

Public Conversations about Environmental Issues in Scotland:

Wind Farms

Participant Handbook

Introduction

This is your Participant Handbook. It contains information about the project and resources that you might find useful. It is yours to keep and use as much or as little as you like.

The first section of your handbook contains information about the research project and a copy of the consent form you have been asked to sign.

The second section provides background information around the topics we're looking at in the project. You might want to look at this information during the time between day 1 and 2 of this project.

We greatly appreciate your participation in this research project. We hope you find the handbook helpful. Please remember that you are welcome to ask questions of the organisers at any time.

The handbook has links to web pages you might find useful. Once you have given us an email address, we can send you the handbook with working links.

Contents

	Pg.
Part 1	
About the research project	
Jury timetable	2
Day one structure	2
Day two structure	2
Information about the research project	3
What is the research project?	3
Why is this research important?	3
What will happen on the two citizens' jury days?	3
How will what you say be recorded and stored?	4
When will the results be published?	4
What will you get out of taking part?	4
Who is funding the citizens' jury?	4
Who else is in the room?	5
Who are the researchers?	5
The Stewarding Board	6
Biographies: Facilitators and Organisers	8
Forms you have been asked to fill in	10
Consent Form	10
Contact Details Form	13
Questionnaires	13

Part 2	Further Reading and Resources	15
	Using this resource list	15
	What is energy?	15
	Sources of energy	16
	Scotland's energy use	17
	Electricity	19
	What is electricity?	19
	Electricity generation in Scotland	19
	Nuclear	19
	Coal and gas	20
	Renewables	20
	Scotland's current renewable electricity mix	20
	Further reading / resources	21
	The environmental impacts of electricity generation	23
	Fossil fuels	23
	Renewable electricity	23
	Further reading / resources	24
	Understanding climate change	25
	Causes of Climate Change	25
	How the Greenhouse Effect Works	26
	Potential Impacts	27
	Further reading / resources	27
	Scottish electricity policy	28
	Further reading / resources	28
	Understanding wind power	29
	Further reading / resources	29
	<i>General information</i>	29
	<i>Arguments for and against wind power</i>	30
	<i>The performance and economics of wind power</i>	30
	<i>Health and noise impacts</i>	30
	<i>Ownership models and community benefits</i>	31
	Glossary of terms	32
	Glossary of energy sources	33
	Research institutions	34

1. Jury Timetable

Jury Day 1 Structure

9.00	-	9.30	Registration and tea/coffee
9.30	-	10.30	Project intro & dialogue session
10.30	-	11.00	Questionnaire 1
11.00	-	11.30	Refreshment break
11.30	-	12.20	Witness Session 1: Context information [energy & environment] <i>1 witness, brief presentation, group Q&A</i>
12.20	-	1.20	Lunch
1.20	-	2.40	Witness Session 2: Renewable energy [onshore wind] <i>2 witnesses, brief presentation each, group Q&A</i>
2.40	-	3.10	Refreshment break
3.10	-	4.40	Witness Session 3: Onshore wind farms [differing perspectives] <i>2 witnesses, brief presentation each, group Q&A</i>
4.40	-	5.00	Questionnaire 2 and refreshment refill
5.00	-	5.15	Close

Jury Day 2 Structure

9.00	-	9.20	Registration [and tea/coffee]
9.20	-	9.40	Questionnaire 3
9.40	-	10.05	Reflective Group Conversation
10.05	-	10.50	Session 1: Identifying key areas for principles
10.50	-	11.15	Refreshment break
11.15	-	12.45	Session 2: Drafting proposals of principles
12.45	-	1.45	Lunch
1.45	-	3.00	Session 3: Agreeing principles statements
3.00	-	3.30	Refreshment break
3.30	-	4.30	Session 4: Principles into practice
4.30	-	5.00	Questionnaire 4 [and refreshment refill]
5.00	-	5.15	Reflection and close

2. Information about the research project

What is the research project?

This research project is looking at how people feel about environmental issues, and wind farms in particular, when they are given an opportunity to learn more about the topic and consider and discuss the issue as part of a group.

A group of 15-20 people will spend two Saturdays together listening to speakers before discussing, as a group, the following question:

“There are strong views on wind farms in Scotland, with some people being strongly opposed, others being strongly in favour and a range of opinions in between. What should be the key principles for deciding about wind farm development, and why?”

There are different ways in which conversations like this can be run. We are going to be using an approach known as a ‘citizens’ jury’. This works in a similar way to a court jury: You (‘the jurors’) have been selected to be representative of citizens in your area. In the course of the two-day jury, you will hear from a number of speakers (the ‘witnesses’). You will have the opportunity to discuss what you have heard, and then you will be asked to give a group verdict on the question in the box above. Note: There is no right or wrong ‘answer’, and there may well be a range of opinions in your group.

The jury’s verdict is for the research only and will not decide what happens to wind farms in the area or in other parts of Scotland.

What will happen on the two citizens’ jury days?

On the first day, you will hear from the expert ‘witnesses’. There will be an impartial speaker talking about different aspects of energy. You will also hear from speakers in favour of wind energy and wind farms and others who are against them. You will be able to ask questions and discuss the issue with the witnesses and the other jurors.

On the second day, you will work together with your fellow jurors to reach a group ‘verdict’ on the question. This should sum up the various opinions of the jury - so you do not need to produce a single ‘verdict’; areas of disagreement as well as agreement will be acknowledged.

The jury will be facilitated by two of the researchers. Their role is to help make the process impartial, interesting and enjoyable. They will make sure that everyone can have a say and that the conversations take place in a respectful and productive way.

Why is this research important?

There are strong views on wind farms in Scotland, with some people being opposed, others being in favour and a range of opinions in between. We believe it is important to involve citizens in discussing issues that affect them. This research enables a diverse group of people to discuss an issue with the help of evidence and arguments from both sides, presented in a calm atmosphere and with time to reflect on the issues raised.

Three locations in Scotland will have a jury, so the result is not just one particular community's view. The research will provide information about what aspects of wind farms are important to local people in Scotland. The research is also valuable in looking at how we can find new ways of involving citizens when making decisions about difficult issues that affect them.

How will what you say be recorded and stored?

At the start and end of each jury day you will be asked to complete a short questionnaire. The sound from the group discussions will be audio-recorded and there will be 2 researchers making notes throughout the days. All of this information – including the questionnaires – will be anonymous. This means that your name/identity will not be linked to your responses in the questionnaires nor to the views you express during the jury.

The questionnaires, audio recordings, and notes will be stored securely for four years following the end of the project. They will only be available to researchers involved in the project, for the purposes of analysis and reporting. After four years, the sound recordings will be destroyed and the anonymous questionnaires and notes from the juries will be made available so other researchers may use them. The purpose of this is to increase the impact of the project and your contributions.

When will the results be published?

The researchers will write a report from the three juries. There will be an event to launch the report, which you are very welcome to attend. The event is likely to be held in Edinburgh in early summer 2014 and invites will be sent to you closer to the time. The report will be published by the University of Edinburgh. We hope many groups, including local and national politicians, will find the report interesting and thought-provoking. Researchers will also use the research to write other academic papers.

What will you get out of taking part?

We hope you will find being part of the citizens' jury a rewarding experience and enjoy learning more about wind farms, taking part in the discussions, and getting to know your fellow jurors. We also hope that you will appreciate contributing towards this important debate in Scotland, and the fact that this research prioritises the views and feelings of citizens. We are very grateful to you for giving up two Saturdays to make this research possible. To say thank you for taking part you will be given £70 at the end of the first day and £100 at the end of the second day.

Who is funding the citizens' jury?

The juries are funded by the University of Edinburgh and Scotland's Centre of Expertise on Climate Change ('ClimateXChange' for short). ClimateXChange is a network of researchers in Scotland working to provide expertise on all sorts of issues relating to climate change. The Research Team acts independently from the project funders and is made up of researchers from four Scottish Universities (see below).

Who else is in the room?

Each day there will be approximately 15-20 jury members. There will also be several other people, including:

- **Two facilitators:** Wendy Faulkner and Oliver Escobar. Their role is to facilitate the interactions within the jury group. They will make sure the process is comfortable and effective, promoting participation and mutual understanding. The facilitators are independent and impartial, that is, they will not encourage any particular viewpoint in the conversations during the jury. They have designed the structure of the Jury process.
- **Two organisers:** Ragne Low (project manager) and Jen Roberts (research coordinator). Oliver Escobar (one of the facilitators) is also the independent Project Director, and so has overseen and contributed towards the project organisation. Ragne, Jen and Oliver will be present for both jury days. They may be joined by colleagues from ClimateXChange, Darcy Pimblett and Anne Marte Bergseng, who have also helped to organise this research project.
- **Two researchers:** There will be two researchers present at each jury. One researcher will be observing the witness presentations and the conversations. The other researcher will be evaluating the structure and process of the day.
- **The witnesses:** On the first day your jury will hear from five witnesses. They have been selected on the basis of their expertise and perspectives and are representatives from different organisations. The witnesses will talk on their topic with the jury for their allotted session. They are not obliged to stay for the rest of the day. There will be no witnesses on the second jury day.

Who are the researchers?

The research team involves researchers from four Universities across Scotland; University of Edinburgh, University of West of Scotland, Queen Margaret University and University of Strathclyde.

University of Edinburgh

Oliver Escobar
Dr Leslie Mabon
Dr Claire Haggett
Professor Andrew Thompson
Dr Mhairi Aitken
Dr Niccole Pamphilis



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University of the West of Scotland

Dr Stephen Elstub
Ruth Lightbody



Queen Margaret University

Dr Magda Pieczka



Queen Margaret University
EDINBURGH

University of Strathclyde

Dr Jen Roberts



University of
Strathclyde
Glasgow

The Stewarding Board

An independent Stewarding Board has overseen the research project. Stewarding Board members represent organisations with a range of opinions about wind farm development in Scotland. Its members include:

Director, Energy Saving Trust Scotland

Chief Executive, Royal Scottish Geographical Society

Press Officer, Scotland Against Spin

Chair, Scotland Against Spin

Director of Public Policy, Academy of Government, Edinburgh University

Chief Executive, Core Solutions

The Stewarding Board has provided helpful advice on key aspects of the project organisation. Overall responsibility for the project and research design has stayed with the Organisers and the Research Team.

3. Biographies of the Facilitators and Organisers

Oliver Escobar

Oliver Escobar is the Project Officer of the Public Policy Network (Academy of Government), and a Principal's Career Development PhD Scholar at the University of Edinburgh. His main areas of research are citizen participation, communication, and policy practice. Oliver has experience as a facilitator in a variety of community and policy contexts in Scotland and abroad. He is also a Public Engagement Fellow of Edinburgh Beltane, where he is involved in developing courses, forums, and activities in the areas of dialogue and public engagement. He is passionate about the power of collective conversation and the art of thinking together.



Oliver is the Project Director, and will be a facilitator, of the Citizens' Juries, ensuring that interactions between the jury are comfortable, effective and enjoyable.

Wendy Faulkner

Wendy Faulkner was an academic until 2009, researching and teaching social issues surrounding science and technology. A project of public engagement around stem cell research opened her eyes to the importance of nurturing 'dialogue' in efforts to increase participation in the challenging issues of our times. Working with Oliver Escobar through the Edinburgh Beltane network, she has developed training on this for researchers and professionals doing public engagement.



Wendy helped design these Citizens' Juries and will be joining Oliver as a facilitator throughout the Citizens' Juries sessions.

Jen Roberts

Jen is a researcher at the University of Strathclyde and her work is funded by ClimateXChange. Jen's research seeks to understand people's perceptions of social and environmental risk - from energy developments in particular. She has expertise in risk communication, previously researching perceived and 'real' risk from geological hazards to inform risk management.



Jen's role in the Citizens' Juries project is to co-ordinate the research, ensuring that the research questions are answered by robust data, and bringing the research findings together for the project report.

Ragne Low

Ragne is Knowledge Manager at ClimateXChange, Scotland's centre of expertise connecting climate change research and policy. Her role is to design and manage research projects that provide evidence on key low carbon and climate change issues. She works with those who develop and implement policy to make use of the best knowledge and insights from the academic community. Sometimes that is achieved through traditional research projects, and sometimes by other means, such as through facilitated conversations or partnership building. Ragne is currently managing a range of energy-related projects, including projects focused on public engagement.



Ragne's role in the Citizens' Juries project is to ensure that the results of the juries' discussions and the learning from the project are communicated to those who develop and manage energy policy across Scotland.

4. Forms that you have been asked to complete

Consent Form

You were asked to read and sign a statement of consent before you participated in this research project. You also signed a copy for your own records, which you may wish to keep.

Why do we need formal consent?

All research projects must obtain formal consent from participants. This means the researchers must tell the participants about the research project, make sure that the participants understand the purpose of being involved, and make sure that participants know they have the right to withdraw from the research at any time. Each person can then decide whether or not they do wish to take part in the project.

The Data Protection Act (1998)

All data will be collected and handled in accordance with the Data Protection Act (1998) and the University of Edinburgh's Data Protection policies.

The Data Protection Act sets out strict rules governing the use of personal information, and the main eight 'data protection principles' state that personal data must be:

1. Used fairly and lawfully
2. Used for limited, specifically stated purposes
3. Used in a way that is adequate, relevant and not excessive
4. Personal data is accurate
5. Kept for no longer than is absolutely necessary
6. Handled according to people's data protection rights
7. Kept safe and secure
8. Not transferred outside the UK without adequate protection

The consent form outlines how data collected and handled during this research project complies with the Data Protection Act (1998).

For more information about the University of Edinburgh data protection policies, see the University website:

<http://www.ed.ac.uk/schools-departments/records-management-section/data-protection/what-is-it/principles>

To view the Data Protection Act (1998) legislation, see the government website:

<http://www.legislation.gov.uk/ukpga/1998/29/contents>



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Research Project: Public Conversations about Environmental Issues in Scotland – Wind Farms

Consent form for participants

Dear Participant,

Thank you for agreeing to take part in this research project which is organised by the University of Edinburgh. This research project will look at group conversations about environmental issues and wind farms in particular. We will be using an approach called ‘citizens’ juries’ for this project. You can find all the important details about the research in the **Project Information Sheet**.

Before filling in the form overleaf, please read the following information and the Project Information Sheet carefully. Please ask questions about anything you do not understand.

You are provided with a copy of this consent form for your records.

To carry out this research we need your formal consent that you understand the purpose of being involved and that you agree to take part. We do not anticipate there to be any risks associated with your participation but you have the right to withdraw from the research at any time. All data will be collected and handled in accordance with the Data Protection Act (1998) and the University of Edinburgh’s Data Protection policies.

Statement of Consent

I understand the information above and by signing this form, I agree that:

- a) I understand that I do not have to take part in this research and I can leave at any time.*
- b) I have read the Project Information Sheet.*
- c) I agree to the questionnaire, observation notes and sound recordings being used as outlined in the information sheet*
- d) I understand that I will be paid £70 at the end of the first day and £100 at the end of the second day.*
- e) I have had an opportunity to ask any questions that I have before signing this form, and understand I should feel free to contact the researchers with any other questions regarding this research that I might have in the future.*
- f) I would like to participate in this study.*



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Your Name [BLOCK CAPITALS]: _____

Signature of Participant: _____ Date _____

Signature of Investigator: _____ Date _____

If you have any concerns regarding your rights as a participant in this study, you may contact the Chair of the Ethics Committee at the School of School of Social and Political Science, University of Edinburgh.

Ethics Committee Address: Ethics Committee Chair,
School of Social and Political Science
Research Office
The University of Edinburgh
Chrystal Macmillan Building, 15a George Square
Edinburgh, EH8 9LD

Email: ssps.research@ed.ac.uk

Contact Details Form

Why do we need your contact details?

On each jury day, we asked you to provide your contact information, including your postal address, telephone number and email. It would be really helpful if the University of Edinburgh were able to contact you for the following purposes:

- To make further information available to you before the second jury day.
- To potentially contact you for a short follow-up interview. This interview would be brief, and would take place within 9 months of the second jury day.
- To invite you to attend a University of Edinburgh event. Your invitation will be sent between April and June 2014.

The University of Edinburgh will keep these details confidential and they will be held in accordance with the Data Protection Act 1998. The University of Edinburgh delete these details after sending out your invitation to the launch event. We will only use them to contact you about this research project. We will not pass them on to any third party.

If you did not complete a contact information form on the first jury day and you wish to provide us with your details, please contact us (see pg. 14 for contact information).

Questionnaires

In each day of the Jury there will be two questionnaires, one at the beginning of the day and one at the end.

What is the purpose of the questionnaires?

The questionnaires aim to find out your perspectives on climate change and energy in Scotland, as well as some of your personal and political views and values. There will also be questions about your experience of the citizens' jury.

Your responses will help us to understand the range of perspectives in this Jury. There are no 'right' or 'wrong' answers, and it is important that you record your own opinion, rather than your impression of the group opinion.

Some of the questions will appear in every questionnaire. You do not have to remember your response to the previous surveys, for your answers and opinions may change throughout the jury process. Please simply answer honestly according to your feelings at the time of completing each questionnaire.

How will the information be used?

Your questionnaire responses are anonymous. We ask you to form an anonymous ID code, that we cannot link to you. The same code should be written on each of the four questionnaires you complete.

The anonymous collated answers to the questionnaires will be handled in accordance with the Data Protection Act (1998).

The opinions expressed in these questionnaires will be summarised in the project report, which will be publicly available in May 2014.

Who can you contact about this research project?

If you have any questions about the project you can contact us by phone or email:

Project Director:	Oliver Escobar	oliver.escobar@ed.ac.uk	tel: 07818 677204
Project Manager:	Ragne Low	ragne@sniffer.org.uk	tel:07717 586992
Research Coordinator:	Jen Roberts	jen.roberts@strath.ac.uk	tel: 0141 548 3177

Part 2: Further reading and resources

Using this resource list

During the first day of the jury process you have heard from witnesses with a range of knowledge and views on wind farms. This section of the Handbook is a resource list about the subject of wind farms. It has definitions of some common terms and gives you links to websites, articles and short films that have more information. We have made the list so that it is easier for you to find this kind of information. There are of course many more sources of information than we have listed here – we haven't space to list them all!

Please note that you do not have to do any further reading or look at any of these resources if you do not want to. There is no need to do any further reading to take part in the jury process. We are providing this resource list for your interest. You might also choose to look for your own sources of information – and that is of course fine too.

To help you use the information that follows, we have distinguished between text that the research team has written, which is in *blue italic* and text that we have taken straight from an information source (which is normal black text). *The blue italic* is our introduction to an issue or our explanation of a graph. All other, black text is quoted from the source text.

What is energy?

Energy is defined as the ability or the capacity to do work.

We use energy to do work and make all movements. When we eat, our bodies transform the food into energy to do work. When we run or walk or do some work, we 'burn' energy in our bodies. Cars, planes, boats and machinery also transform energy into work. Work means moving or lifting something, warming or lighting something.

Energy lights our cities, powers our vehicles and runs machinery in factories. It warms and cools our homes, cooks our food, plays our music, and gives us pictures on television¹.

¹ EduGreen, "What is Energy", available online at http://edugreen.teri.res.in/explore/n_renew/ener.htm, accessed 1 October 2013.

Sources of energy

The main sources of energy being used today can be divided into two categories; **renewable** and **non-renewable**.

Renewable energy comes from resources that can be replenished at a comparable rate to the rate of consumption. Energy sources like hydroelectric power, solar energy and wind power are considered “perpetual resources” because they run no risk of depletion (i.e. the planet won’t run out of water, sunshine and wind).

Non-renewable energy refers to energy sources like petrol, natural gas, coal, and nuclear energy that take millions of years to form and cannot be regenerated in a short time period².

The table below shows some of the various renewable and non-renewable energy sources.

Renewable Energy Sources	Non-renewable Energy Sources
<ul style="list-style-type: none">• Solar• Hydro (rivers and dams)• Wind• Biomass (wood or other organic material)• Geothermal (using heat from underground)• Hydrogen• Tidal and Wave	<ul style="list-style-type: none">• Petroleum (oil)• Liquefied gas• Natural Gas• Coal• Nuclear

Source: energy4me, 2013

² Energy4me “Energy Sources”, available online at <http://www.energy4me.org/energy-facts/energy-sources/>, accessed 1 October 2013.

Scotland's energy use

Scotland consumes about 150,000 Gigawatt hours (GWh) of energy per year. The figure below shows the proportion of energy used by different activities in Scotland each year since 2005.

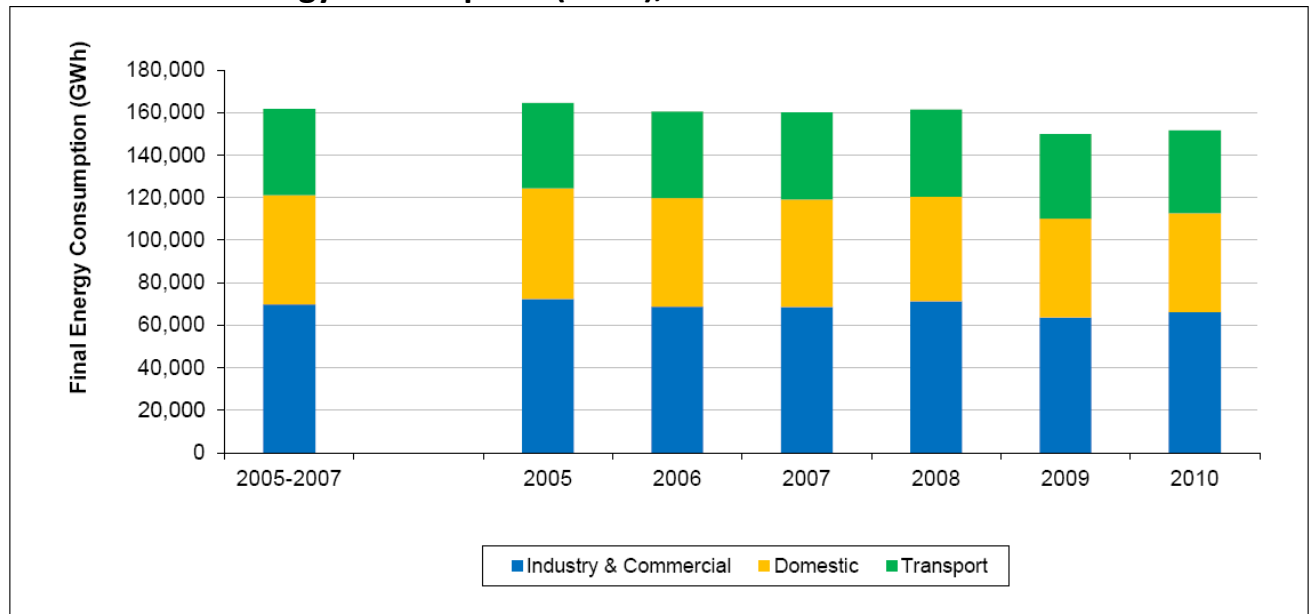
How is electricity measured?

Energy is commonly measured in **Joules**. One Joule is defined as the amount of energy required to raise the temperature of one kilogram of water by one degree Celsius.

A **Watt** is a measurement of power equal to one Joule per second. A **Watt hour** is a unit of energy equal to the power of one watt operating for one hour.

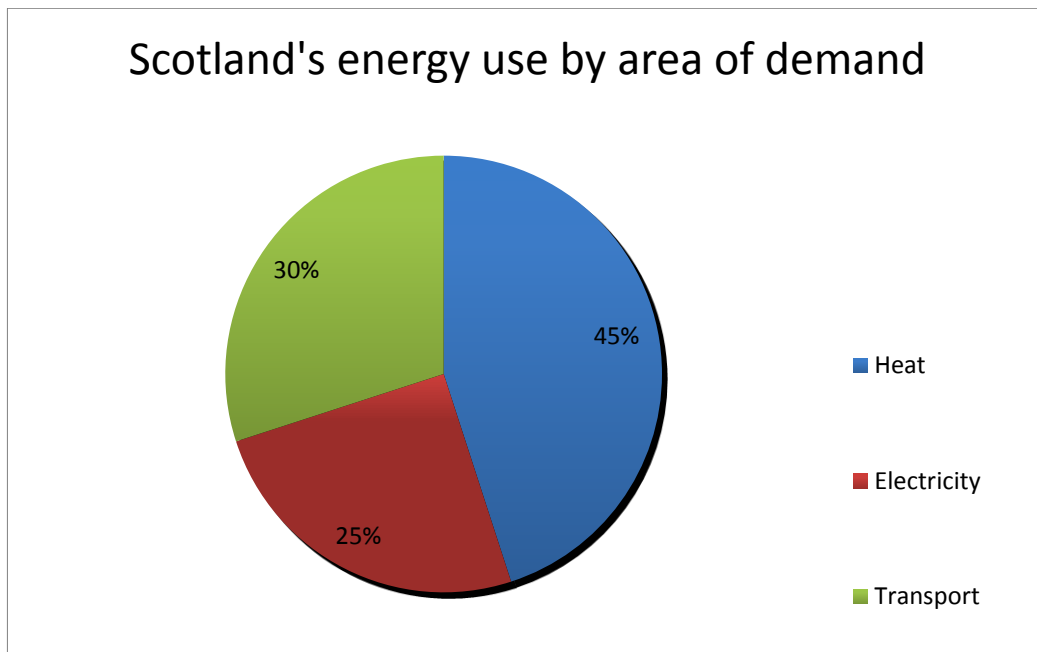
A **Kilowatt hour (KWh)** is equal to **one thousand Watt hours**. A **Gigawatt hour (GWh)** is equal to **one billion Watt hours**.

Final energy consumption (GWh), Scotland 2005-2010



Source: The Scottish Government, 2013

Scotland's energy consumption can be divided into three main areas of demand; **Heat Energy, Energy for Transport and Electricity**. The table below shows Scotland's energy use over each of these areas.



Source: Scottish Council for Development and Industry, 2013

Heat represents around 45% of energy use in Scotland. Electricity represents around 25% of energy use (with around 5% of this assumed to be for electric heating) and transport represents around 30%. Demand for electricity is growing most strongly. National Grid expects it will double by 2050³.

³ Scottish Council for Development and Industry, "Future Scotland – Energy", April 2013, available at http://www.scdi.org.uk/pi/2013/SCDIFutureScotlandApr13_Energy_web.pdf, accessed 1 October 2013.

Electricity

Wind power is used to generate electrical energy, commonly referred to as electricity. The rest of this information pack will focus on **electricity**.

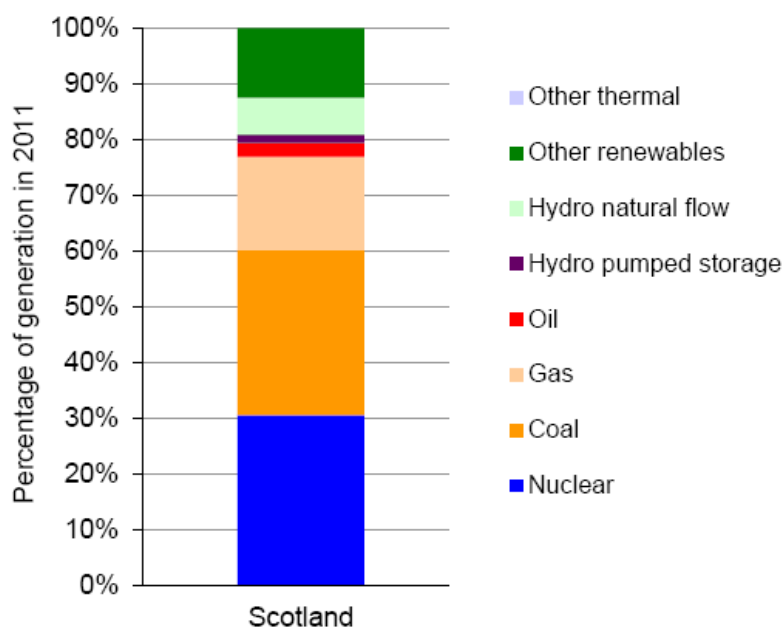
What is electricity?

Electricity results from the movement of an electrical charge. Naturally occurring electricity can be witnessed in the form of lightning during electrical storms. The ability of humans to generate, transmit and store electricity is crucial to modern industry, technology and, in most countries, domestic life⁴.

We use electricity to power things like fridges, washing machines and computers. A light bulb changes electrical energy into useful light energy and waste heat energy⁵.

Electricity generation in Scotland

Percentage of electricity generated by fuel source, Scotland 2011



Source: The Scottish Government, 2013

⁴ WiseGEEK, "What Is Electrical Energy", available online at <http://www.wisegeek.com/what-is-electrical-energy.htm>, accessed 1 October 2013.

⁵ The Children's University of Manchester, "Energy and the Environment", available online at <http://www.childrensuniversity.manchester.ac.uk/interactives/science/energy/what-is-energy/>, accessed 1 October 2013.

Nuclear

Two nuclear power stations currently operate in Scotland. These produce around **33% of Scotland's electricity**.

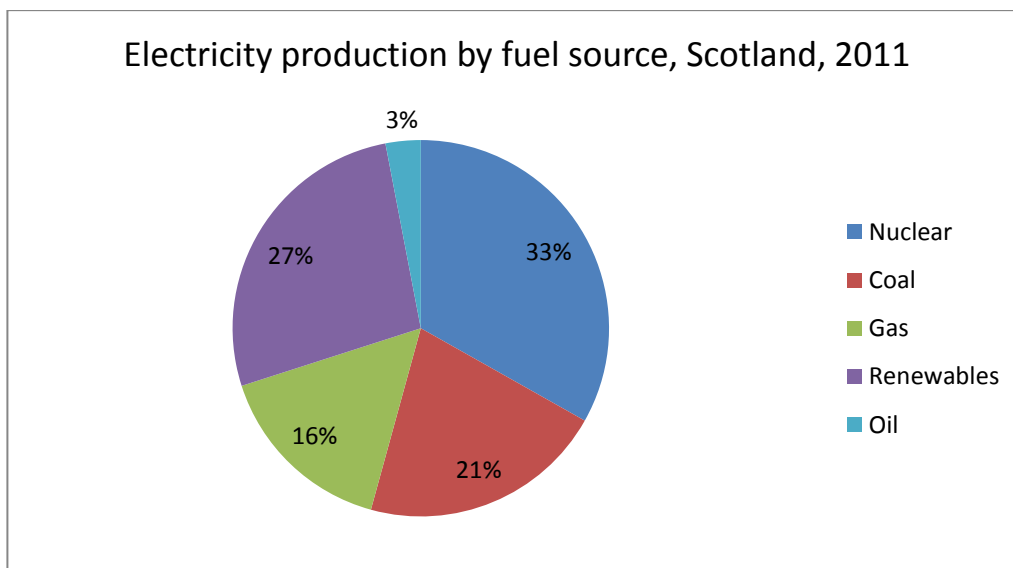
Coal and gas

Scotland currently has 2 coal-fired power stations and one gas-fired station. Together these produce about **37% of Scotland's electricity**⁶.

Renewables

*Scotland is increasing the proportion of electricity it produces from renewable sources. In 2011, Scotland produced **27% of its electricity from renewable sources**.*

The figure below shows the proportion of electricity produced by renewables compared to other sources in 2011.



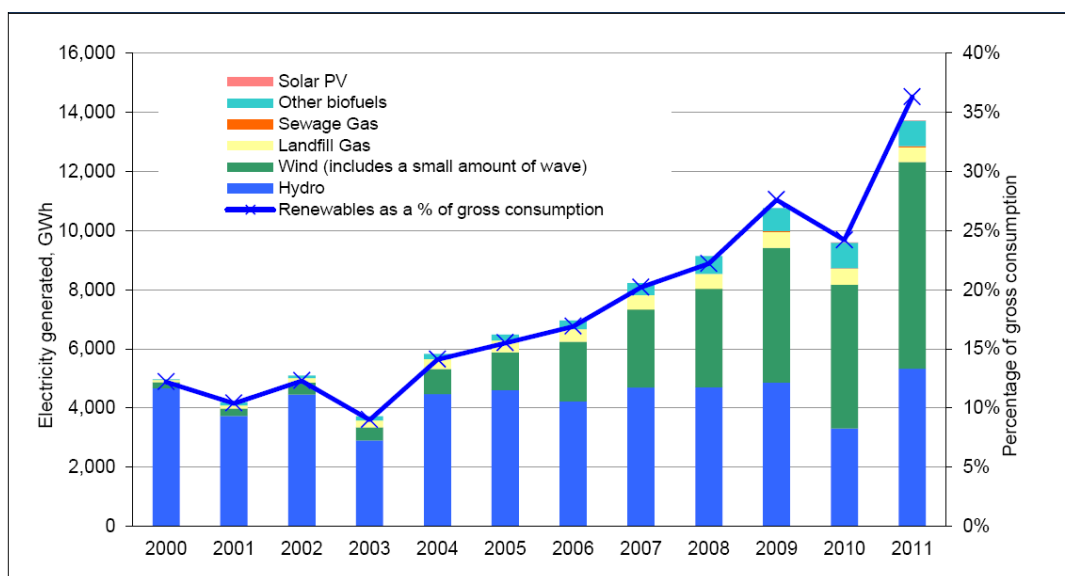
Source: *The Scottish Government 2013*

⁶The Scottish Government, "A Compendium of Scottish Energy Statistics and Information", January 2013, Available online at <http://www.scotland.gov.uk/Resource/0041/00415880.pdf>

Scotland's current renewable electricity mix

Renewable electricity generation in Scotland from 2000 to 2010 is shown in the figure below. The graph shows how the amount of energy generated from renewable sources, particularly wind, has been increasing each year. In 2010, wind generated more electricity than hydropower for the first time.

Electricity generated from renewables in Scotland by technology



Source: The Scottish Government, 2013

Further reading / resources:

- Information about different types of energy sources
<http://www.energy4me.org/order/download-energy4me-kit-materials/english/slideshare-energysourcespowerpoint/>
- An Open University introduction to energy
<http://www.open.edu/openlearn/science-maths-technology/science/environmental-science/energy-resources-introduction-energy-resources/content-section-0>
- An Open University introduction to sustainable energy
<http://www.open.edu/openlearn/science-maths-technology/science/environmental-science/why-sustainable-energy-matters/content-section-4.3.1>
- Information on fossil fuels
http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/supply_and_demand/revision/1/
- A UK Government fact sheet on energy security
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6

[2501/Factsheet19-Energy-Resources-Climate-Change.pdf](#)

- How does a power station work?
http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/generation_of_electricity/revision/1/
- Scottish Government's webpage on onshore wind power
<http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1>
- A short film showing different small-scale renewable technologies on an eco-house in Fife
<http://www.bbc.co.uk/learningzone/clips/renewable-energy-sources/474.html>

The environmental impacts of electricity generation

It is very beneficial for humans to be able to use electricity when they want to. However, generating electricity can also have negative effects on the environment.

Fossil Fuels

Fossil fuels are non-renewable energy resources. Their supply is limited and they will eventually run out. **Fossil fuels do not renew themselves, while energy sources such as wood, solar and wind can be renewed.**⁷

Fossil fuels **release carbon dioxide when they burn**, which adds to the greenhouse effect⁸. The environmental impact of climate change is one of the biggest threats to humanity.⁹

Climate change and the greenhouse effect are explained further in the next section.

Of the three fossil fuels (*coal, oil and gas*) coal produces the most carbon dioxide for each unit of electricity produced and natural gas produces the least.¹⁰

Coal and oil **release sulphur dioxide, nitrogen oxide** and other polluting chemicals **when they burn**. These gases can cause breathing problems for living creatures and contribute to **acid rain**.¹¹

The production, transportation and use of fossil fuels can also cause water pollution (such as oil spills) and land degradation.¹²

Renewable Electricity

Renewable electricity sources have less of a negative impact on the environment than fossil fuels because they generate less polluting gases, including greenhouse gases. However, no energy source is completely harmless to the environment and generating renewable

⁷ BBC GCSE Bitesize Science, "Generating Electricity", available online at http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/mainselectricityrev1.shtml, accessed 1 October 2013.

⁸ BBC GCSE Bitesize Science, "Generating Electricity", available online at http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/mainselectricityrev1.shtml, accessed 1 October 2013.

⁹ United Nations Office of the High Commissioner for Human Rights, "Human Rights and Climate Change", available online at: <http://www.ohchr.org/EN/Issues/HRAndClimateChange/Pages/HRClimatChangeIndex.aspx>, accessed 1 October 2013.

¹⁰ BBC GCSE Bitesize Science, "Generating Electricity", available online at http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/mainselectricityrev1.shtml, accessed 1 October 2013.

¹¹ BBC GCSE Bitesize Science, "Generating Electricity", available online at http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/mainselectricityrev1.shtml, accessed 1 October 2013.

¹² Union of Concerned Scientists, "The Hidden Cost of Fossil Fuels", available online at: http://www.ucsusa.org/clean_energy/our-energy-choices/coal-and-other-fossil-fuels/the-hidden-cost-of-fossil.html, accessed 1 October 2013.

electricity can often have negative impacts including **noise and visual impacts** as well as **habitat destruction** and **air pollutants**.¹³

Further reading / resources:

- The impacts of different electricity generation technologies:
http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-of.html
<http://www.energy4me.org/energy-facts/environmental-protection/environmental-impact-by-source/>

¹³ United Kingdom Environment Agency, “Renewable Energy and its Impact on the Environment”, available online at: <http://cdn.environment-agency.gov.uk/geho0305biwj-e-e.pdf>, accessed 1 October 2013.

Understanding climate change

There are many different definitions of climate change. Below are some of the most commonly used.

The Oxford Dictionary

Climate change is a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.¹⁴

United Nations Framework Convention on Climate Change

"Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.¹⁵

Intergovernmental Panel on Climate Change

Climate Change is defined as a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.¹⁶

Causes of Climate Change

*The Planet's climate has always changed through natural causes, however it is now considered **extremely likely** that human activities are contributing significantly to climate change.*¹⁷

*Human activities are influencing the planet's climate by adding to the **greenhouse effect**.*

¹⁴ Oxford Dictionary, "Definition of Climate Change in English", available online at:

<http://oxforddictionaries.com/definition/english/climate-change>, accessed 1 October 2013.

¹⁵ United Nations Framework Convention on Climate Change, "Term Definition: Climate Change", available online at:

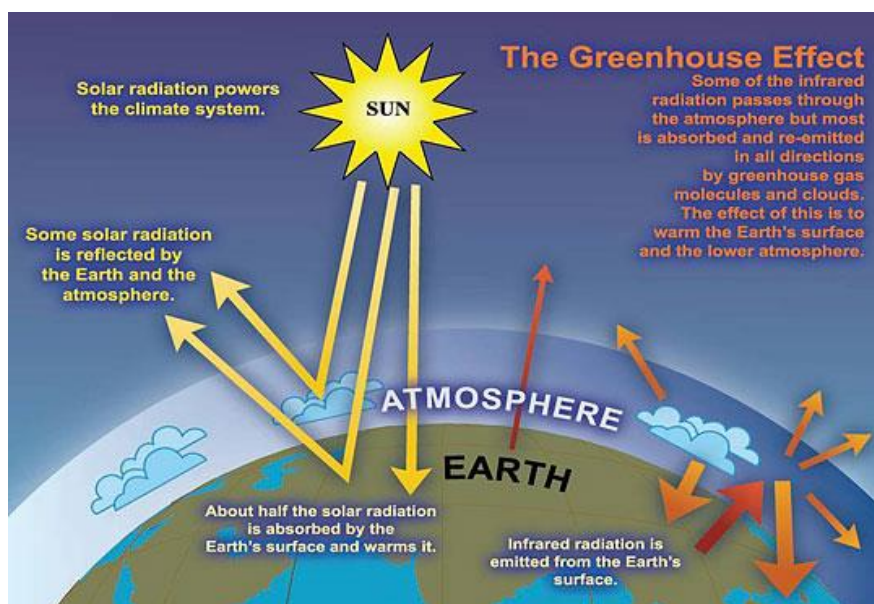
http://unfccc.int/files/documentation/text/html/list_search.php?what=&val=&valan=a&anf=0&id=10, accessed 1 October 2013.

¹⁶ Intergovernmental Panel on Climate Change, "Climate Change 2007: Synthesis Report", available online at: http://www.ipcc.ch/publications_and_data/ar4/syr/en/mains1.html, accessed 1 October 2013.

¹⁷ Intergovernmental Panel on Climate Change, "Climate Change 2013: Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis", available online at: http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_All.pdf, accessed 3 October 2013.

How the Greenhouse Effect works

The **greenhouse effect** is the natural process by which the atmosphere traps some of the Sun's energy, warming the Earth enough to support life. Most mainstream scientists believe a human-driven increase in "greenhouse gases" (such as carbon dioxide and methane) is increasing the effect artificially.¹⁸



Education Scotland, 2013

Human activities like burning fossil fuels add greenhouse gases to the atmosphere, while the destruction of forests limits the amount of greenhouse gases that are absorbed by trees and removed from the atmosphere.

As a result, greenhouse gases in the Earth's atmosphere have increased significantly since the beginning of the industrial revolution¹⁹. This is leading to increased global temperatures, which may increase by 1.8°C to 4°C by the end of this century if action is not taken to avoid climate change.²⁰

¹⁸ BBC News, "Guide to Climate Change – Greenhouse Effect", available online at: http://news.bbc.co.uk/1/shared/spl/hi/sci_nat/04/climate_change/html/greenhouse.stm, accessed 1 October 2013.

¹⁹ United Nations Framework Convention on Climate Change, "Feeling the Heat: Climate Science and the Basis of the Convention", available online at: https://unfccc.int/essential_background/the_science/items/6064.php, accessed 2 October 2013.

²⁰ Intergovernmental Panel on Climate Change, "Climate Change 2007: Synthesis Report", available online at: http://www.ipcc.ch/publications_and_data/ar4/syr/en/mains1.html, accessed 1 October 2013.

Potential Impacts

Increases in global temperatures are likely to have negative impacts such as:

- Increases in extreme weather events such as cyclones, heat waves, floods and droughts
- Rising sea levels
- Species extinction
- Reduced food security
- Increased spread of human diseases²¹

Given that carbon dioxide released through energy generation represents the majority of global greenhouse gas emissions, the fight against climate change has become a defining factor for energy policy-making.²²

Further reading / resources:

- A Met Office infographic explaining climate change
<http://www.metoffice.gov.uk/news/in-depth/climate-infographic>
- A short Met Office video explaining climate change
http://www.youtube.com/watch?feature=player_embedded&v=bjwmrg_ZVw
- An explanation of the science and evidence of climate change by the United Nations
<http://www.un.org/climatechange/the-science/>
- The consequences of climate change as explained by the United Nations
<http://www.un.org/climatechange/the-science/>
- An overview of climate change science and impacts by the United Nations Framework Convention on Climate Change
https://unfccc.int/essential_background/the_science/items/6064.php

²¹ United Nations Framework Convention on Climate Change, “Feeling the Heat: Climate Science and the Basis of the Convention”, available online at:

https://unfccc.int/essential_background/the_science/items/6064.php, accessed 2 October 2013.

²² International Energy Agency, “Climate Change”, available online at:
<http://www.iea.org/topics/climatechange/>, accessed 2 October 2013.

Scottish electricity policy

The Scottish Government set a target of delivering the equivalent of at least **50%** of gross electricity consumption from renewables by 2015 and **100% by 2020**. By 2020, the Scottish Government also aims for the country to be exporting as much energy as it consumes, generating twice as much electricity as Scotland needs - just over half of it from renewables, and just under half from other conventional sources.²³

In order to achieve these goals, Scotland will need to make changes to the way that it produces electricity.

The Scottish Government has outlined the energy mix that it thinks will be required to meet these targets in the [Electricity Generation Policy Statement](#).

Further reading / resources

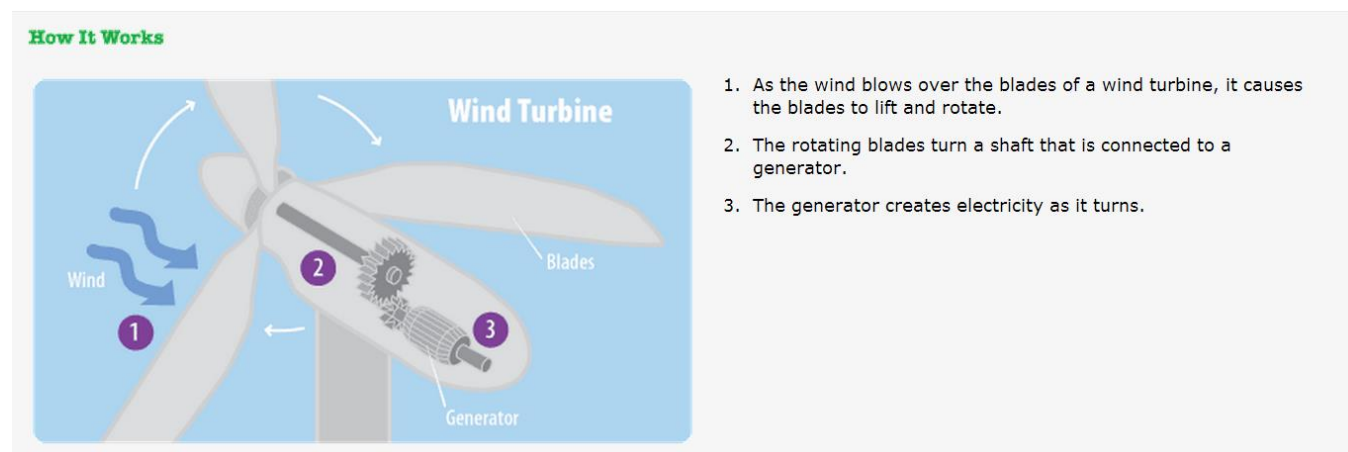
- The Scottish Government's Electricity Generation Policy Statement 2013
<http://www.scotland.gov.uk/Publications/2013/06/5757>
- The Scottish Government's Renewables Action Plan
<http://www.scotland.gov.uk/Resource/Doc/278424/0083663.pdf> and Routemap
<http://www.scotland.gov.uk/Resource/0040/00406958.pdf>
- Article on Scottish policy and progress on renewables from the Herald
<http://www.heraldscotland.com/news/environment/watchdog-casts-doubt-on-scots-renewables-policy.22133860>

²³ The Scottish Government, "2020 Routemap for Renewable Energy in Scotland", June 2011, available online at: <http://www.scotland.gov.uk/Publications/2011/08/04110353/0>, accessed on 2 October 2013.

Understanding wind power

Wind power can be used to generate electric power. This is done as the wind turns the blades of a wind turbine - converting kinetic wind energy into electricity.

Wind power generation can range from small single turbines to large-scale wind farms. Wind turbines can be situated on land or offshore.



Source: United States Environmental Protection Agency, 2013

Further reading / resources

General information

- A short film introducing wind power
<http://www.bbc.co.uk/learningzone/clips/generating-electricity-from-wind-power/6616.html>
- Short BBC films about wind farms
<http://www.bbc.co.uk/learningzone/clips/wind-farms-pt-1-3/1461.html>
<http://www.bbc.co.uk/learningzone/clips/wind-farms-pt-2-3/1462.html>
<http://www.bbc.co.uk/learningzone/clips/wind-farms-pt-3-3/1463.html>
- Scottish Government's webpage on onshore wind power
<http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1>
- Scottish Natural Heritage's 'wind farm maps' showing the location of larger wind farms in Scotland
<http://www.snh.gov.uk/planning-and-development/renewable-energy/research-data-and-trends/trendsandstats/windfarm-footprint-maps/>
- Scottish Natural Heritage's landscape guidance on wind farms
<http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/landscape-impacts-guidance/>

Arguments for and against wind power

- A Podcast on attitudes towards wind farms by the BBC
http://downloads.bbc.co.uk/podcasts/radio4/aitm/aitm_20130611-2132a.mp3
(start listening at the 7 minutes 45 seconds point).
- A briefing paper on onshore wind by Scottish Renewables
http://www.scottishrenewables.com/media/uploads/publications/sr_onshore_wind_briefing_040613.pdf
- The Mountaineering Council of Scotland, Manifesto on Onshore Wind Farms
<http://www.mcofs.org.uk/lps.asp>
- A wind power 'mythbuster' by WWF
<http://earthhour.wwf.org.uk/renewable-energy/busting-the-wind-power-myths>
- Ramblers Scotland Submission to the Economy, Energy and Tourism Committee Inquiry into the Scottish Government's Renewable Energy Targets
<http://www.ramblers.org.uk/~media/Files/Scotland%20microsite/SP%20inquiry%20Feb12%20renewables%20inquiry.pdf>
- A podcast on wind power from Imperial College
<http://www.imperial.ac.uk/imedia/content/view/2264/the-truth-about-wind-power>

The performance and economics of wind power

- A report on the case for and against onshore wind energy in the UK by the Grantham Institute and the Centre for Climate Change Economics and Policy
<http://www.lse.ac.uk/GranthamInstitute/publications/Policy/docs/PB-onshore-wind-energy-UK.pdf>
- An analysis of the costs of wind power from the Global Warming Policy Foundation
<http://www.thegwpf.org/images/stories/gwpf-reports/hughes-windpower.pdf>
- A report by the Institute for Public Policy Research on the effectiveness of wind power
<http://www.ippr.org/publication/55/9564/beyond-the-bluster-why-wind-power-is-an-effective-technology>
- Various publications by the Renewable Energy Foundation
<http://www.ref.org.uk/publications>
- A report on common concerns about wind energy by the Centre for Sustainable Energy
http://www.cse.org.uk/downloads/file/common_concerns_about_wind_power.pdf

Health and Noise Impacts

- A report by the Acoustic Ecology Institute on Wind Energy Noise Impacts
<http://www.acousticecology.org/docs/AEI%20Wind%20Turbine%20Noise%20report%202009.pdf>
- A review of the evidence for alleged health conditions related to wind turbines commissioned by RenewableUK

<http://www.renewableuk.com/en/publications/index.cfm/Wind-Turbine-Syndrome-Review>

- A report on wind turbine noise, sleep and health by Dr. Christopher Hanning
http://www.acousticecology.org/wind/winddocs/health/Hanning%202010_Wind%20turbine%20noise%20sleep%20and%20health%20November%202010.pdf
- Wind turbines and health - a rapid review of the evidence, prepared by the Australian National Health and Medical Research Council
http://www.nhmrc.gov.au/files_nhmrc/publications/attachments/evidence_review_wind_turbines_health%20.pdf
- A sound recording of the noise heard when 550m away from 3 wind turbines at Knabs Ridge Wind Farm in Yorkshire
http://www.masenv.co.uk/listening_room#item153

Ownership models and community benefits

- A Scottish Parliament report on community wind power ownership models
http://www.scottish.parliament.uk/ResearchBriefingsAndFactsheets/S4/SB_12-71.pdf
- Community Energy Scotland's submission to the Economy, Energy and Tourism Committee Inquiry into the Scottish Government's Renewable Energy Targets
http://www.scottish.parliament.uk/S4_EconomyEnergyandTourismCommittee/Inquiries/Community_Energy_Scotland.pdf
- An article on the benefits of community ownership of wind power
<http://www.windpowermonthly.com/article/1143179/scotland-shows-community-ownership>

Glossary of terms

Acid Rain	Acid rain occurs when sulphur dioxide and nitrogen oxides react with water in the atmosphere to form acids. These acids then fall to earth dissolved in rain. Acid rain can have serious negative impacts on human health, waterways, vegetation and buildings.
Atmosphere	This is the gases surrounding planet Earth; comprising of mainly nitrogen (78%) and oxygen (21%) gases.
Food security	The task of ensuring the production and supply of enough safe and nutritious food in a sustainable way for a growing global population.
Greenhouse gas	<p>A gas which both absorbs and emits radiation, causing the 'Greenhouse Effect'.</p> <p>Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), and ozone (O₃) are the primary greenhouse gases in the Earth's atmosphere, as well as some that are entirely human-made.</p>
Habitat destruction	When a species' home no longer exists as it has been destroyed or changed.
Kinetic energy	The energy in moving objects; also known as movement energy.
Nitrogen dioxide	A reddish brown gaseous compound with an irritating smell. It is one of the nitrous oxides.
Non-renewable energy	These are fossil fuels. These supplies are not infinite and will one day run out.
Pollutant	A substance that when introduced into the environment it has undesired effects or it damages the usefulness of a resource. It may cause short or long term damage.
Renewable energy	Any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use.
Species extinction	When one kind of animal or organism ceases to exist as the last member of the species dies.
Sulphur dioxide	A colourless gaseous compound with a pungent, choking smell that is produced when the element sulphur is burned in air. It is one of the gases that is given off when fossil fuels are burned. When it dissolved in rain clouds, acid rain forms, damaging the environment.
Turbine	Equipment that converts the kinetic energy of a flow of a substance (air, water, hot gas or steam) into useful power for electricity generation.

Glossary of energy sources

Solar	Solar energy is emitted by the sun in the form of radiation, which can be harnessed and used to provide renewable energy.
Hydro	This is the energy of water moving from higher elevations to lower elevations, which is converted into usable renewable energy by a turbine or other device to operate
Wind	Wind power is the conversion of wind energy into a useful, renewable form of energy by the use of wind turbines. These are turned by the wind, creating electricity.
Biomass	Biological material consisting of living or recently living organisms (such as wood or other organic material). It is burned to provide energy.
Geothermal	Thermal energy stored below the Earth's crust that is accessible – used to generate renewable electricity in a thermal power plant or provide heat to assist other processes requiring it.
Hydrogen	This is not an energy source, but an energy carrier that is used in fuel cells and batteries.
Tidal	A form of hydropower that converts the energy of the ocean's tide into a useful renewable energy source i.e. electricity.
Wave	The transport of energy by ocean surface waves, and the capture of that renewable energy to generate electricity.

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