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WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Science Debate Kit: Electricity Distribution

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Debate Kit: Electricity Distribution
Should we build pylons in Kinewell Valley?

A structured practice debate on a controversial topic. The different 'rounds' of the debate help students think through the issues and reconsider their opinions. The structure also shows them how to build a discussion and back up their opinions with facts.

You can use all eight characters, or fewer, as you wish.

The minimum is the four essential characters (**in bold**), this gives two for and two against.

Characters

For building pylons in Kinewell Valley	Against building pylons in Kinewell Valley
• **Ellie Peebles – Local Nursery teacher**	• **Tony Cullen – Restaurant owner**
• **Trent Beckett – Music producer**	• **Thea Adefuye – Member of local housing co-op**
• Fearne Wilson – Otter conservationist	• Lee Bramley – Retired
• Brian Kirkholme – Local business leader	• Becky Horner – Baker

Facilitation tips

Ensure pupils know there is no right or wrong answer. Be observant of ones who want to speak and are not getting a chance. Encourage students to give a reason for their opinions.

Designed for KS4.
Can be used with ages 11-18

For groups who may need extra support you can put the following prompt sentences upon the board:
"I think pylons should/shouldn't be built in Kinewell Valley because....."
"I think ..... is the most important point to think about."

Learning notes

Learning objective:

- To practise discussing and debating issues and expressing an opinion
- Understand more of the technical, social and environmental factors around electricity distribution.

Other learning outcomes:

- Consider social, ethical and factual issues in an integrated way
- Think about different points of view
- Learn to back up their opinions with facts

Curriculum points covered:

Working scientifically:
- Societal aspects of scientific evidence
- Developing an argument

Substantive:
- Consider the economic costs and environmental effects of energy use.

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Debate

Brian Kirkholme – Local business leader

To meet Britain's energy needs we must build lots of new windfarms and solar farms. These tend to be in remote places, far away from existing electricity cables. So to take the electricity to the people who need it, we have to put in lots of new cables. We need to do this as cheaply as possible, so that British businesses will still be competitive. Also, so that consumers can afford their electricity bills. No-one wants to sit in the dark!

Fact: It costs ten times as much to put cables underground as it does to put in pylons.

Issue: If you're going to MAKE electricity in remote places, you have to have SOME way of getting it to the people who want to use it.

Question: If you don't want pylons, do you want to pay twice as much for your electricity then?

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Debate

Becky Horner – Baker

So bread is ready first thing in the morning, we start work at 2am. We get a discount on our bills – electricity is cheaper at night and I wondered why. It turns out you can't switch power stations off and on very easily, so at night they have more electricity than needed. But only just enough sometimes in the daytime.

Fact: Our distribution system has to be big enough to handle 'peak' demand – when everyone switches their kettle on at once – but most of the time demand is lower, so a lot of capacity is wasted.

Issue: Not everyone starts work at 2am, but with a bit of thought we could all use electricity overnight more - for example to charge phones and laptops and run washing machines.

Question: Why don't we get smarter about this and get more people using electricity at night, so we even things out.

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Debate

Fearne Wilson – Otter conservationist

Otters are such beautiful, graceful, playful creatures. I fell in love with them when I visited a zoo as a kid. Then when I studied zoology I found out that higher predators like otters can show that you've got a healthy ecosystem. Now I work for the Otter Conservation Trust, helping protect these lovely animals and educate people about them.

Fact: Underground cables take longer to put in and involve more disruption to wildlife.

Issue: The wildlife and the health of the ecosystem is what's important. Animals like otters are shy and easily disturbed.

Question: Are you really so shallow you think the view for humans to look at is more important than habitats for animals to live in?

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Debate

Ellie Peebles – Local Nursery teacher

I work at a local nursery school. I love kids; it's all I ever wanted to do. I look at them all running round, so happy and full of enthusiasm and I really worry what their futures are going to be like. We can't just mess up the world and leave it for them to deal with. Underground cables could make this windfarm so much more expensive that it won't get built.

Fact: Scientists think that unless we make big changes now, global warming is likely to exceed 2°C by the end of the century and that will be seriously devastating.

Issue: We have to put up with some stuff now, or it will be much worse later.

Question: Don't you realise how serious the situation is? We can't afford to be fussy about beauty spots.

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Debate

Lee Bramley – Retired

I've lived in this valley for ten years and it's beautiful. This view always brings peace to my heart and makes it seem everything's OK with the world. There are trees here that were growing before my great-granddad was born, and they would outlive me if humans don't chop them down.

Fact: I fought for this country in the first Gulf War, nearly got blown up and saw my colleagues die. I ended up with post-traumatic stress disorder. Looking at this view was the first time I started to heal.

Issue: There's concrete and metal everywhere now. It's worth keeping some beautiful places, or humans will end up like battery chickens.

Question: Why should this beautiful view and these ancient woodlands be destroyed, just because humans miles away are too lazy to switch lights off?

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Debate

Trent Beckett – Music producer

I work with talented young musicians at my studio in Manchester. Of course the business I'm in – like the whole of modern civilization – depends on electricity. Your grandparents just wanted electricity for vacuums, fridges and TVs. These days we've got phones, computers, X-Boxes... It's more things every year and more people every year, so we need more electricity. What are we going to do instead, go back to the Stone Age?

Fact: Many of our coal-fired power stations are reaching the end of their lives, but we need more and more electricity.

Issue: Millions of people live in the Manchester area and need electricity, when only a few of you enjoy the view.

Question: Did you spoiled country-dwellers care when WE were living next to a big coal-fired power station and YOU were using the electricity?

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Debate

Thea Adefuye – Local housing co-op

House prices are high round here, me and my friends couldn't afford them. So we clubbed together to buy some land and built eco-houses on it. This is a real community and we try to be self-sufficient. We've got solar panels and a wind turbine and we make most of the electricity we use. I'm a fan of renewables, but big windfarms, with pylons connecting them to the grid are just replicating the problems of the system we've already got. Let's try things a different way.

Fact: When electricity is transmitted across the National Grid, about 10% of it is lost on the way.

Issue: Making electricity near to where it's used means less is wasted. And I think it's more fair too.

Question: Why should the people in one place get the benefit, and people in another place suffer the inconveniences?

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Debate

Tony Cullen – Restaurant owner

I bought a house up here so I can get away from it all and enjoy the outdoors. I love it! And now they plan to put in this windfarm and all these pylons. Because these days it's all 'renewables', instead of coal-fired power stations. I'm really not all that convinced about global warming. I know the scientists all say it's happening, but scientists can be wrong.

Fact: Global temperatures went up and down in the past, even before humans existed.

Issue: If humans AREN'T causing global warming, then we can carry on using coal-fired power stations and the existing electricity distribution network.

Question: Are you so sure of this scientific theory that you'll change our whole world around for it?

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Teachers Notes

Question: Should we build pylons in Kinewell Valley?

Lesson plan

This debate kit is designed to highlight some of the issues around electricity generation and distribution. To avoid the debate becoming a simple NIMBY (Not In My Back Yard) campaign against pylons, we suggest setting some context about electricity production and demand to focus on the idea that sometimes electricity produced in one part of the country might need to be delivered to consumers in another part, and in our debate kit, a windfarm has been proposed that would require the electricity generated to be distributed through Kinewell Valley. The different 'rounds' of the debate help students think through the issues and reconsider their opinions. The structure also shows them how to build a discussion and back up their opinions with facts.

One benefit of the kit is to show students how debating an issue can change peoples' minds. We have developed an online tool to track how your class changes its views and gives results at the end.

You can find links to the survey and other resources here: http://debate.imascientist.org.uk/electricity

KS4: Designed for KS4. Has been used with ages 11-18.

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Support: To help students you can put the following prompt sentences up on the board:

"I think pylons should/shouldn't be built in Kinewell Valley because....."

"I think ..... is the most important point to think about."

Plenary: 10 minutes

Vote for the position they agree with most (if there is one) and fill in the third question of the **online survey**. The next panel of the online survey will show how your students' views have changed through debate.
Why has their opinion changed? Which arguments were the most persuasive?

Note – Pupils can stay in roles all the way through debate, or only for the first round if you prefer. If it's all the way through, give them a chance to express their opinion at the plenary.

For groups who are not confident at class discussion, it might help to have them start by discussing the question and/or their character's position in pairs, and then compare notes in fours. They've then had chance to rehearse some of what they want to say before having to do it in front of the whole class.

Background notes for teachers

Mention electricity and the issues which usually come to mind are about how we generate that electricity – fossil fuels, renewable, nuclear power. We mostly take distribution for granted. But distributing electricity is a major engineering and technical challenge. This debate kit is designed to bring to the fore some of the issues around electricity generation.

The **National Grid** is the high voltage electricity distribution network which connects large power stations to major substations, across the whole of the UK. It means that electricity can flow around the country to wherever it is needed. There is, in fact, a net flow of electricity from Scotland and the north of England to the south of England, most of the time. As there are more power stations in the north of the UK.

Substations transform the electricity from high voltage to a lower voltage, so it can be more safely transmitted locally and used in domestic and other settings.

Some key issues in electricity distribution:

The **pattern of electricity generation is changing**, which has implications for distribution. Big fossil fuel power stations were often located in industrial areas and it was relatively straightforward to connect them up to the grid with huge power cables and pylons.

Now we are seeing much **more wind and tidal power** – which is often generated in attractive areas of countryside, which people object to getting covered in pylons. Also it's often in remote areas, where you'd have to add a lot of cable to connect it to the grid.

The **social context** has also changed. There have been two big waves of pylon building – in the 1920s and '30s, when everyone thought electricity was exciting and shiny and cool, and in the 1960s and '70s, when rural communities were being connected to the grid for the first time, which they tended to see as a great thing. New pylon building now (to connect windfarms to the grid, for example) is not seen as bringing the same benefits, by many people. Not everyone is convinced of the need for wind power, and the benefits of it don't so directly accrue to the people affected by the pylons.

We are also seeing **a lot more small-scale generation**, including domestic solar panels or wind turbines. The electricity that comes into the local network from this kind of microgeneration is 'dirty' (the sine wave is a messy shape, not smooth), this puts more strain on system components. It also means it needs to be 'cleaned up' before it can be supplied to other consumers. This means it would be preferable to use the electricity close to where it's generated, as much as possible. But it's **difficult to store electricity**. Batteries to store enough electricity to power the average house for a few hours would be the size of about three Sky boxes. To store enough electricity for days would not only take up a lot of room, but the batteries would cost tens of thousands of pounds.

Perhaps the biggest headache in engineering terms is **managing demand**. There are big peaks in electricity demand – when everyone switches their kettles on at half time in the world cup, or in the morning when everyone has a shower. But as it's so hard to store electricity, the system needs to be able to meet that peak demand – not just in making electricity, but in distributing it too. So most of the time there is a lot of wasted capacity.

Engineers and planners at distribution companies are trying to explore **ways of smoothing out that demand**. As it is, we keep needing bigger and bigger wires to distribute the electricity, but if we could smooth out demand and make the distribution system work smarter we wouldn't. It may not have the glamour of a mission to Mars, but this is a huge technical challenge that no-one knows how we are going to solve. Maybe one day one of your students will help to solve it.

Starter: 10 minutes.

What do your students think are the big issues about electricity? They should know a bit about how it's generated, but what do they know about how it's distributed? How does it get from the power station to our plug sockets, whenever we need it? How can this be done as efficiently as possible while also keeping (most) people happy? Also, how have the sources of energy changed over time? Which were the main sources of energy 20 years ago and which ones are the main ones now?

To support this introduction, we have prepared some slides at: http://debate.imascientist.org.uk/electricity

Do the students already have an opinion on the way electricity should be distributed? Ask their opinion and fill in the first question of the **online survey**.

Main Activity: 25 minutes.

1) **Split students into** as many **groups** as characters you want to cover.
2) **Give** them their **character cards** – one per group, and give them a few minutes to read them over.
3) Get one student in each group to **read out** their **first section** to the rest of the class.
   What are the class's initial thoughts? Is there one position they identify with or reject?
4) Take it in turn to **read out** their **fact.** Does it change the way they think? Fill in the second question of the **online survey**.
5) **Read** the **issue**. Any different feelings?
6) Each team **asks** their **question to** the **character of their choice**.

All facts in this kit have been researched. References can be found online at: debate.imascientist.org.uk/electricity

This debate kit is being commissioned by Western Power Distribution. Western Power Distribution is the company in charge of providing energy to almost 8 million customers in the Midlands, South West and Wales.

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