

Democs for Schools: Bioenergy



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Overview

Suitable Age: 13-19

Duration: 90 minutes or longer

Learning outcomes:

Students will be able to

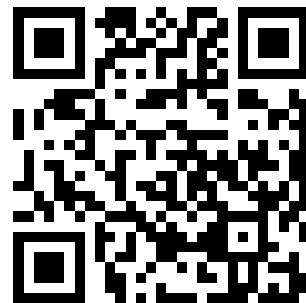
- Discuss the ethical and social issues around Bioenergy
- Understand how bioenergy affects different areas of society
- Form your own opinions on bioenergy

Keywords: Biofuel, renewable, biodegradable, biodiesel, biomass, carbon footprint, carbon neutral, energy poverty, energy security, non-renewable, biodiesel, bioethanol, biogas, carbon dioxide, waste, residue, fossil fuels, greenhouse gas, climate change, feedstock, environmental, water

Topics: Renewable energy, biofuels

What you will require:

- Democs cards
 - Story cards
 - Issues cards
 - Information cards
- Voting grids



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download

Suggested prior knowledge:

No prior knowledge of biofuels is required. Students should be familiar with fossil fuels, climate change and the requirements plants have for water and nutrients in order to grow properly. To get the most from discussions and contribute their opinions it will help if students are familiar with the concepts of fossil fuel depletion and the role of greenhouse gases in climate change.

Introduction to Democs

Using Democs in the teaching and learning of controversial issues

- A Introduction to Democs
- B Teaching controversial issues
- C Using Democs effectively in the classroom: A step by step guide.

A Introduction to Democs

What is Democs?

Democs (DEliberative Meeting Of CitizenS) is a conversation card-based activity, i.e. a discussion-based learning tool for dealing with controversial issues. It enables students to find out about a topic, form their opinions, discuss the topic with others, and vote on what they would recommend that the Government or other decision-makers should do.

More about Democs

- Democs comes in an A6 box or online.
- Democs is an interactive, collaborative learning process.
- It is straightforward to facilitate.
- It is suitable for students of Year 9 and above.
- No previous knowledge of the topic is required.
- Democs is unbiased – the cards include different viewpoints on the topic.
- Democs is active citizenship. Results from the activities are collected and fed into a bigger national picture, which can inform decision-makers and the government of public opinion.

B Teaching controversial issues

What are the benefits of studying controversial issues?

Students learn to:

- Weigh up conflicting evidence.
- Find out information.
- Detect bias.
- Question the validity of sources.
- Present their own considered viewpoint.
- Develop skills such as communication and working collaboratively.
- Relate science to everyday life.

What do we need to consider when teaching controversial issues?

- Teachers need to give a balanced viewpoint.
- All views are expressed with equal emphasis.
- The necessary scientific principles need to be understood.
- Arguments, opinions and information from all sides are presented.
- Sensitivity and tolerance to different views are encouraged.
- Bias, prejudice and indoctrination are excluded.
- A neutral stance is maintained.

Maintaining neutrality and balance

- Teachers should not use their authority as teachers as a platform for promoting their own views.
- The mode of enquiry should have discussion rather than instruction at its core.
- Discussion should protect divergence of view.
- Teacher should have responsibility for quality and standards in learning.

How does Democs implement these principles?

During Democs students get involved with the topic:

- They develop background knowledge and understanding through an introductory information sheet.
- They understand the impacts on people using Story Cards.
- They gather further information using Information Cards.
- They discuss the major questions using Issue Cards.
- As a group, they identify their concerns and dilemmas by identifying which group the issues belong to.
- They use their knowledge and judgement to decide which area of the Making choices in the real world sheet is most important to them.

Further valuable features of Democs

1. Conversation guidelines create a supportive environment in which all students can form their opinion and express themselves safely.
2. Activities can be given for a follow-up session, to translate student's enthusiasm and learning into action.
3. Most of all, Democs unpicks a topic, making it simple and accessible by breaking it into easy steps.

How does Democs link with key parts of the National Curriculum?

Democs links with the National Curriculum with Key Stages 3 and 4 in Science, particularly How Science Works, and Citizenship. It can also be used for General Studies, English, Geography, PSHE, and Religious Education.

What learning does it promote?

- Democs helps students learn about, think and reflect on controversial topics.
- It provides an opportunity to students to develop opinions, explore a range of options, and negotiate with others.
- Through Democs students can consider moral responsibility, as well as train in political literacy – two of the three key aspects of the Citizenship Curriculum.
- Democs links thinking, speaking, emotional literacy, and decision making skills.
- Democs fosters deliberation rather than debate.

Democs with science students

Democs can help students to:

- Explore ideas about science, and its essential role in society.
- Develop scientific literacy.
- Develop a critical approach to scientific evidence and methods.

C Using Democs effectively in the classroom: A step by step guide.

The whole process is outlined on the PowerPoint presentation. These notes are designed to support you through that process.

Tips for facilitating Democs

1. Give clear instructions (briefing).
2. Ensure all students understand what they have to do and what is expected of them.
3. You may have to demonstrate.
4. During the action trouble shoot, listen, support, help, challenge, and maybe demonstrate to small groups or whole group if common problem.
5. Debrief as described (you could also include discussions you had listened to during the action).
6. Follow-up to consolidate the learning.

Kit Contents

Each Democs kit contains the following:

- One set of instructions (which you're reading!)
- What is bioenergy hand-out (page 9).

Main cards

You can use these cards every time you play:

- 7 large pink story cards (Set S)
- 39 (green) information cards (Set A)
- 37 (blue) issue cards (Set B)

Single-use items

These items get written on during the game. We've given you enough for one or two games, but after that you'll need to go on www.bbsrc.ac.uk/bioenergydialogue and print some more.

- 8 blank cards
- 10 white cluster cards
- 8 'Making choices in the real world' forms
- 1 feedback form

Basic Elements of the Game

Story Cards (Set S)

These are stories about some people and situations to do with bioenergy. All but one of the people are fictitious but the stories are based on real issues which have arisen, or ones which might arise in the future.

Information Cards (Set A)

These are facts about bioenergy. These come from experts and reliable sources of information.

Issue Cards (Set B)

These are different people's viewpoints and opinions on bioenergy. They are here to make you think, but they might be things that not everyone thinks are true.

Blank Cards

If anyone thinks of something important that's not included, they can write it down on a blank card.

Making Choices in the Real World

These are sheets which players use at the end to say how important the various goals for biofuels are. One copy is given to each player.

Lesson Plans

Lessons 1 and 2

Step 1: Introducing Democs to the students

Introduce to the students that they are going to participate in a series of activities about a controversial area of science. This will lead them towards evaluating the issues around biofuels. It is useful to show the PowerPoint presentation in this step on a whiteboard or computer, so students know what they will be doing.

Step 2: Conversation guidelines

With some groups of students it is important to set ground rules. You can either introduce the set of conversation guidelines (page 11) to the students, OR they can develop their own.

Step 3: Developing the background knowledge and understanding of the students

These utilise the “what is bioenergy” information sheet. The sheet is read and then questions a-g answered. The students work in pairs on these activities in the classroom, or individually if they are done as homework activities. These will help them to develop their knowledge and understanding of the basic science and issues underpinning the topic.

Step 4: Using the story cards

This step is to enable the students to identify that there are various views and concerns surrounding the biofuels debate.

- The dealer deals out the story cards (some may have to share depending on the size of groups).
- They read their cards.
- They take it in turns to read their two story cards out to the group.
- They then make a list of the views and concern of each character as a group.

Step 5: Information cards

Utilise the information cards

- Give each group of four a set of the information cards.
- The dealer deals out all the cards.
- Each student reads their cards. They choose two cards that are important to them or relate to their story character.
- They place the unwanted cards to one side, face down.
- They take it in turns to read their 2 cards to the group.
- They then discuss why they think they are important.

Step 6: Issue cards

The aim of this round is for the students to engage in an open debate that will allow them to deliberate the different views. They will take on the role of their story character and debate with the other “characters” using the issue cards.

- Give each group of four a set of the issue cards. The dealer deals out all the cards.
- They read their cards, choose 2 that are most important to their story character.
- Place the unwanted cards to the side face down.
- Each person reads their 2 chosen cards to the group.
- They place the chosen cards on the table.

- They discuss why the cards are important in relation to their story character.

Step 7: Clusters

- Students take the issues that they have chosen and group them according to the correct cluster on the making the choices in the real world form.
- They should also think about which cluster their story character would think is most important.
- They may also create their own cluster if they think of one.

Step 8: Voting - Making choices in the real world

- For each group students fill in a making choices in the real world form.
- Ask the students which cluster they think is most important to them and why.

Step 9: Debriefing

- Ask three or four groups to present their discussion back to the class.
- Summarise the feedback on the voting.
- You may also have to sensitively correct any misconceptions on the topic that have arisen during the activity.

Step 10: Follow-up

It is important to consolidate the learning by using a follow-up activity which enables the students to individually, or in their groups, communicate their ideas, thoughts and feelings about the issue.

- Give out a follow-up activity sheet to each student.
- In their groups, students decide which follow-up activity they are going to undertake e.g. write a letter to the secretary of state, a newspaper article, a public information leaflet or poster. In each case the students should:
 - Outline the background science
 - What the issues are
 - What different people think about the issue
 - What they think and why.
- Each group presents its work to the class, and the presentation is evaluated against the group's criteria for success.

What is bioenergy?

Bioenergy is a general term for any way of using biological materials (collectively called 'biomass') from plants, animals or humans to produce energy. This can be burning solids directly like wood or household rubbish, or converting crops, residues or wastes into liquid (biofuels) or gas (biogas). A waste is something which has no future use and is discarded, like carbon dioxide when fuel is burned in a car. Residues are things which aren't the main product but are not necessarily just wastes, like straw from a food crop. A residue might be used for something else, like ploughing straw back as a soil nutrient.



This game focuses mainly on biofuels, which are renewable liquid or gaseous transport fuels derived from various types of plant or animal material. The aim is to replace oil and gas from fossil fuels; to contribute to energy security, to help tackle climate change by reducing greenhouse gas emissions and to facilitate economic development.



Biofuels are renewable because fresh supplies of the plants and the by-products used to make them can be produced as needed. So in theory there could be an unlimited amount and a secure supply, whereas once you use up fossil fuels they are gone. In principle, biofuels should also be 'carbon neutral' - only returning the carbon dioxide to the atmosphere which the plants had absorbed in growing. In practice, other factors may offset some of the climate change improvement, as we shall see.

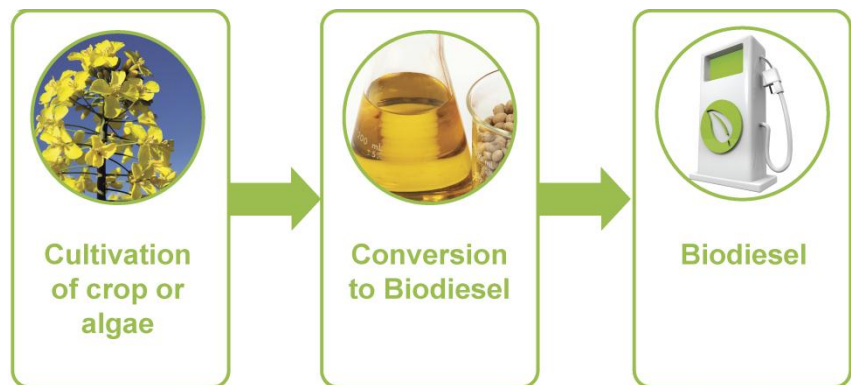
The main current biofuels:

1. Bioethanol is a replacement for petrol. It's the same alcohol as in fermenting grapes or barley for wine or beer, but currently it's typically produced from sugar cane or beet, or cereals like maize, wheat and rice, and distilled to be used as fuel.
2. Biodiesel is a replacement for diesel oil. It is mainly made from vegetable oils (this is how diesel oil was first produced, in fact).
3. Biogas is produced from decomposition of animal or plant material - a process called anaerobic digestion.

There are three stages in producing biofuels from crops:

1. Feedstock production: growing and harvesting crops.
2. Conversion of feedstock into biofuel.
3. Most biofuels need to be blended with fossil fuels and transported so they can be sold at biofuel pumps.

First generation biofuels used commercially today have mostly used existing food crops like maize and vegetable oils, and have been



controversial. New biofuels technology aims to use abundant biomass feedstocks of non-food crops (like willow trees or grasses) or unused residues from food crops (e.g. woody parts like straw), or perhaps eventually water-borne algae.

Unfortunately these are all more difficult to process into fuel, and need development to become economically viable. Other considerations include the need for minimal input of resources like fertiliser, land or water, and minimising harms to the environment or local populations and livelihoods.

New biofuels could also become very valuable as replacements for oil as the feedstocks to make chemicals, plastics other industrial materials.

How to play the game

Conversation Guidelines

- We are all equal – one person one voice/vote.
- Your view matters – especially if you are the only one that holds it.
- You have a right to be heard – but so does everyone else.
- Listening is as important as speaking – so work at understanding as well as being understood.
- Find common ground – look for where you agree.
- Don't worry if you are surprised or confused – it might mean that you are learning something new.

Timetable – 90 minute version

The timings below add up to 90 minutes. If you have longer, please increase the timings appropriately. The Democs game can be carried out over a number of lessons. If possible carry out the discussion in a double lesson.

Introduction	10 mins	Players read through “Whats bioenergy?” and answer the questions in their groups.
Round 1: Stories	10 mins	Players use the story cards to introduce some of the issues about bioenergy through the story characters.
Round 2: Information	15 mins	Players are dealt a hand of information cards about bioenergy. They choose two that interest them, to share with the group.
Round 3: Discussion	15 mins	Players select from the issue cards in the same way, opening up ethical and social questions that they think. They also need to think about how their character would view the issue.
Round 4: Clusters	25 mins	Players group the issue cards into the cluster they think it fits best. They also share which cluster their story character would think is most important.
Round 5: Voting	15 mins	Players give their views by individually filling in the Making Choices in the Real World forms.

Round 1 – The Reading Round

In this activity you will explore some of the issues surrounding bioenergy and finally decide where you stand on this topic.

1. Read through 'What is Bioenergy?'
2. Get into your discussion groups. Your teacher may have already put you into groups. Elect a chair person and answer the following questions.
 - a) What is bioenergy?
 - b) What is the difference between waste and residue?
 - c) What are biofuels? How do biofuels differ to fossil fuels?
 - d) What challenges can biofuels help tackle?
 - e) How are biofuels renewable?
 - f) What does the term 'carbon neutral' mean?
 - g) What are the three main biofuels?

Round 2 – The Story Round

1. Shuffle the big pink story cards and give one to each player. (Some may have to share.) Each card ends in a dilemma.
2. Read your card carefully. Make a list of the main views and concerns of your character in relation to biofuels.
3. Tell the group what your character would want to happen with regards to biofuels

Round 3 – The Info Round

Which information cards are most important?

1. Shuffle the green information cards and deal them all out to the players. It doesn't matter if not all players have exactly the same number of cards.
2. Each player should pick what they personally think are the two most important cards from their hand. Players can choose what "important" means for themselves. It could be:
 - Relevant to the dilemma on their story card
 - Interesting
 - Surprising
 - Something they strongly agree with
 - Something they strongly disagree with
3. Ask players to take it in turn to play one card by reading it out to group and then explaining why they chose these.

Round 4 – The Discussion Round

Which issue cards are most important?

1. Shuffle the blue issue cards and deal them all out to the players. It doesn't matter if not all players have exactly the same number of cards.
2. Each player should pick what they think their story character would think is the most important issues
3. Ask players to take it in turn to play one card by reading it out to group and then explaining why they chose the card whilst acting as their character. Once a player has finished reading the card out, other players can share their views and opinions. Once the discussion has finished, the player puts the card down face up next to their story card. Each player should have two cards, so you need to go around twice.

Round 5 – The Cluster Round

Which clusters do the issue cards fit into?

The clusters are:

- Affordable transport for people and freight.
- Food security for all.
- Justice for the poor.
- Providing a livelihood for local people.
- Maintaining local ecology (soil, nutrients, biodiversity, etc.).
- Reducing global warming.

Group the issue cards in the separate clusters.

You may also think about the wider implications of the issues in relation to biofuels.

Round 6 – The Voting Round

In this last round, players should fill in the Making Choices in the Real World forms.

1. Collect the sheets *Making choices in the real world sheet*.
2. Individually fill in the sheet.
3. Finally take some time to each discuss which cluster was most important to you and why.

Glossary

Bioenergy - Energy including, heat, electricity and liquid fuels, derived from non-food feedstocks or from inedible elements and waste from food crops.

Biodegradable – Substances that are able to decompose in a natural environment.

Biodiesel – An organic compound derived by processing and transesterification of plant oil or animal fats that can be used as a transport fuel in replacement of diesel derived from fossil fuel.

Bioethanol – Biofuel consisting of ethanol produced by the fermentation of plant material rich in sugar or lignocellulose.

Biofuels – A renewable fuel produced from biological material such as recently dead plants, animals or their waste.

Biogas – Renewable gaseous fuel comprised of methane (approximately 60%) and carbon dioxide, produced by anaerobic digestion of organic material by microorganisms. Can be used as a transport fuel or, as a replacement for natural gas.

Biomass – Any biological material that can be used either directly as a fuel, converted to a fuel or used in industrial or fibre production.

Carbon dioxide (CO₂) – A gas produced by cell respiration and the burning of fuels. Used by plants for photosynthesis.

Carbon footprint – The amount of carbon dioxide emitted due to the consumption of fossil fuels.

'Carbon neutral - Applies to a process which occurs without any change in the total amount of carbon dioxide present in the atmosphere.

Energy poverty – A term for a lack of access to electricity, heat, or other forms of power.

Energy security – A term for an association between national security and the availability of natural resources for energy consumption

Feedstock – Biomass that can be used in the production of biofuels including edible crops, non-edible biological material, waste and residues.

Fossil fuels – Non-renewable fuels, such as coal, oil and gas, formed over millions of years from the decomposition, in anaerobic conditions, of plant and animal remains.

Greenhouse gas – Gas such as carbon dioxide that traps heat in the atmosphere

Non-renewable – A resource that cannot be renewed at the same rate as it is being used and will eventually run out.

Renewable energy – A resource that can be renewed more quickly or at the same rate as it is being used or is unlikely to run out due to inexhaustible supplies.

Yield – A measure of the amount of crop produced.

Further reading and links

Bioenergy public dialogue

The Royal Society, January 2008. *Sustainable biofuels: prospects and challenges*, Policy document 01/08, ISBN 978 0 85403 662 2.

Nuffield Council on Bioethics, April 2011, *Biofuels: ethical issues* ISBN: 978-1-904384-22-9 www.nuffieldbioethics.org/biofuels-0

Algal Research in the UK: A Scoping study for BBSRC, July 2011.

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Nafisa Bakkar, Tristan MacLean

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