hot water to the building. These provide more efficient water heating, even in winter because the water in the tubes on the roof are heated up for free!

SOLAR

We looked at examples of **photovoltaic** (electricity producing) solar panel arrays. We were told about how they could be used more widely and learned that the oldest solar panel at CAT was recently inspected after fifteen years and was found to be almost fully as efficient as at installation!

During the tour we asked about the **'energy paypack'** time for renewable technologies (amount of time it takes to generate the amount of energy used in manufacture). According to CAT, a solar panel on a house pays for itself in 2-3 years, although a large wind turbine has a better energy payback time of only six months! So we learned that even though carbon emissions are created in the process of making solar panels, the amount of CO_2 they save over 2-3 years makes up for that and then there is no CO_2 produced.

MICRO-HYDRO power

One of the most interesting methods of micro-generation we saw was a **micro-hydro** turbine. These usually generate between 0.8 and 4 kW and are suitable for anywhere with a source of water. This type of power seemed to have gone 'out of fashion', but its popularity is returning, especially in wet, mountainous areas such as Wales.

Later on in the year, Youth Panellists had the chance to visit the absolutely inspirational village that is turning carbon negative by 2015 – **Llangattock** – and learned that it had six micro-hydro turbines, with a capacity of more than 100kW, creating lots of energy to help power the village as well as earning several tens of thousands of pounds for the local community. These units do require a water source however, such as CAT's reservoir 30m above the main site – something that is obviously not available to most.

While at the Centre we were told about a number of reports produced by CAT and also another research centre based in Machynlleth: the Public Interest Research Centre (PIRC):

The Offshore Valuation[12], a report coordinated by PIRC, in conjunction with, amongst others, DECC and the Crown Estate, shows the massive potential for UK to produce and even export renewable energy at a large scale. See the **offshore wind** section for more information.

The **Zero Carbon Britain 2030**[13] report goes far beyond the UK's target of cutting carbon emissions by 80% by 2050 and aims to make Great Britain carbon-neutral by 2030.

Reflections:
I found the trip to the Centre for Alternative Technology really inspiring because they have been demonstrating for decades how it is possible to live sustainably in terms of energy(Helena Wright) – when to the majority of us this seems a fairly recently emerged issue. (Tom Youngman)

Case Study – British Gas Energy Academy, Wales Thursday 4th November
Michael, Claire, Elle, Tom, Kirsty

British Gas has helped fund an **'Energy Academy'** set up in the last year to provide **training** for employees, as well as independent contractors, on the latest in installing sustainable technology in the home. We think the Energy Academy is a brilliant social enterprise that will train up people in their community who will then be able to use these skills and work in their community too.

The Academy features demonstration housing units, specialising in 'hard to treat' homes, such as the old, traditional ones in rural Wales. There were several different houses showcasing various levels of work, and it really struck us how powerful this graphic portrayal was. To see this advanced technology and such superb facilities that are available to train people in their fitting really impressed us. **This is action happening now and happening in a way that everyone can understand and get involved with.**

As well as showcasing new gas boiler technologies, such as 'combined heat and power', 'fuel cell' and biomass, other renewable energy forms were on display. They were particularly emphatic about **heat pumps**, which draw heat from several metres into the earth and have the potential to heat whole homes. These technologies, in combination with new and retrofit thermal efficiency measures, could very soon revolutionise the way we heat our homes – with the right education, of course! The only disadvantage to these was the high initial cost and their larger scale than a conventional boiler.

We all found the Energy Academy to be a truly remarkable and pioneering place that is tackling social issues as well as finding exciting ways to develop renewable technology that will provide much cheaper electricity and energy to heat homes.

After the informative tour of the Energy Academy we visited the village of **Llangattock**.

British Gas has sponsored Llangattock to reduce the village's carbon emissions as part of the 'Green Streets' project.[14] Llangattock is in the Brecon Beacons National Park and is made up of about 400 homes, and is a vibrant community of about 1,000 people. We met with the inspirational community leader of the project and now CEO of the Community Interest Company "Llangattock Green Valleys", Michael Butterfield. Michael showed us the houses around the village where solar panels are being installed; he showed us the community allotment field where families are successfully growing their own vegetables; and he also showed us the site where there might be a community anaerobic digester that will power the community. All of these examples of micro-generation in practice showed us how villages and community groups are clubbing together to reduce their own carbon footprints and make the villages self-sufficient.

Llangattock has the ambition to turn carbon negative by 2015. This means that the village will not be relying on power generated outside of the village, but will be creating their electricity and bio-gas themselves. The solar panels and micro-hydro turbines will not only power the village, but will also provide green electricity for the National Grid. This extra electricity will generate money for the village through the Feed in Tariffs and fund community projects. Michael told us that it has not always been easy to encourage the other villagers to support the project, but the determination and dedication of the Green Valleys team really shone through and it was clear to us that this group was really leading the way in supporting themselves. We found Michael to be a true eco-warrior and loved his catch phrase: "We have an ambition to turn this village carbon negative by 2015. And guess what? We can."

Is micro-generation fair to the young generation?

Ninety-five point two percent (95.2%) of the people who responded to our survey on the fairness of energy felt that solar power is fair. Four point eight (4.8%) thought it was not so fair. No respondents thought it was unfair or a raw deal.

Conclusions: micro-generation producing clean energy and behaviour change

Micro-generation could supply a good proportion of Britain's electricity, especially if implemented in appropriate settings – but there is far more to them than just generation. The key advantage of micro-generation is its **visibility**. With a solar panel on their roof, people start to think about their energy consumption. They are a visual symbol for green, clean and free energy that could trigger radical behaviour change – essential if the UK energy supply is to rely on renewable sources.

We are interested in incentives and schemes that help individuals and communities invest in micro-generation commitment. We think that the FiT helps make the up front costs of (for example), solar panels a very solid investment. We are aware that there is criticism that FiT is neither efficient or progressive because it is not subsidising the technologies that make the most financial sense in the UK and it can be seen as inequitable, as the investment opportunity requires significant initial capital, therefore might only benefit the rich and contribute to the wealth gap. However, we would like to see more done so that community interest groups can form and share resources to find funding for, or contribute to up-front costs.

Recommendations – micro-generation

- Demand side energy reduction is possible and essential. The Government must continue with the Feed in Tariff scheme to develop micro-generation;
- In addition to the Feed in Tariff as it is currently, financing options for less wealthy families must be investigated. We recommend a commissioned report to find out how the FiT could be used to benefit the least wealthy members of society to ensure equity within the system;
- Some charities are now using the FiT to secure funding – the Government should facilitate the process of community led groups working together to develop micro-generation and benefit as a community from the FiT;
- The British **Green Streets** programme is an excellent example of a business supporting community led renewables projects. The Government should introduce a scheme to encourage business led 'social enterprise' support to other community projects;
- The DECC Calculator needs to include the recommendations from the Offshore Valuation about what is possible to achieve for offshore wind.

Connecting people to energy

NATIONAL GRID

The National Grid UK is responsible for the transportation of energy from different sources (such as Power stations; wind farms; gas fields) and delivering it to end users (e.g homes, schools and business). The current system is very 'one-way' where users take energy from the grid, rather than an integrated system of dynamic flow between user and grid. However, as you will read below, this dynamism of the grid is developing.

The grid was initially designed in 1926 to reduce electricity costs, and deliver this incredible creation to the general public. Since then, the grid has grown and come to be more reliable and efficient than ever before. Delivering these gas and electricity amenities, however, is not an exact or straightforward challenge. Energy demand is highly variable, changing from minute to minute, which requires extensive modelling and constant oversight in order to keep supply on par with demand, and to ensure your lights stay on.

The pylons and electricity wires of the Grid will be familiar to most people in the UK: the looming pylons connect us to power stations and deliver electricity to our homes. However, it is important to consider the impact that grid developments will have on the landscape and countryside. Dustin Benton, Energy Policy Adviser at CPRE, met with the Panel to talk to us about his work and told us we should also consider when upgrading the grid:

"CPRE protects the countryside for its intrinsic value. We must cut our carbon emissions, because these are the greatest long-term threat to the environment. But in so doing, we need to conserve the beauty, tranquillity, and special character of the land and landscapes which we have inherited – and hope to pass on to future generations."

Case study Visit – National Grid 18th October
Michael, Olivia, Aakash, John, Helena and Kirsty

With none of us really understanding what the National Grid does, we arrived at the Head Quarters with much anticipation, and everyone hoping (or was it just me?) that the control room looked like it was straight from the set of a James Bond film, writes Michael.

A couple of fascinating presentations helped us fathom an understanding of the complexities of both construction and maintenance of this complex and ageing beast, whilst ensuring the 99.4% reliability of the network was maintained

Once we'd got to grips with the back ground, it was off to the control room. At the front of the room, a TV screen large enough for even Bond's most evil villain, stood displaying the status of the national network. It showed the D/C connection to France in full operation, delivering electricity from the UK to the continent.

Key Facts[20]:

- Even though it was first developed in the 20s, most of the grid was built in the 1950s and 60s.
- When we visited the control room there was 4.3% wind energy showing on the screen (almost at its maximum).
- The National Grid's 'Gone Green' scenario estimates that the UK must generate 35% of its electricity from renewable energy by 2020, compared with about 5% today. They argue this would meet the UK's target of 15% of total energy from renewables by 202021
- When there is a sudden increase in demand, hydro pumped storage is the quickest to start up. Gas is the next quickest.

Squeezed into the lower section of the screen, there was a display of the current energy mix. The contribution of wind during our visit was 4.3% of national supply (almost at its maximum level). However, what this visit made clear is that without the ability to capture and store peaks of renewable supply, these intermittent yet abundant renewable energy sources will remain incompatible with the highly variable energy demand. To put it another way, when X-Factor finishes, and everyone makes a cup of tea, you can't say wind farms 'Go!' like you can with many of the fossil fuel technologies.

In the afternoon, our 'energy future' was discussed. The distribution role of the National Grid provides them with a unique stance free from a vested interest in a certain technology. As such, the vision and feasibility of a new 'SMART Grid' which allows a different approach to managing, and smoothing out variability of demand enabled a really visionary future to be imagined.

Panel reflections

Regardless of which energy landscape route is embarked on, significant changes to the existing grid scheme are inevitable, and as such will all encounter significant technological, environmental and economical challenges.

Currently, there is a significant North to South flow of energy (specifically electricity) in the UK. At the boundary of Scotland there is a 'pinch point' where the network needs upgrading to enable increased supply to flow to the rest of the country: providing Scotland with secure revenue and England and Wales with secure renewable energy. As ambitious renewable targets are pursued in Scotland, having the capability to transport the electricity will become paramount. Also, in order to accept more renewable energy connections over the whole grid, the substations require upgrading from the 'mesh' substations that were built in the sixties to the new 'double bus-bar' substations.

With wind farms in particular, we learned there is a notable 'chicken and egg' problem where a wind farm will not be built unless there is a good grid connection, but equally, no grid construction will go ahead unless there is existing infrastructure for it to service. In order for this to be overcome, Government should support the upgrading of the National Grid to create a logical and efficient grid system which supports emerging technologies, whilst delivering maximum efficiency to the end user. When building offshore wind farms, it will be more efficient to bring the energy on-shore in grouped cables, rather than in a fragmented and disjointed way. Here government support will be crucial to ensure that a cohesive approach to bringing offshore electricity onshore and transported around the country.

SMART Grid

With a changing electricity generation landscape, the construction of a SMART Grid (a system which is 'intelligent' in its use and delivery of electricity) could fundamentally shift the Grid's capabilities. A SMART grid, would work in conjunction with Smart appliances, such as new electric car fleets and SMART meters in the homes. Electric cars would store energy in periods of abundant renewable electricity production, and feed this energy back to the SMART Grid when demand becomes high. The SMART Grid can play a crucial role in the two-way relationship between energy user and the Grid.

Technical issues which surround 'new', renewable forms of energy production are clear, but are in no way insurmountable. Increasing the UK's connectivity to the Continent presents exciting opportunities for different approaches to both capturing, and utilising natural resources. The construction of a European Super Grid, although not without its hurdles, presents exciting interconnectivity potential, and increased energy security for the continent as a whole. The creation of the **Supergrid** requires the coordination of many different parties due to the different regulatory regimes in each country, and the UK could play a lead role in this.

Is the development of a SMART grid fair?

89.6% of participants in our fairness survey thought developing a SMART grid was fair. 10.4% thought it was not so fair. Nobody thought it was unfair or a raw deal.

Conclusions: developing a dynamic relationship and a SMART grid

Technical issues which surround 'new', renewable forms of energy production are clear, but are in no way insurmountable. Increasing the UK's connectivity to the Continent presents exciting opportunities for different approaches to both capturing, and utilising natural resources. Current market forces have helped deliver low cost electricity to the general public. These established mechanisms have the potential to further incentivise production from renewable sources. This would either require changing the primary legislation in the Energy Act, or depend on effective, or depend on a responsible carbon price.

Recommendations – National Grid

- The Government should facilitate a more joined-up approach to realising the most efficient delivery of new technologies, notably off-shore wind, to the main Grid system;
- The government should take a leading role in facilitating the pan-European SuperGrid, so the immense export potential of the UK wind resource can be maximised;
- The government must further support current work upgrading the Grid to allow localised electricity micro-generation to be delivered, and developing a SMART Grid, including Smart appliances and meters to ensure variability in demand and supply;
- At the boundary of Scotland there is a 'pinch point' where the grid network struggles, which needs upgrading.

Producing Energy from Renewables on a large scale

WIND POWER

Onshore-Wind:

Wind energy has been used for thousands of years, starting with the use of windmills for grinding corn. Being an island, the UK is an ideal location for small wind turbines as well as offshore wind.

Key Facts

- Wind turbines harness the power of the wind and use it to generate electricity;
- Onshore wind is cheaper than offshore wind, and large wind farms are generally cheaper than smaller wind turbines; so overall it has been found that onshore wind is the "cheapest zero carbon" source of electricity.[22]

Locations with wind speeds of over 4.5 metres per second are suitable for wind energy[23] but the path of the wind must be unobstructed by buildings or obstacles, so wind turbines are better suited to rural locations. In the UK it can be difficult to get planning permission for a wind turbine and it had been found that almost 70% of planning applications are refused.[24] This is because some people are concerned about the visual impact and noise from wind turbines.

At the Centre for Alternative Technology we learned about the benefits of onshore wind and as a Panel are very supportive of this renewable technology. We also learned on the tour that onshore wind is a much cheaper renewable than offshore wind as well as nuclear power, which means that it makes economic sense to invest in this technology.

Offshore wind

Being an island the UK has a huge offshore energy resource. Shallow waters, a long coastline and high winds make for a fantastic renewable base. Offshore wind turbines are touted as a saving grace in the UK's 2020 target to deliver 15% of energy from renewables and the Panel, in discussions about offshore wind, has been very excited to learn more about this clean, green and modern way of creating electricity.

Key Facts

- Wind is abundant but there are issues surrounding it because the wind is not always blowing. This is called 'intermittency';
- A major limiting factor is the UK's ability to manage up to 50% variable energy on the grid.[25] To truly realise the full potential of wind the UK will need to develop new ways to work with this electricity producing technology.

Panel discussions on wind power

We wanted to find out much more about offshore wind power and in particular how it could be used more effectively. To quote Michael Furey, one of the panel members: "at the national kettle-switch on moment during the X-Factor ad break you can't call up and say "go wind, go!' ".

This is linked to our investigation of the SMART grid and creating a two-way' system of electricity flow as well as developing **smart** electricity storage solutions. In our discussion with Professor David MacKay DECC's chief scientific advisor (a real whizz on sustainable energy) he explained that the electrification of cars coupled with a smart grid, would mean that the storage issue will be overcome by a diffuse network of batteries/capacitors and this will really allow us to harness the energy from the wind!

While at the Centre for Alternative Technology we were presented with an inspiring research piece on the UK's offshore capacity:

The Offshore valuation report which found that the UK's practical offshore energy resource, if developed to its maximum potential, **could generate electricity equivalent to 6 times current UK electricity consumption**.[26] So if we invested heavily in offshore capacity we could become a net energy exporter – selling our lovely renewable electricity to Europe!

The Valuation also shows that more than 340,000 jobs could be created by investing in the most ambitious scenario for offshore wind. The research pointed out that the cost of offshore wind would also come down if the parts were produced locally in the UK, developing the supply chain. This could effectively spur the manufacturing and steel industry in the UK. **This is particularly interesting for young people at a time when youth unemployment has hit a record high**: In May this year the Office for National Statistics announced that there are around 900,000 16-24 year olds out of work.[27]

With the electrification of heat and transport (primarily cars) increasing, these technologies easily be switched on/off and so can be integrated with a SMART grid that can help control fluctuations in supply. This will greatly complement the development of the wind industry.

Guy Shrubsole of Public Interest Research Centre (PIRC), the independent think tank that coordinated the Offshore Valuation report, said to us:

"The Offshore Valuation shows that the UK has an abundant offshore renewable energy resource. Using just a third of it could by 2050 make us a net electricity exporter, generate the electricity equivalent of a billion barrels of oil, and create 145,000 new jobs."

Case study – Site Visit: Scroby Sands offshore wind farm – Friday September 2010
Visited by Michael, Unkha, Rose and Kirsty

Scroby Sands is situated off the coast of Great Yarmouth, in Norfolk, and is run and managed by **E.ON**. E.ON **generates** its own electricity and plays a big role in distribution to its customers. It is 'the world's largest investor-owned power and gas company' which means that the investors (shareholders) have a very big say in the way E.ON works.

Scroby Sands has 30 large wind turbines and generates up to 60MW of power (enough for about 30,000 homes). This wind farm was developed in 2004 and was one of the very first to be built in the UK! It is also very accessible because the wind turbines are clearly visible from the shoreline and there is an informative visitor centre on the beach that has upwards of about 35,000 visitors every year. This site is a tourist attraction, as well as being well visited by locals, which is testament to its acceptance in the area.

After having a few of us come back from CAT with exciting news about exporting offshore wind we were excited to quiz E.ON about the report and learn about E.ON's plans to further develop the offshore wind in the UK.

We were very kindly greeted at the train station by two of people from the E.ON renewables team who took us to the Scroby Sands HQ. Security badges were issued and tea and coffee distributed before the presentations began. There was a good mix of Youth Panel members, E.ON Renewables staff, including a student who is interning there for six months, and the researcher of the local MP.

We heard presentations from different members of staff in the E.ON renewables team and learned about the challenges as well as opportunities related to developing offshore wind technologies.

We learned that prior to construction detailed and lengthy site assessments must be completed, such as Environmental Impact Assessments (EIAs) and also cost assessments. We were told that the cost assessment is a significant deciding factor and will determine whether or not a project goes ahead. This is because as an investor-owned company E.ON has a duty to ensure that investments will create profit for shareholders. Since offshore wind is still a relatively young industry (compared to other power plants run by E.ON) there is less certainty about the rate of financial return. This makes shareholders and the Board of Directors nervous and less likely to take risks with investor's money.

Once consent is granted to build the offshore wind farm, the construction phase begins. This is a process that runs to a strict budget. This is a 'key factor' for Board and investor confidence in the project and Scroby Sands, being one of the first, was keenly watched.

The process is very weather dependent because the engineers have to travel out on a boat to work on the turbines and if there were gale force winds or rolling waves then it would have been a nightmare to try and do any work!

Connecting to the grid was also a big issue and part of the final construction phase was digging up the beach (in the winter time) to lay down powerful electricity cables. These are run into a substation on the mainland where the electricity is connected to the National Grid.

Scroby was developed on time and is a great icon for the East of England. There are operational challenges to be overcome but these are done by fancy computers in the main onshore work centre, and engineers only travel to the actual turbines if it is urgent.

Reflections from Rose: "We learned that there really are massive risk factors involved with this technology, and a deliriously long process to complete. It seems that at the moment there is a lot of uncertainty around the Regulations being set by the Government, and the financial incentives and subsidies that are offered for these green technologies."

Keys Facts from Scroby Sands Tour

- Scroby Sands financial model: ~£1.3m per MW (2004)
- Scroby Sands has 30 wind turbines
- 30 Offshore wind turbines powers 40,000 houses
- 1 windmill per 500 people
- 48KWh = 3 times current electricity demand.

Is offshore wind fair?

Offshore wind was regarded as fair by 92.3% of the people responding to our survey – third most popular form of energy after solar and wave power. 6.3% thought it was not so fair, 1.1% unfair and 0.4% a raw deal.

Conclusions

E.ON described the 'Offshore Valuation' as blue-sky thinking and constantly talked about the financial risks associated with developing offshore wind. For businesses many aspects of the Valuation made sense in theory, but that the cost of these is seen as such a limiting factor that it seems 'unrealistic.' Companies such as E.ON seem reluctant to further invest in the floating wind turbines that the Offshore Valuation proposes.

It seems that the intention of the E.ON renewables team is good. Certainly the people we met with are determined and dedicated to the offshore wind industry. We noticed, however, that it is the Board of Directors and the shareholders of companies such as E.ON that ultimately decides if they really are going to put their money where their mouth is and invest in green, cleaner technologies. We ask them to take notice of the overwhelming support for offshore wind power among young people and to continue taking a 'progressive risk' when choosing to invest in the offshore industry.

Recommendations – offshore wind

- To facilitate the development of electricity connections between the UK and Denmark. This will allow the UK to export electricity from the offshore wind developments, as well as receive electricity from other countries in Europe if the UK needs more;
- To finance and facilitate the development of the 'floating turbine' technology that is proposed in the offshore wind valuation;
- To establish and set the Regulations for the offshore wind industry to give certainty and clarity in the rules surrounding the development of the technology;
- Try to lower costs of offshore wind development – by directing innovation support – so mitigate the risk that deters investors;
- To commit to making the UK the leader in offshore wind by 2020. this will safeguard electricity supply to the UK and also provide needed income to the country that has relied on oil and gas reserves which are now massively depleting.

BIO ENERGY

The panel took the opportunity to explore how renewable energy such as biofuels, biomass and biogas can produce energy – both heat and electricity – on different scales. These types of renewable energy technologies are in addition to the renewable technology looked at in the Micro-generation section.

Key Facts

A biofuel is a fuel source that comes from organic matter such as plants. The fuel is either a waste product from farming or it is grown specifically to be burned as a fuel.

Types of biofuel include:

- virgin wood fibre e.g. chipped round-wood and recycled wood chips;
- ''1st generation biocrops' that can be residues from processing cereals (wheat, barley and maize) and oilseeds (rapeseed and sunflower);
- '2nd generation biocrops', like miscanthus grasses and palm oil that are grown specifically to be burned rather than as food crops.

Case study – Bristol City Council planning meeting: 8th September 2010
Unkha and Kirsty

Bristol, being a City on the River Severn, has an old dockyard site called **Avonmouth Docks** and on that site the Council has granted planning permission for the development of a Biofuels Plant, or more specifically 'construction of Biomass fuel store and biomass fired electricity generating plant'.[28]

After a long bus ride into Bristol I met Kirsty at the Bristol City Town Hall for the Planning Committee meeting about a biofuels plant. The agenda item about the biofuels plant was on the specific planning policies regarding a recently approved biofuels plant (being constructed by Helius Energy Plc). The Bristol Planning Committee was meeting to discuss a 'variation of consent', which related to the amount of fuel being transported to the biofuels plant by road.

This was an opportunity for us to see how decisions about large-scale power developments are discussed at the local council level and gave us an insight into the way that really important decisions being made about energy developments are being made. **The Planning Officer** to the Bristol Planning Committee recommended that the consent be given to the developer, with some conditions attached to it, and ultimately the committee approved this 'variation of consent'. We then had the opportunity to speak with a planning officer and learn more about how decisions made at the local level can have a serious and significant impact at the international level.

The butterfly effect of biofuels

Earlier this year a biofuels plant had been refused planning permission by the Bristol Planning Committee. This was because the Committee decided that the plant, in importing palm oil, would have serious impacts on fragile habitats and ecosystems and these impacts would be contrary to the Council's Principle of incorporating 'Sustainable Development' into it's work. The issue of palm oil growth for biofuels could be seen as having something of a **'Butterfly Effect'**[29]. The committee took a **holistic** (or **'big picture'**) approach to it's decision-making and considered that if a biofuels plant in Bristol uses palm oil, this will almost directly be linked to the endangerment of the orang-utan in Indonesia. I thought this was a really fair approach to take and in weighing up the evidence the committee had considered the wide-reaching impacts that their decisions could have. I think it is important that all decision makers – at the local, national and international levels – take this big picture approach and consider the **butterfly effect** of their decisions.

Are biofuels fair?

26.3% of participants in our survey thought burning biofuels was fair. 39.3% thought it was not so fair, 21.5% unfair and 13% a raw deal.

Conclusions

In considering biofuels as part of the 'Energy Pathways' we have a responsibility to consider how fair this decision would be on our counter-part young generations in countries such as Indonesia. We would like to see an holistic approach to decisions about whether to use biofuels. As young people we require a world that is thriving in life and biodiversity. We require the natural services that ecosystems such as rainforests provide to continue up to 2050 and beyond. We know that trees in the rainforest play a vital role in sucking CO2 from the atmosphere and breathing oxygen out again. This keeps our air in balance and this is something that we require if young people and future generations are going to grow up in a healthy, clean and safe world.

Recommendations – biofuels

- To apply a holistic approach to decision making surrounding biofuels and ask "before I decide that a biofuel should be used I must first consider the butterfly effect of that decision";
- To not allow biofuel palm oil to be used as an energy crop;
- To not allow any biofuel crop to be grown where a (rain)forest has been cleared or agricultural land used;
- Biofuels will only form a small part of the energy mix if the biofuel comes from sustainable sources indigenous to the UK.

Biomass

Biomass is used on both small and large scales. On a small scale, it is being used to heat homes, for example in wood chip burners. On larger scales, power plants are being developed to generate electricity to feed into the National Grid. Coal fired power stations can also use biomass material to burn at the same time as coal and is being developed as a technology to make the coal burning process less dirty.

Key Facts

Types of biomass include:

- Wood based, i.e. trees, shrubs, etc;
- grass, straw;
- animal faeces/bedding & sewage, municipal waste (biodegradable organics), food wastes;
- Burning biomass materials produces much less CO2 than conventional fossil fuels.

Biomass in the City – Conference: Thursday 23rd September 2010
Daisy, Zach and Kirsty

The three of us were very keen to learn more about biomass, particularly because it is a part of the DECC 2050 Energy Pathways and there is a big debate surrounding the use and development of biomass as an energy source.

The Building Centre is an independent forum based in central London that is 'dedicated to providing information and inspiration to all sectors of the built environment.' It organises events and conferences where knowledge and research can be shared across the sector as well as conducting in-house research.

The Biomass in the City conference was on such event and for the afternoon we had the opportunity to hear from a range of experts in the field sharing their opinions and expertise on the matters arising from developing biomass as a fuel source. The presentations were very informative and we heard from a wide range of experts such as:

- the Renewable Energy Association (REA) presenting on biomass as a fuel source and the way it can contribute to emissions reduction targets;
- the Sylva Foundation, which focuses on forestry and sustainable forest management, sharing advice on how to source biomass from sustainable sources;
- Bioregional (see the BedZED case study) sharing from their experience of using biomass and Combined Heat and Power technology;
- Environment Protection UK presented on the issue of air quality especially in the city (to prevent SMOG and other pollutants);
- and the Centre for Renewable Energy Systems Technology.

Is Biomass fair?

Opinions are somewhat divided on whether burning biomass is a fair form of energy 33.7% of people who responded to our survey thought it was fair and 39.4% thought it was not so fair. 21.2% thought it was unfair and 5.7% a raw deal.

Conclusions: the importance of sustainable sourcing

The issue of sustainable sourcing of fuel and ensuring that farming land is not selected as a place to grow 'energy crops' rather than food is a critical issue in considering biomass' place in the energy mix.

Biomass technology is attractive because it can be developed on a small scale. The flexibility and viability of the fuel source will help with localising energy production and empowering families and offices to be in more control of their fuel source which will in turn encourage them to be more aware (and hopefully) conservative with their energy use.

We agreed that Biomass, and in particular wood-fuel, will play a key role in delivering renewable energy for the UK. However, we would only support it as a technology if the material is sourced in a sustainable way and does not come from old growth forests.

Recommendations – biomass

- To develop a sustainability certification process for biomass material;
- Forest Stewardship Council (FSC) should be the absolute minimum certification and the Government should not allow importing of non – FSC material for biomass;
- Biomass co-firing in coal power stations must not be an excuse to extend the life of coal power stations and allow unabated coal to be burned. The Government must introduce regulations to ensure that co-firing is used to reduce carbon emissions as coal is phased out.

Biogas

For many years **'biogas'** has been produced in anaerobic digesters – simply large containers in which manure and waste parts of crops are allowed to rot while starved of oxygen – to provide clean, inexpensive gas with which to cook and heat homes.

This is now being attempted for the first time on a larger scale in Great Britain. We therefore set out to research the possibilities of using biogas in the energy mix.

As well as around 40 existing units there are more than 60 proposals for digesters in the UK[31], such as that for a large, community owned, £7.2 million plant in **Llangattock, South Wales** (*see micro-generation section). This would produce **'bio-methane'** which is 'scrubbed' (refined) on site and then sold back into the national gas grid. Facilities like this are generally most appropriate in rural areas where there is wide availability of manure and waste plant matter, and it is not foreseeable that this could provide gas for the entire country – but it appears to be an effective solution where appropriate.

Key Facts

- Methane, the principle component of natural gas, is produced naturally by anaerobic digestion in cows and in decomposition of organic matter;
- This anaerobic digestion also occurs on landfill sites, where methane is produced when the rubbish decomposes. This is normally a problem, as methane is a potent greenhouse gas – about 20 times more potent that CO_2[30];
- There are now attempts to harness this as **landfill gas**;

Conclusions: reducing atmospheric pollution

The large impact methane has on the climate means that there is a huge benefit to the production of energy from **landfill gas** which is incentivised by the Environment Agency as a way of reducing harmful methane emissions. This has created strong uptake, although for similar reasons to biogas, there is much debate as to whether energy generated from landfill gas can be considered renewable at all. Whether it is or not, utilisation of landfill gas is undeniably important, as it reduces atmospheric pollution hugely, although all attempts should be made to alleviate the need for landfill entirely. Even on sites where utilisation of the gas occurs it is estimated that up to two-thirds of the methane still escapes into the atmosphere unchanged.[32]

Recommendations – biogas

- DEFRA should continue to help landfill sites install gas generation and use facilities, and the implementation of biogas production facilities using landfill waste should be investigated;
- Efforts to reduce the amount of waste going into landfill should be ensured to take precedent, however.


British Energy

Producing Energy in POWER Stations

COAL

Key Facts from the Drax Tour

- Coal-fired power stations generated 28% of energy between them in 2009, a significant proportion of the energy mix.
- Coal use has declined rapidly in the United Kingdom since the discovery of oil and gas in the North Sea, and the understanding that since coal emits carbon dioxide into the atmosphere it makes a significant contribution to climate change;
- Coal fired power stations tend to be around 30% – 38% efficient in turning the raw fuel into electricity (See case study).
- 'Carbon Capture and Storage technologies' (CCS) could allow much of the carbon emissions from a coal power station to be removed after creation, then stored underground for hundreds of years. The Government is funding demonstration plants to test if CCS works.

Case Study – Drax Coal-Fired Power Station, Doncaster 13th October 2010
Mairi, Zachary, Michael and Kirsty

Drax is an independent power station with a capacity of 4000MW – enough to supply six million homes. It claims to be 'the largest, cleanest and most efficient coal-fired power station in the UK'. It is twice as big as the second largest coal-fired power station in the UK. **Drax is the single largest source of CO^2 emissions in the UK**, but as it generates 7-8% of the UK's required power the station **emits less carbon per unit of energy generated than most coal fired power plants**.

Drax puts much effort into improving efficiency and is upgrading their turbines so as to keep coal-fired electricity economically competitive. Drax currently has six turbines and they hope to have twenty-four turbines in the near future at a cost of £100 million, reducing its carbon emissions by 5%.

We learned that Drax power station is approximately 38% efficient. This means that 62% of the energy from the coal is lost in the process of creating electricity – this is lost through heat being wasted and sent up the cooling towers (it is actually steam coming out of the iconic big chimneys!).

Effort is also being put into using **biomass**, either co-fired with coal or on its own, at Drax. Currently various waste plant matter, such as straw, is co-fired with coal to produce 12.5% of Drax's output. The primary aim of this diversification (or variety of fuels sources) has been to attract future shareholders and investment, especially with increasing environmental concerns and associated negative press with coal. We were informed that the supply chain of this biomass is fully documented and follows Forestry Stewardship Council (FSC) regulations, in order to receive its renewable energy subsidies.

Reflections: Mairi McInnes

"Growing up as a kid in the UK and many parts of the Western world where you were constantly reminded 'if you are bad Santa will bring you coal' was not the best platform for a budding relationship to inspire a generation to argue its corner in the energy mix of our future. However I gave it the benefit of the doubt, wrapped up, caught a train to Doncaster to understand the ins and outs of coal at Drax Power Station, Selby. I have to say as a young panel we were greeted with open arms and vegetarian sandwiches (on request)."

"The tour was put into context initially by meeting those that work at Drax. While the panel challenged the employees and board members with what some might deem controversial questions they seemed and stated they were very pleased such a young group was asking such challenging questions and thinking about their future."

"While the welcome committee and glossy literature was enough to make me scrap my initial stereotypes I still walked away from the plant feeling that although Drax was quick to demonstrate it's work in the community and young apprenticeship schemes, that ultimately every decision was largely profit led. Although it is taking the right baby steps to introduce sustainable biomass conversions and co-firing projects it needs the pressure of DECC to implement these steps ethically and while coal remains the black diamond nothing is going to change fast."

Is the use of coal to produce energy fair?

Only 2.2% of people who took part in our fairness survey thought that coal as a source of energy was fair. 14.8% thought it was not so fair, 38.4% not fair and 44.6% a raw deal. This view was also reflected in our first survey and the face-to-face workshop we held. Young people told us that because coal emits such vast quantities of CO2 that it is directly and negatively impacting on the atmosphere around us and creating pollution that is inappropriate in the modern era.

Conclusions: Coal is no longer the answer

Even today there are still significant risks associated with coal mining and it is a devastating tragedy whenever there is a mining accident. We have to ask if these mining risks, and risks associated with climate change, are worth the power that the coal plant creates? Ultimately, the Panel – and the wider consulted group – does not think that this is a very progressive risk. Rather, it would be a regressive risk to continue burning coal and engaging in the dangerous mining activities.

We recognise that carbon capture and storage technologies may offer some form of solution to the carbon emissions issue. However, it is very much a 'horizon technology' (i.e. a new idea) – and a working, commercial scale model has not been built. The Government is funding some CCS demonstration plants and if they are successful this technology should be made 'Open Source'. Where coal is co-fired with biomass or biomass used on its own, it is vastly important that the source of biomass comes from a sustainably managed forest or is not grown on land that could be used for agriculture (see Biomass section for more information).

Recommendations – coal

- To ensure that unabated coal fired power stations are **phased out** within the next decade;
- To invest in CCS technology to find out if CCS is viable within the next 2 years. If it is not technically feasible to be rolled out by 2015, then coal must be phased out as above;
- To make all CCS technology that is funded by Public money Open Source;
- To ensure that biomass co-firing will not be used as a green-wash to extend the lifetime of existing coal power stations;
- Burning coal is inefficient and co-firing will be a waste of the precious biomass materials. However, where it is used, stringent regulations must be enforced to ensure sources are sustainable;
- To develop a sustainability certification process for biomass material: Forest Stewardship Council (FSC) should be the absolute minimum certification and the Government should not allow importing of non – FSC material for biomass.

GAS

Gas is familiar to us because we have used it on a daily basis in cooking and central heating systems since the Victorian era. The real boom began at the discovery of the North Sea oilfields in the 1970s, bringing much wealth and energy security to Great Britain. These reserves are now diminishing, gas is gradually becoming harder to extract, and many fields are now becoming uneconomic to exploit.

Key Facts

- Natural gas constitutes 30.5% of Britain's total energy supply[33]
- Energy produced by natural gas is the least carbon intensive of that produced from a fossil fuel and it produces approximately 55% less carbon emissions per unit of energy generated than coal;
- Gas also burns more cleanly – producing less harmful gases such as sulphur dioxide, nitrous oxides and asthma-inducing particulates – but it is still a fossil fuel;
- 18% of Britain's energy is supplied as electricity – 45% of which is gas-powered. (*pie chart)
- The burning of gas, as a whole, accounts for an estimated 208.8 million tonnes of carbon emissions per year in the United Kingdom[34];
- The Department of Energy and Climate Change (DECC) estimates use of biogas from food and farm waste could supply 7% of the UK's renewable energy by 2020[35];
- British Gas, part of Centrica, is Britain's largest domestic energy supplier, holding 15.7 million customer accounts in gas and electricity at the end of 2009;

Case Study: British Gas 4th November 2010
Claire, Michael, Elle, Tom and Kirsty

We visited various **British Gas facilities** to learn more about the role of Gas in the energy mix, as well as to see other projects that British Gas is supporting. (see the **'British Gas Energy Academy'** case study).

We also visited Barry gas-fired Power Station, eight miles from Cardiff, a crucial resource for South East Wales, being the only non-coal station locally. We learned that Barry, like other gas-fired power stations, produces relatively low carbon emissions – 20 000 tonnes of carbon dioxide per month. The plant was built in the 1990s as an independent baseload power station (running at all times) but now runs only at peak hours during the day (between 11:00 and 19:00). Thirty-four people are employed at Barry Power Station and it is part of a Centrica fleet of eight gas-fired power stations of various sizes.

As at other power stations we visited, safety was given highest priority, and like Drax we were allowed in the main control room and permitted to watch as instructions came from the National Grid. The staff appeared happy and proud of their industry, and keen to talk about its future. Barry power station receives its gas from the National Grid, which includes renewable gas fuel. We asked why CCS technology was not being considered for gas power stations and was told that since a gas station emits much less carbon than a coal power station, it is not yet economically viable to develop CCS. Recently, however, DECC has opened the competition for £1 billion worth of funding for a carbon capture and storage demonstration unit to gas-fired power stations.

Is gas-fuelled energy fair?

Only 6.8% of participants in our fairness survey thought gas was a fair form of energy. 34.5% thought it was not so fair; 39.0% thought it was not fair and 19.7% felt it was a raw deal.

Conclusions: fairer than coal but not a fair option

If the option is available to invest fully in renewable, low carbon technologies, then looking to gas is not a fair option – but if it is as an alternative to coal, then it seems an obvious option. It emits less than half as much carbon dioxide per unit of energy generated as coal does and emits far fewer other emissions that cause public health concerns (see the British Gas Energy Academy case study).

Ultimately though, gas is still responsible for a huge amount of carbon emissions, and its use should be reduced over the next decades. Gas stations will no doubt remain long into the future to supply the peak demand that they can do so much more effectively than most other technologies, but ultimately diminishing gas supplies are likely to make electricity storage (such as pumped storage and smart charging and discharging of electric vehicles – and hydro-power far cheaper. We were told that it is expected that North Sea gas will be used up in less than 30 years time. Most of the Youth Panel will still be running their own homes by then and so we are especially interested in developing cleaner, renewable technologies to replace these diminishing supplies.

Recommendations – Gas

- Gas should be given priority over other fossil fuel forms of energy when looking at applications from new power stations;
- The use of Carbon Capture and Storage technology on gas-fired power stations be investigated fully, and if feasible be used as widely as possible;
- Gas-fuelled power stations be phased out in favour of renewable technologies;
- The development of a SMART grid and energy storage infrastructure to handle the peak load that gas is currently required to cover;
- Home insulation and thermal efficiency programs, education and subsidies be offered across the country to reduce the use of gas for heating in the home.

NUCLEAR

Public and political opinion on the role that nuclear energy should play in the future energy mix is divided, and this split was reflected both on the Youth Panel itself and among those young people surveyed in the compiling of this Report.

There are plans to extend the lifetime of current reactors and support building of an entirely new breed of nuclear power plants, which is likely to commit our generation to decades of nuclear power. It is therefore absolutely vital that we investigate nuclear power for ourselves and make sure young people are involved in this decision-making process.

Key Facts from Hinkley Point Tour

- Electricity generation from nuclear sources accounted for 18% of the UK's supply in 2009;
- Nuclear power is able to offer 'base-load' electricity to the National Grid, which means that the amount of power being produced is constant. For this reason, if the National Grid continues to function along the 'business as usual' lines, then nuclear power is a valuable resource;
- A number of our nuclear power stations are approaching the end of their lifetimes, leading to fears of an 'energy gap' by 2018.

Case Study – Hinkley Point
Visited by Aakash, Alice, Kirsty, Zach, Tom

Hinkley Point lies on the banks of the Severn Estuary in Somerset and is split into three separate sites: A, B and C. With each site at a different stage of the life-cycle of a nuclear plant, it afforded us a remarkable view of the past, present and future of the nuclear industry in the UK.

Hinkley Point employs mostly local staff, and meets regularly with local stakeholder groups. We were pleased to find that they have previously run a three-year apprenticeship scheme, and they are involved with the local Bridgwater College and the proposed 'Nuclear Academy' in Bridgwater.

Hinkley Point A

Hinkley Point A, came online in 1965 and was an operating nuclear power plant until 2000. Over its lifetime, it produced over 103 TWh of electricity – enough to power the UK for 100 days.

It is now being 'decommissioned' which means that it is being dismantled because it is no longer in use and because the nuclear waste needs to be cleaned up. This decommissioning is being done by a private company, answerable to the Nuclear Decommissioning Authority (NDA). This process involves making safe the dangerously radioactive materials produced during its lifetime to prevent contamination of surrounding areas. Low level waste, which accounts for the highest proportion of waste, is not very radioactive (about as much as a brazil nut) and can be safely disposed of on site. Intermediate and High level waste, which includes clothing, equipment and components of the reactor and spent (or used up) nuclear fuel is more highly radioactive and dangerous. This is either stored in concrete containers at Hinkley Point A (intermediate) or it is transported to a different site at Sellafield in Cumbria (high level).

We learned that the strategy for dealing with intermediate and high-level waste is subject to changes as management at the site changes, which can add confusion to the process. We also learned that the strategy for dealing with nuclear waste is not long term enough and since the waste will exist for a very long time, we think it is crucial that a plan of how to deal with the waste exists.

When the Panel met with the Energy Minister Charles Hendry one of the first things he told us was that half of his Department's (Energy and Climate Change) budget goes into decommissioning nuclear waste. We learned that the cost of decommissioning waste is a contentious issue and that the private company that ran site A did not leave money for the waste when the nuclear plant was nationalised and came under Government control.

Hinkley Point B

This site, run by EDF, represents the current generation of nuclear reactors in the UK. It has been producing 950 MW since 1976, which is the equivalent of powering one million homes. It is due to be decommissioned in 2021, by which point it will no longer be used to produce electricity. In contrast to the issues surrounding the decommissioning of Site A, EDF has said that money has been set aside for the post-2021 clean-up at Site B, which should hopefully provide a more robust source of funding for the decommissioning. This will also reduce the financial demands on tax-payers' money.

We were particularly interested by their safety practices, and were pleased to learn that safety information is shared well in the nuclear power industry, and the training of staff in safety procedures seemed rigorous. When walking around the turbine hall (which was so noisy!) we saw that the place was very clean and well-maintained. When in the viewing gallery of the reactor hall we saw some workmen changing the uranium rods.

Hinkley Point C

The UK hasn't built a new nuclear power plant since 1995, but Hinkley Point C is one of eight sites proposed by the government on which to build Britain's new generation of nuclear reactors.

The proposed plant will power five million homes and, if given the green light, should be coming online in 2018. However, we have doubts about how realistic this might be (see conclusions below)

Reflections from the Panellists

While we were very conscious that we were only receiving one side of the story, we mostly came away from the visit with a more balanced view of nuclear power. There is a lot to be said for having the chance to walk around the power station and see it in action. The decommissioning seemed well managed and safe, and we welcome the level of engagement with the local community, especially with the local youth. However, in visiting Hinkley Point, we became concerned about the lack of a long-term strategy for dealing with the UK's high-level waste, which will remain dangerously radioactive for thousands of years.

The government bears the cost of this – half of the Department of Energy and Climate Change's budget (see above). However, we were told by a staff member at Hinkley Point that most of this money goes to Sellafield, where the bulk of the UK's high-level nuclear waste is dealt with, and this can leave the work at Hinkley Point short of funds. We also noted that the decommissioning on site A has ran over time and it is not clear where the money to finish the job will come from. It felt strange to walk around site A, not for fear of our safety, but because there was an overwhelming sense that things were slowing down and the staff were waiting to have the funds to continue with the task at hand. It has taken 6 years so far to transport all high level waste to Sellafield and to deal with the intermediate level waste on site. However there is more to do because the main building on site B

needs to be rebuilt to house the Intermediate waste that will stay on site for a planned '100 years.' We were told on the tour that after 100 years, whoever is in charge of dealing with the waste will have the rather disconcerting task of then deciding what to do with it.

We remained in doubt about how quickly the new breed nuclear power stations can be built – equivalent plants being built in Finland are three years behind schedule and billions of Euros over-budget. It will last for more than 60 years and is designed to be more efficient and safer than any previous reactor design.

On the question of whether nuclear power should be included in the future energy mix, the Panel did not reach consensus. So we have offered two opposing views to encourage further debate and help readers to make up their own minds.

How fair is nuclear power?

Of all the types of energy generation, nuclear power is the one on which opinion is most divided. This divide was consistent across our surveys, at the face-to-face workshop and within the Panel itself.

19.8% of people taking part in the survey thought nuclear power was fair, 26.6% not so fair, 30.8% not fair and 22.8% a raw deal.

We found that a critical issue for everyone, regardless of their position on nuclear power, is whether or not the waste can be transported and disposed of safely.

Nuclear is necessary:

Any energy mix must add up. The scale of the carbon reductions that we must make by 2050 are necessarily daunting, and while it may be technically feasible to achieve this without nuclear, we believe the road to 2050 would be far more difficult as a result.

The technologies touted as alternatives are still very much in their infancy – offshore wind turbines and carbon capture and storage systems have yet to prove themselves on a large scale, while nuclear power stations have been reliably powering the grid for decades.

There is a strong case to suggest that nuclear power is the 'lower carbon' alternative to Coal and oil and in the face of serious and significant impacts of continuously increasing the amount of CO2 being spewed out in to the atmosphere then it is better to reduce the CO2 emissions now to stop any greater chances of CO2 induced climate change wreaking havoc across the globe.

When we met with Professor David MacKay he suggested that if we were to meet young people in the year 2100, surely they would be more happy with having to deal with a contained amount of radioactive waste than if we had continued developing coal and putting CO2 in the atmosphere. Surely these people of 2100 would be thankful that we had reduced CO2 to prevent worsening climate change across the globe.

We acknowledge that the nuclear waste is an issue, but we think that nuclear is necessary in a world facing severe impacts from climate change.

Choosing nuclear is morally irresponsible:

The arguments against nuclear no longer revolve around conspiracy theories and Chernobyl-style meltdowns – visiting Hinkley Point reassured us that the generation side of the nuclear industry is extremely safe. We acknowledge that there is still a significant risk and threat of unforeseen human error in the generation but the nuclear industry appears to have learned over the years about imposing strict safety measures at the plant.

Now there is a much greater moral argument against nuclear power: the management of waste that will remain dangerously radioactive for hundreds and thousands of years. Nuclear waste will require management for longer than any system of government has yet to exist. In fact, in most cases it will need to develop a clear and safe strategy to be overseen by an establishment that will need to exist for longer then the Roman Catholic Church. The question is: how can we ensure its safekeeping that long into the future?

Industrial accidents over the last 100 years have killed many thousands of workers after corporations have cut costs, so it is a concern that accidents could happen when the industry is dealing with the nuclear waste. Especially if it is not in a company's interest to put money into the decommissioning and management of waste, when there is little financial profit to be had from this.

We have learned that Nuclear power is only needed to supply baseload electrical capacity similarly to how it has been done for the past century: by a few, enormous, dispersed stations. This has worked under the 'business as usual' model of having a one-way system that takes electricity from power stations and feeds it into homes and offices. With the prospect of radically increasing the capacity to store electricity through 'pumped storage', storage of electricity inside electric vehicles and the smart grid allowing renewable technologies to be fully harnessed despite their fluctuating nature, the need for such a base load would be unnecessary. The replacement of nuclear is an exciting engineering challenge that Britain certainly has the wealth of talent to be able to tackle.

We are very concerned that short-term reasoning is being used to justify building a technology with substantial long-term impacts and responsibilities. The risks associated with nuclear cannot be ignored. Dangerous nuclear waste is a legacy we would rather not leave to future generations, and the heavy investment that will be required threatens to distract us from pursuing safer, cleaner and more future-friendly energy solutions.

Conclusions: At minimum a need for a long term strategy for dealing with high-level waste

Recommendations – nuclear

While opinion on nuclear power will remain divided, there are certain actions that we believe must be taken for the good of future generations in a world where nuclear power already exists:

- The government must develop a transparent and viable long-term strategy for dealing with our legacy of nuclear waste. This long-term strategy must forecast beyond the current Parliamentary term to at least a minimum of 150 years;
- The government must make sure that adequate funding for the decommissioning of current and any future nuclear power plants is assured in the long-term, and that this financial burden is not unfairly placed upon future generations;
- Any funding or governmental support for further nuclear power development must not detract from any funding or support for alternative, renewable forms of energy.

Conclusions

As you have read, the Panel has spent five months working hard to learn more about how energy is used and created to power our lifestyles, and how decisions made about energy affect our future. We have shared with you the story of our journey and written about the different thoughts and opinions we have had along the way.

In completing this project, the first of its kind for the UK Government, the Panel members have actively participated in working out for themselves what they think of energy issues in the UK. This has been an example of practically integrating intergenerational equity in government decision-making. In other words, the Youth Panel have brought the Youth voice to the Government decision-making table. You will have read our case studies and opinions, and hopefully you too will have thought more about how energy is a part of your life and your future.

Overall the message from the Panel is clear: **it is important to think about how energy is used before working out plans to create more of it**. This is why one of the key recommendations is that the Government supports measures to retrofit houses and offices to make them more energy efficient. It is also vital that the Government commits to keeping the promise about making new houses zero carbon by 2016 – to ensure that new builds are significantly more energy efficient than they are currently. The **Centre for Alternative Technology** in Wales and the **Zero Carbon Britain** report illustrate how important – and feasible – it is to reduce energy demand.

The Panel visited inspirational schemes such as the British Gas **Energy Academy** in Wales, where young people are trained up to install renewable technologies in homes – such as solar panels and solar hot water systems. Training up young people to be skilled in this area is absolutely imperative and will empower young people to safeguard the future. The Panel also visited the **Green Valleys** community scheme in Llangattock, where the village is working together to produce renewable energy that will reduce carbon emissions and earn them money through the Feed in Tariff scheme. Both of these examples show us that communities in Britain can work together to reduce carbon emissions and proactively produce energy in a sustainable and renewable way.

The crucial link between power stations and renewable power sources, and our homes, schools and offices, is the **National Grid**. The Grid **connects people to energy** across the country and has traditionally fed this energy in a one-way direction. When we have used energy in the past we have just taken it, without being able to give something back. The Panel is very excited about the potential for the **SMART grid** and developing smarter solutions to transporting energy from home back to the Grid. This will create a more two-way relationship that users have with their energy and could go a long way to making people more aware about the amount of energy they actually use.

Developing **electric cars** that could act as battery stores for electricity will go a huge way to supporting the SMART grid. These 'batteries' could then be used by the SMART grid to power places that need energy when the cars are parked. The Panel also encourages other low-carbon transport developments such as increased investment in **cycling** and **public transport**.

The UK has the potential and capacity to be a leading provider of **home-grown renewable energy**, especially in offshore wind. In developing the renewable sector and in continuing to support it financially and politically, the Government will contribute to building the safe, clean and green future that young and future generations require of them. It will also create jobs for young people across the country and provide security of supply.

The Panel is adamant that the Government must continue to fund renewable technologies and incentivise others to invest in such technologies. The Panel l earned about how investors are cautious to put money into projects that might pose a 'financial risk' and so the Government must lead the way in supporting this technology to illustrate the importance of taking this progressive risk. Other forms of bioenergy can play a part in the energy mix if – and only if – the biomass or biogas is sustainably managed and sourced.

The Panel was fortunate to visit **power stations** and see some of the technology that has powered the UK for many years, such as coal, gas and nuclear. We are all agreed that unabated coal does not have a future in the energy mix from now until 2050, because it is the biggest carbon emitter. The technology that is being developed to keep coal as an option (Carbon Capture and Storage, CCS) is very expensive and is not set to be complete for commercial use for many years. The Panel sees the reliance on this unproven technology as taking a significant regressive risk, because the money used to test CCS could be used on other projects, such as renewables.

In comparison to coal, **gas** is a much 'cleaner' fossil fuel, however it does still produce carbon emissions and so is less clean than renewable technology. We were also informed on the British Gas visit that Gas reserves are depleting and we learned that it is foreseeable that North Sea gas reserves run out within our lifetime. We think that whilst it is appropriate to keep the current gas powered stations open, it is not appropriate to divert money away from developing renewable technology and continue the life of gas power stations in full knowledge that gas reserves will soon be exhausted.

Nuclear was a very interesting and hotly debated topic. You will have read that the Panel, as well as participants surveyed, are split on whether to develop nuclear. On the one hand, nuclear may go some way to produce base-load power to feed our electricity appetite in a much more low carbon way than coal; however on the other hand the nuclear reaction produce highly radioactive and dangerous waste that will exist for thousands of years. Those who do not support nuclear power believe it is morally inappropriate to burden future generations with the waste, and to spend money on the expensive technology at the risk of decreasing funding in renewable technology.

Unique perspective

The Panel has approached the issue of energy from a unique angle. The Panel members are not interested in making decisions based on short-term business or political gains. Rather, the Panel has been true to the Guiding Principles, established in the first meeting, and made decisions based on the long-term impacts that these decisions would have.

The Panel has also worked hard to tackle the issue of fairness throughout the project – looking at how fair a decision is in the context of intergenerational equity and whether or not a decision would lock young and future generations into ecological debt.

Ultimately the Panel recognises that in developing a clean, safe and low carbon energy sector there will be risks taken. And we accept that. However we have made a distinction between two types of risks that we think is important to make. We think risks should be judged based on whether they are progressive or regressive. This means that if decisions need to be made about which industry to fund or develop we urge decision makers to consider if the risk would have positive or negative impacts on the future.

Perhaps there might be a financial risk to be considered. Perhaps there might be risks that a new technology will not work. Perhaps there is a risk that a new, safe and low-carbon technology is more expensive than an old fashioned, polluting and harmful technology. Perhaps there is a risk that the legacy of the decision-maker will be forever tainted by their not having had the courage to do what is morally appropriate in the face of strong lobbying from other groups. Or perhaps a decision maker will go down in history as the one who knew that they had a moral responsibility to safeguard the rights of young and future generations, and they showed real leadership in taking a risk that would ultimately protect the interests of generations to come. When making decisions that present financial and investor risks, we urge decision-makers to consider whether or not they are risking our future. We implore decision-makers to protect the interest of young and future generations.

What do you think?

A call to action:

Planning the energy mix is planning for the future. As young people, we are the future. And that is why we have written this report. Not just to say what we think. But to start a debate.

You might be a policy maker or influencer. We want to influence you, to consider us. This report contains practical information and recommendations that could be implemented. We want to debate those with you.

You might be a young person. We want to engage with you and hear what you think. You might already know lots. You might not know much about energy at all. Read the report. Debate with us about your thoughts for the future energy mix of the UK and let us know what you think!

You can:

- If you have any comments or questions about the report please send an email to the Youth Panel: youthpanel@think2050.org
- Join the debate about energy by reading this report and the talking about energy in your school, university, work place and home;
- Write to your MP and ask them if they are thinking of young people when making decisions. Find out who your MP is at: http://www.theyworkforyou.com;
- You could ask to do a carbon audit of your school or University and suggest energy reduction measures;
- if you live near someone from the youth panel, contact us (look at the website to see who lives near you!) and email us: youthpanel@think2050.org;
- Go on to the DECC website and try your own calculator: http://2050-calculator-tool.decc.gov.uk/pathways/1/primary_energy_chart;
- Watch out in February 2011 for the DECC online computer game that will help you work out how you want energy to develop in this country;
- You can also follow the blog online http://youthpanel.blogspot.com;
- There is a competition open until March 2011: 'Your World. Your Vision. Your Future.' After reading this report you might have some ideas about what you want your future to look like so go to: http://sacilloyd.com/competition-info

Energy: how fair is it anyway? Tell us what you think!

Appendix A: DECC Youth Advisory Panel Guiding Principles

As the meeting on the 5th July 2010, when the Youth Advisory Panel was convened for the first time after the Pilot session, the following Guiding Principles were establish:

- To always consider and apply the Principles of Inter-generational equity (equity between the different generations) as well as intra-generational equity (equity within the Youth generation) when asking questions, forming opinions and making decisions;
- To always consider and pay respect to the rights of Future Generations;
- To understand the principle of 'ecological debt' and how energy issues will impact on this;
- To make decisions that do not entrench young and future generations in ecological debt;
- To consider how energy infrastructure will contribute to clean, safe and sustainable jobs for young people and the training, apprenticeships and education that will be associated with this;
- To apply an understanding of economics to the analysis, within the context of the above;
- To have an overarching consideration for 'sustainability' and to set the Youth Panel definition of sustainability, including an understanding of social justice, environment and economics.

Appendix B: Decc 2050 Pathways Calculator

DECC has a policy team that works hard to establish the 'Energy Pathways to 2050.' To enable them to do this they have developed an online tool called the 'Decc 2050 Pathyways Calculator'. This is a gadget that allows people to work out what their own preferred energy pathway would be and it is something that the Youth Panel has worked on throughout the project.

When we first learned about the Calculator, we did find it a bit confusing to work with, especially because we were very new to the issues of energy. However, we found over time that it became much more easy to work the calculator and build on the knowledge we learned from the visits to inform our own energy pathways. We decided that, for illustrative purposes, the Panel would develop three pathways to show people how the calculator works in practice. We decided that we would develop a scenario without nuclear, one with, and another that tries to push past the 80% by 2050 reduction. They are outlined below.

It is important to note that the calculator itself has helped us develop our understanding of what will be required in terms of energy supply and demand, and it has been a useful tool in applying out thinking in practice. The Panel looks forward to the online game that will be launched in the Spring in 2011, called the 'Serious Game.' This game will provide a more interactive and graphically fun method of working out energy pathways and the Panel encourages others to use both the online calculator tool and the Serious Game to better understand energy issues.

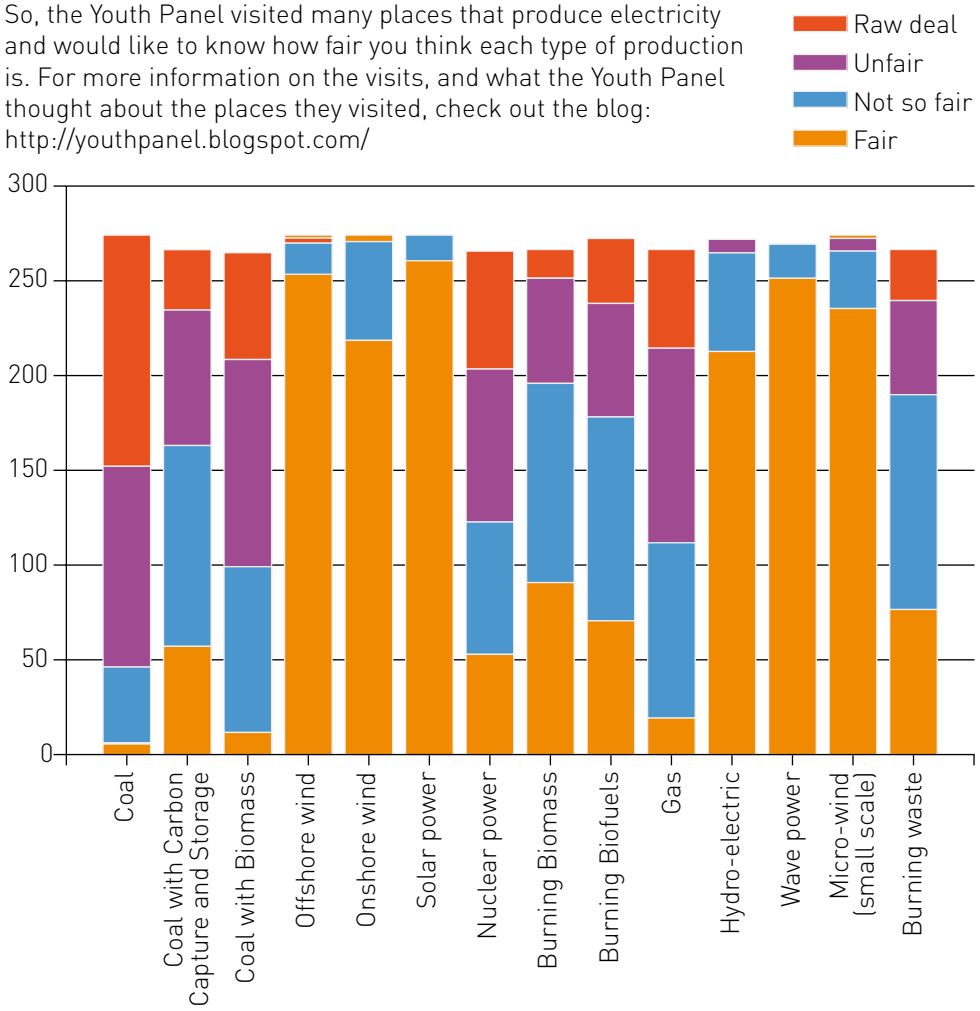
The first image is of the Youth Panel '2050 pathway' using nuclear power. In order to reduce carbon emissions to the required 80% by 2050, even when using nuclear power, there is still a need to work hard at reducing demand. This illustrates a pathway that has installed lots of nuclear and coal, but does not prioritise the installation of other renewables. This is something that the Panel is concerned about because there is a real possibility that investing in nuclear and CCS could divert money away from renewables. The first scenario shows what would happen if that was the case:

The second scenario show the 2050 pathway without developing nuclear or Coal and CCS technology. There is still a similar amount of work done to reduce the demand side of things, which is shown in the right hand column. There is also a lot of effort put into offshore wind, however the Panel believes that the level 4 of the energy calculator be amended to adopt the suggestion in the Offshore Valuation report that the UK has a greater capacity for offshore power.

Appendix C: Summary of Consultations

A SUMMARY of the survey shows that of all participants surveyed, 92% think that offshore wind is fair; 72% think onshore wind is fair; 95% think solar panels are fair; and 93% think wave power is fair. Only 2.2 % thought coal is fair, and 4.5% think coal with biomass is fair. Nuclear power is the most divided with 19.9% thinking it is fair, 30.5% thinking it is unfair and 23.3% thinking it is a raw deal.

So, the Youth Panel visited many places that produce electricity and would like to know how fair you think each type of production is. For more information on the visits, and what the Youth Panel thought about the places they visited, check out the blog: http://youthpanel.blogspot.com/



Appendix D: Youth Panel Carbon Audit

The Project Carbon Audit

In keeping with the aims of the project, the Panel thought it important to assess and monitor its own carbon footprint to account for the emissions produced in travelling to meetings, visits and appointments made over the course of our research.

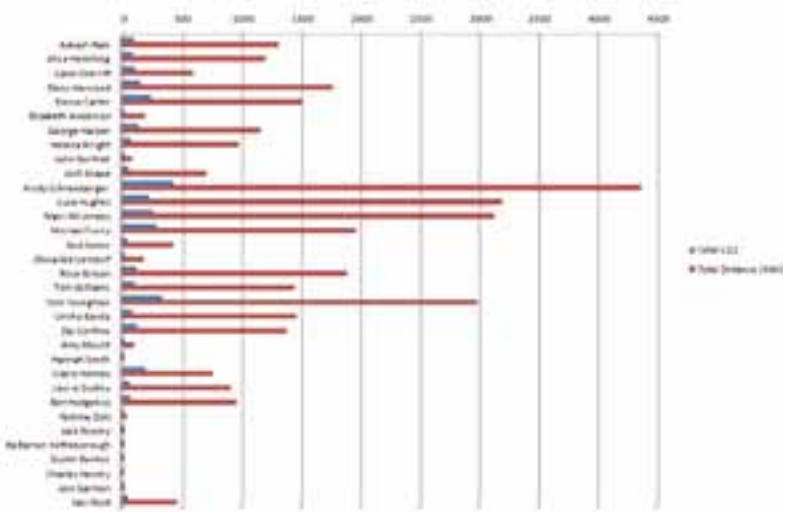
A huge thank you must go to Michael Furey for volunteering to do the full carbon audit. He has tirelessly asked people about their individual journeys, and worked hard at number crunching to achieve the final results. All the graphs and the following text are courtesy of Michael Furey.

For simplicity, the audit focused on direct emissions of different transport methods, which provided a clear insight to the environmental impact of the travel itself. During the project, the Panel covered over **35,080km**, which produced around **3.16 tonnes of CO_2** (which is the same amount of CO_2e produced for one economy passenger, taking a return flight from London to Hong Kong.

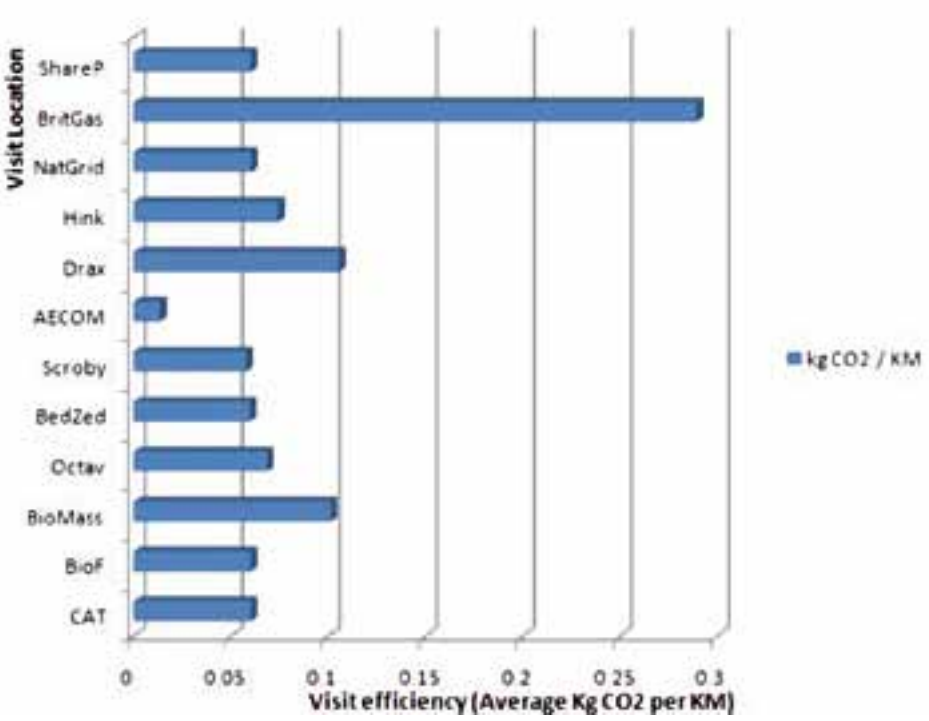
We thought it would be interesting to compare this carbon footprint with a football away game. So we worked out that if Spurs take 40 players and staff to play Inter Milan in Italy, assuming they travelled economy, the return flights (just for them alone, and not including the fans etc.) are equivalent to emitting 13.1 tonnes CO_2. This does not include the climate forcing of high altitude emissions.

The following graphs are included to provide a breakdown of each individual panellists travel, and the footprints associated with each visit. For a full breakdown of the Audits findings (including an outline of the methodology, figures and references used), log on to www.DECC.gov.uk/YAP_Carbon_Audit.

Carbon Audit – Panellist Distance & CO_2



Carbon Audit – Visit CO_2/KM efficiency



It is important to note that the British Gas visit has a significantly lower efficiency than the other trips, due to the substantial sub-journey undertaken by coach. Incidentally, this sub-journey was the longest of the whole project as we visited 3 projects within the south Wales area.

Most visits, despite variable distances travelled appear to have similar efficiencies. This is due to the dominant use of public transport (specifically train).

The BioMass visit is worth an additional mention, as this clearly illustrates the impact of single occupant car journeys. Although the car journey accounts for less than 10% of the journey length it significantly reduces the carbon efficiency opf the whole visit.

Carbon Audit – Travel Comparison

Panellist	Travel during Project		CO_2e Emissions produced are approximately equal to...		
	Kg of CO2	KM travelled	Kg's of Cheese*	Pairs of Trainers**	Powering a desktop computer for ...***
Josh Snape	47.9	702.6	9	59	1 day, 19 hrs
Kirsty Schneeberger	410.9	4363.9	75	364	15 days 17 hrs
Mairi McInnes	243.3	3128.6	44	261	9 days, 7 hrs
Nick Seton	22.9	423.3	4	35	21 hrs
Tom Youngman	328.0	2987.2	60	249	12 days, 15 hrs
Unkha Banda	74.1	1460.3	13	122	2 days, 19 hrs

In this Table, the sources Bernerst Lee M (2010) 'How bad are bananas?', and MacKay D (2010) 'Sustainable Energy – without the hot air' have been used to enable a basic appreciation for the emissions produced during the travel phase of the Project visits. Such comparisons are used only to promote discussion and provide some scale to our activities. For this reason, the comparisons made are ONLY ROUGH ESTIMATES. For more accessible, thorough and detailed discussion on carbon footprints, please see the sources cited.

*Production of 1kg of cheese = roughly 5.5kg CO2e (taken from Bernerst Lee M (2010) 'How bad are bananas?')

**Production of trainers = roughly 12kg CO2e (taken from Bernerst Lee M (2010) 'How bad are bananas?')

***Normal Desktop = 2kWh per day (taken from MacKay D (2010) 'Sustainable Energy – without the hot air – at average grid CO2 factor – http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm

The above chart is a comparison of a variety of panel members. As coordinator of the project, Kirsty Schneeberger went on every single visit and made it to all the meetings. She travelled a whopping 4,363.9 Km for the project, which gives an indication of the scale of the Youth Panel project!

Panel Members

Aakash Naik	National Union of Students
Alice Hemming	People & Planet
Amy Mount	UKYCC Sheffield
Ben Hodgekiss	Scouts
Claire Holmes	Welsh Youth Forum for Sustainable Development
Daisy Haywood	UNICEF and National Trust
Eleanor Carter	BTCV London
Elizabeth Anderson	UKYCC London
George Harper	CPRE
Hannah Smith	UKYCC
Helena Wright	Young Friends of the Earth
Ita Barton Kettleborough	BTCV
Jack Rowley	British Youth Council London
John Northall	Global Action Plan
Josh Snape	British Youth Council
Kirsty Schneeberger	Co-ordinator
Laurie Dudley	Oxfam Youth Board
Luke Hughes	UNICEF
Mairi McInnes	Friends of the Earth Scotland
Michael Furey	Defra Intern
Nic Seton	WWF London
Nishma Doti	People & Planet
Olivia Wessendorf	UK Youth Parliament
Rose Wilson	Plan UK
Tom Williams	Scouts
Tom Youngman	Green Flag Schools
Unkha Banda	Oxfam Youth Board
Zac Confino	Energy Savings Trust

Places


Mairi
Luke
Laurie
George
Ben
Ita
Tom
Amy
Claire
Michael
Daisy
Josh
Nishma
Alice
Unkha
Eleanor
Nick
Hannah
Jack
Elizabeth
Zac
Olivia
John
Helena
Tom
Kirsty
Rose
Aakash

Endnotes

1 Energy mix: There are many types of energy. The 'energy mix' is the different types of energy the country decides to use. They are like ingredients in a cake – will it be tasty or toxic?

2 The Panel has created two different '2050 pathways' on the tool, based on the research conducted for this report. You can see the Panel pathways at Appendix B. Also see the DECC website to find out more about the 2050 Pathways Calculator: http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/2050/2050.aspx

3 See appendix A for the full list of Guiding Principles that the Panel established at the beginning of this project

4 David JC MacKay (2008) "The balance sheet" *Sustainable energy – without the hot air* UIT Cambridge, England p. 24

5 For more information about the Octavia Housing PassivHaus see the website: http://www.octaviahousing.org.uk/about-us/news/view.php?Id=343

6 See the Octavia Housing website: http://www.greenoctavia.org.uk/

7 Myra Butterworth (12 November 2010) 'Energy customers face higher bills from next month' *The Telegraph*, UK, see: http://www.telegraph.co.uk/finance/personalfinance/8128563/Energycustomers-face-higher-bills-from-next-month.html

8 Martin Kemp and Josie Wexler (Eds) (2010) *Zero Carbon Britain 2030*, Centre for Alternative Technology, Wales, UK. See http://zerocarbonbritain.com/

9 Digest of UK Energy Statistics (2010) 'Renewable sources of energy' *Chapter 7*, see: http://www.decc.gov.uk/assets/decc/Statistics/publications/dukes/313-dukes-2010-ch7.pdf

10 Digest of UK Energy Statistics (2010) 'Renewable sources of energy' *Chapter 7*, see: http://www.decc.gov.uk/assets/decc/Statistics/publications/dukes/313-dukes-2010-ch7.pdf

11 Energy Savings Trust (2010) 'Wind Turbines' *Generate your own energy*, see: http://www.energysavingtrust.org.uk/Generate-your-own-energy/Wind-Turbines

12 The Offshore Valuation Group (2010) *A valuation of the UK's offshore renewable energy resource*, Public Interest Research Centre p. 14, see: http://www.offshorevaluation.org/

13 Martin Kemp and Josie Wexler (Eds) (2010) *Zero Carbon Britain 2030*, Centre for Alternative Technology, Wales, UK. See http://zerocarbonbritain.com/

14 See the Llangattock Green Valleys website for more detail: http://llangattockgreenvalleys.org/

15 2001 UK census, c.f. David JC MacKay (2008) *Sustainable energy – without the hot air*, p29

16 David JC MacKay (2009) *Sustainable energy – without the hot air*, p29

17 DECC 2050 Pathways Analysis, see: http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/2050/2050.aspx

18 International Maritime Organisation (2009) *Control of Greenhouse Gas emissions from ships engaged in International trade*, Report of the fifth session of the Conference of the Parties, Copenhagen, Denmark, see: http://www5.imo.org/SharePoint/blastDataOnly.asp/data_id=27012/ExecutiveSummary-CMP5_1.pdf

19 International Maritime Organisation (2009) *Control of Greenhouse Gas emissions from ships engaged in International trade*, see: http://www5.imo.org/SharePoint/blastDataOnly.asp/data_id=27012/ExecutiveSummary-CMP5_1.pdf

20 The Key Facts were taken from the tour and the presentations at the Grid

21 See the National Grid 'gone green scenario': http://www.nationalgrid.com/NR/rdonlyres/554D4B87-75E2-4AC7-B2226B40836249B5/32656/ScenarioNarrative.Pdf

22 See the case study in the Microgeneration and the visit to the Centre for Alternative Technology, where we learned about small-scale wind technology

23 See the RenewableUK briefing paper, at: http://www.bwea.com/ref/faq.html

24 RenewableUK (2 March 2007) *Decision makers must heed Stern warning on climate change*, news release, see: http://www.bwea.com/media/news/070302.html

25 The Offshore Valuation Group (2010) A *valuation of the UK's offshore renewable energy resource*, p. 14

26 The Offshore Valuation Group (2010) *A valuation of the UK's offshore renewable energy resource*, p. 14

27 Office for National Statistics cited at http://www.bbc.co.uk/news/10109965

28 See the Helius Planning Application here: http://www.bristol.gov.uk/committee/2009/wa/wa002/0513_6-1.pdf; see also the Helius Press Release here: http://www.heliusenergy.com/rns_viewer.php?id=3361695

29 There have been big campaigns to stop palm oil being used in products such as soap, shampoo and chocolate (like the Greenpeace campaign Kit Kat campaign http://www.greenpeace.org.uk/forests/faq-palm-oil-forests-and-climatechange). Palm oil is grown in plantations in countries such as Indonesia but in order to make way for biofuel crops the Indonesian rainforest has been chopped down to clear space. This affects animals such as the orang-utan and the local community who rely on the forest for vital resources. The rainforest also acts as a vital 'sink' of Carbon Dioxide, and this benefits the whole world.

30 David JC MacKay (2008) *Sustainable energy – without the hot air* UIT Cambridge, England

31 Department of Energy and Climate Change (6th July 2010) 'Anaerobic Digestion – Realising the potential' (press release) see: http://www.decc.gov.uk/en/content/cms/news/pn10_77/pn10_77.aspx

32 Environmental Protection Agency (2006) 'Solid Waste Management and Greenhouse Gases' *Landfilling Section*, EPA (US Govt.) see: http://epa.gov/climatechange/wycd/waste/SWMGHGreport.html

33 Digest of UK Energy Statistics (2010) 'Energy' *chapter 1*, p14, see: http://www.decc.gov.uk/assets/decc/Statistics/publications/dukes/307-dukes-2010-ch1.pdf

34 Office for National Statistics provisional estimates for carbon emissions in 2009, data table (via DECC) http://www.decc.gov.uk/en/content/cms/statistics/climate_change/data/data.aspx

35 Department of Energy and Climate Change (6th July 2010) 'Anaerobic Digestion – Realising the potential' (press release) see: http://www.decc.gov.uk/en/content/cms/news/pn10_77/pn10_77.aspx

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This report has been written and produced by
the DECC Youth Advisory Panel 2010, for further
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November 2010