

SECONDARY LEVEL



## FACILITATOR'S PACK

Power for Everyone Everywhere is a hands-on enquiry-based workshop that enables pupils to explore the global issues associated with electricity access and the role that engineering plays in electricity distribution.



UK

ENGINEERS

WITHOUT BORDERS

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Last dated update of this document: 09 September 2019.

This document and the accompanying materials are available to download from:  
<http://www.ewb-uk.org/power-for-everyone-everywhere>.

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## OVERVIEW

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Power for Everyone Everywhere is a workshop designed to encourage pupils to explore the challenges associated with access to clean, reliable electricity around the world. Pupils learn about the importance of electricity to people's everyday lives and the role that engineering infrastructure plays in the distribution of electricity. Pupils design, build and test their own model wind turbine as part of this workshop. This workshop builds on the Sustainable Development Goals and the concept of global citizenship.

This document is a guide for Engineers Without Borders Ambassadors delivering the workshop. Teachers and youth group leaders can also use it. It should be used in conjunction with the accompanying slides, slide notes and printouts. Please note that this resource is periodically updated. The date of the last update is on the inside front cover.

If you are not a teacher/youth group leader, please sign up to become an Engineers Without Borders Ambassador to be able to deliver this resource. Find out more and register on our [website](#). For any queries, please contact Engineers Without Borders UK directly using the email address: [outreach@ewb-uk.org](mailto:outreach@ewb-uk.org).



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## THE WORKSHOP IN BRIEF

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### PUPIL'S LEARNING OBJECTIVES

- Understand the importance of electricity and access to it is not equal
- Describe the role of an engineer in bringing about access to electricity
- Consider the challenges engineers face to give people around the world access to electricity
- Design your own model wind turbine

### TEACHER'S EDUCATIONAL OBJECTIVES

- Incorporate global issues into classroom learning
- Provide careers related learning within subject lessons
- Hands-on activity that develops the pupils' ability to use cross curricular knowledge and skills, and work as team

### SUITABLE AGE GROUP & SIZE

The session is designed for a standard school class of approximately 30 pupils with the class divided into groups of two to six pupils for the build activity. However, the content can be easily modified to suit smaller or larger groups. Please contact us for guidance on this.

This particular resource is suitable for KS3-4 (11-16 years of age, Years 7-11). There are separate resources suitable for upper KS2 (9-11 years of age, Years 5-6) on the Engineers Without Borders UK website.

## WORKSHOP LESSON PLAN & RISKS



Overall workshop length is 100 minutes. To amend for a shorter session only do one of the activities (e.g. the build activity for science lessons, the case study and reflection activity for geography lessons) and present some of the Q&A rather than ask the pupils.

Workshop section description	Time (min)
<b>INTRODUCTION: HOW WE USE &amp; RELY ON ELECTRICITY (slides 1-9)</b>	
<p>Introduction to the facilitator/s and to Engineers Without Borders UK. Starter activity to encourage pupils to think about how we use and rely on electricity and brief overview of the session. Presentation of the learning objectives. Summary of all the ways we use electricity, and how important it is. Explanation that 1 billion people do not have access to electricity. <i>Encourages critical thinking and self-reflection.</i></p>	10
<b>HOW DOES EVERYONE EVERYWHERE GET ACCESS TO ELECTRICITY? (slides 10-40)</b>	
<p>Introduces the notion of unequal access to reliable electricity in the world and the impact this can have on your life. Presents case studies for pupils to engage with in a card sort activity. The case studies explain how different communities around the world are addressing this issue locally. Highlights the global Sustainable Development Goals initiative. <i>Introduces a global dimension to understanding electricity access and raises the issue of global inequality. Highlights local and global initiatives addressing this.</i></p>	15
<b>REFLECTION ACTIVITY: ELECTRICITY ACCESS ISSUES (slides 41-45)</b>	
<p>Learning about how electricity is generated by moving a magnet inside a coil of wire to induce an electrical current. Discussion about how electricity can be transported from where it is generated to where it is needed. Optional group activity discusses challenges faced when providing people access to electricity. Pupils each given a scenario getting them to analyse factors affecting access to electricity for their population. <i>Encourages pupils to explore some of the reasons why people may not have access to reliable electricity supplies and consolidate learning on the importance of reliable electricity access.</i></p> <p><b>KEY RISKS:</b> Use of scissors – only facilitator to handle scissors.</p>	15
<b>THE ROLE OF ENGINEERING (slides 46-59)</b>	
<p>Introduces the role that engineering plays in access to electricity through a Q&amp;A activity. Draws upon existing knowledge of energy resources. Pupils are asked to group power resources into definitions introduced in this section. The dangers of fossil fuels are addressed, in combination with the issues of our growing global energy use with increasing population. <i>Encourages critical thinking to discover where electricity comes from, the technologies used to generate and distribute it and raises the issue of the link with climate change and population.</i></p>	35



### EXPLORING WIND ENERGY: WIND TURBINES (slides 60-62)

Information about the use of wind turbines in the UK, to generate electricity from UK wind resources. Presentation of the advantages and disadvantages of using wind turbines to generate electricity, and detailed description of how the blades on a wind turbine affect how much electricity it can generate.

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*Encourages the pupils to understand that even renewable power resources are not perfect, and engineers must make educated choices about which power resources to use.*

### BUILD ACTIVITY: BUILDING A WIND TURBINE (slides 63-67)

Practical, creative, team activity to design and build a small wind turbine. Turbine blade performances are then tested, and pupils evaluate their designs.

*Teambuilding activity encouraging critical creative thinking to understand and apply the principles of generating electricity. Discussion of performance issues and relevant design adjustments.*

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**KEY RISKS:** Use of scissors with card and cardboard – mitigate risk through use of safety scissors, advise children of the risks and maintain supervision of activity.

### WHAT YOU CAN DO & LOOKING AFTER ELECTRICITY (slides 68-72)

Revisits the impact to people's lives when they do not have access to electricity. Explains that engineering can be used to ensure that everyone has access to electricity. Brief overview of electricity conservation actions individuals can undertake, and how engineers are developing ways of saving energy. Final written activity for pupils to identify what they have learned in the workshop.

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*Helps pupils understand how their actions can have an impact on the world and encourage self-reflection.*

### REFLECTIONS ON LEARNING (slides 73-75)

Recaps the learning objectives accompanied by quizzing the pupils on the key messages and lessons from the workshop. End of the workshop. Gives the pupils an opportunity to ask any questions they have about the workshop, STEM, or higher education.

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## **GUIDANCE FOR ADJUSTING WORKSHOP LENGTH**

### **LENGTHENING THE WORKSHOP TO 120 MINUTES**

Increase the workshop length by spending more time on activities such as taking answers from pupils, designing and building the wind turbine, and taking questions at the end of the workshop.

### **DECREASING THE WORKSHOP TO 60 MINUTES**

Save time by focusing more on talking through the slides, and asking closed questions to maintain pupil engagement, rather than open questioning and pupil discussion. As well as this, you can decrease workshop length by:



- Cut **slide 41**, about generating electricity.
- Cut the optional 'REFLECTION ACTIVITY' on **slide 44**.
- Remove the 'TASK' from **slide 54** and talk through **slide 55** with the help of suggestions from the class, rather than having the class discuss in pairs.
- Cut **slides 61-62**, which cover the advantages and disadvantages of using wind turbines to generate electricity.

## SPLITTING THE WORKSHOP INTO TWO 60 MINUTE SESSIONS

LESSON NUMBER	SLIDES TAUGHT	LEARNING OBJECTIVES MET	TIME TAKEN (MINUTES)
<b>1</b>	<b>1-45</b>	Understand the importance of electricity and access to it is not equal.  Describe the role of an engineer in bringing about access to electricity.  Consider the challenges engineers face to give people around the world access to electricity.	<b>50</b>
<b>1</b>	<b>73-75</b>		<b>10</b>
<b>2</b>	<b>1-4</b>	Describe the role of an engineer in bringing about access to electricity.	<b>10</b>
<b>2</b>	<b>6-9</b>		<b>10</b>
<b>2</b>	<b>46-75</b>	Design your own model wind turbine.	<b>50</b>

## PREPARATION

### PRESENTATION

Familiarise yourself with the slides and accompanying slide notes. Know how long each section of the workshop should take. If you are delivering the workshop in a small team, decide how to split delivery of the sections up between you.

### MATERIALS & RESOURCES

The activities are an important part of the workshop, so spend extra time ensuring you have all the materials for these well in advance of the workshop date. Printouts are also needed for the workshop and are available to download. A checklist is provided, so check carefully to make sure that you have all materials and resources before the scheduled workshop. Ask the school in advance if they can provide any of the materials or equipment for the workshop and inform them of the amount required.





## ROOM SETUP

A normal classroom is fine for this workshop but check that it is okay to do the build activity in this environment. Ensure pupils tidy as much as they can before they test their turbine. Be prepared to help clean up afterwards. Enquire about audio-visual facilities at the school as you will need to be able to present a PowerPoint slide show.

## GETTING FEEDBACK

Ensure you know how you are going to receive feedback. The guidance provided in these resources indicates how to get feedback from the pupils during the final section of the workshop. Please request feedback from the teacher/youth group leader using these online forms **before** and **after** the workshop. See the Engineers Without Borders Ambassador's handbook for further guidance on asking for feedback from teachers/youth group leaders.

## PHOTOGRAPHY

We would really like photos for our publicity materials and rely on you to send us photographs of your workshops to show our work in action. Ensure you have asked for permission for photography from the school and that you follow any procedures they have in place. Photographs should be high quality and preferably of landscape orientation. Submit photos to [outreach@ewb-uk.org](mailto:outreach@ewb-uk.org) with captions to describe them.

## MATERIALS & EQUIPMENT LIST

Read the activity notes to understand any preparation you need to do. You will need to calculate how much you need depending on the total class size and number of groups you are delivering the workshop.

Item	Number required
<b>FOR PRESENTATION</b>	
Laptop/computer connected to projector	1
Power for Everyone Everywhere PowerPoint presentation	1
Flip chart, A3 or A4 paper for starter activity	2 per group (optional)
<b>FOR CASE STUDY CARD SORT</b>	
Case Study Card Sort Printouts	1 set of cut cards per group
Envelope	1 per set of cards
<b>FOR BUILD ACTIVITY: MAKING A WIND TURBINE</b>	
Build Activity Printouts	1 worksheet per group
Pens/pencils	1 per pupil



Recyclable Paper Straws	10 per group
Card (A4 suggested)	10 pieces per group
Cardboard (A4 size suggested)	5 pieces per group
Sellotape	1 per group
Safety scissors	At least 1 pair per group
Cotton reel (without cotton if possible)	1 per group
'Turbine Tower'	1
Hairdryer (you might need an extension cable)	1
<b>FOR REFLECTION ACTIVITY: ELECTRICITY ACCESS SENARIOS</b>	
Reflection Activity Printouts	1 card per group
<b>FOR REFLECTIONS ON LEARNING &amp; GETTING PUPIL FEEDBACK</b>	
Large sticky notes ('super' size if possible)	Enough for up to 4 per pupil
Large board for sticking the sticky notes on	1

## ACTIVITY NOTES

### HOW DOES EVERYONE EVERYWHERE GET ACCES TO ELECTRICITY: CARD SORT ACTIVITY

The activity encourages pupils to engage with the information within each case study. The case studies each present a location, electricity access issue and solution that communities have employed.

#### Preparing the materials

- Read through all instructions as well as speaker's notes in **slides 20-37**
- Source the cards from the printouts document well in advance of the workshop
- Consider how many sets you will need (this is best as a paired activity)
- Make sure the cards are cut up and placed in envelope sets PRIOR to attending the workshop to save time (you may wish to number the sets)

#### Delivery instructions

- Read through the example case study on **slides 21-24**
- Encourage pupils to sort the cards to decipher the story of each case study. Prompt them to read all the information on each card. Encourage groups that finish quickly to think and discuss the challenge questions displayed on **slide 37**
- Use the slides to go through correct card matching and highlight overall message of each case study
- Ask pupils to return the cards to the envelopes at the end of the activity



## BUILD ACTIVITY: BUILDING A WIND TURBINE

This activity allows pupils to explore the principles of wind turbine movement, apply them and work in teams to plan and build a model wind turbine. Turbine performance is evaluated after testing.

### Preparing the materials

- Read through all instructions as well as speaker's notes in **slides 63 - 67**
- Source all the materials and print printouts well in advance of the workshop
- Make your 'Turbine Tower'. This needs to allow the cotton reel at the centre of the pupil's turbines to attach to a rigid base for the hair dryer test. You can either make use of the school's own retort stands and clamps, make something to hold by hand, or build a free-standing base. To make something to hold by hand, the simplest option is to use a plank of wood (approx. 2.5cm deep, 4 cm wide, 40cm tall), drill a hole towards one end on the wide face and fix a pencil in the hole. Check your cotton reels can fit onto the pencil and rotate without resistance
- Either before you arrive if there is time before the class enter the room, group the materials for ready for the activity, to save time and confusion

### Delivery instructions

- Read out the information about the underlying principles of wind turbine movement from **slide 65**
- Read out the activity instructions to the class from **slide 66**
- Split the class into groups of between 2-5 pupils
- Give each group a worksheet to produce labelled designs their turbine blades (10min). Remind pupils of time limits
- After the designs are completed, give each group their materials and tell them to get started making their wind turbines. Remind pupils to follow their design sheets and reiterate the time limit for building (10-15 mins)
- Encourage the pupils throughout, highlighting skills they are showing that are important for engineering. Provide help where needed, referring back to turbine movement. Keep them to time
- When the time is up, move onto the instructions on **slides 68-69**
- After testing, encourage pupils to complete the evaluation section on their worksheet
- Lead by example to clear up during and afterwards, leaving as little mess as possible



## REFLECTION ACTIVITY: ELECTRICITY ACCESS ISSUES

This activity allows pupils to consolidate their learning regarding the issues that arise due to lack of access to reliable electricity and explore some of the causes of this.

### Preparing the materials

- Read through all instructions as well as speaker's notes on **slides 46-47**
- Source all the scenario cards in the printouts document well in advance of the workshop. Consider in advance how many cards you will need (extras can be given as extensions to groups that complete the activity quickly)
- Make sure the printouts are cut up PRIOR to attending the workshop to save time

### Delivery instructions

- Take the group through the activity following the instructions on **slide 44**
- Encourage the pupils think about what they have learned through the session, to analyse the challenges. Reassure pupils that there are no right or wrong answers
- Encourage the pupils throughout, provide help where needed and keep them to time
- When time is up, ask one person from each group to present a short summary of their analysis (limit to 1 or 2 sentences to save time)

## REFLECTIONS ON LEARNING & GETTING PUPIL FEEDBACK

This activity allows pupils to reflect on their learning from the session as well as enabling you to collect feedback from them about the key points that they have remembered.

### Preparing the materials

- Read through all instructions as well as speaker's notes in **slide 73**
- Source all the materials well in advance of the workshop

### Delivery instructions

- Read out the activity instructions to the class from **slide 73**
- Encourage the pupils throughout, provide help where needed and keep them to time
- When the time is up, ask the pupils to bring up their sticky notes and add them to the board you have brought with you
- Clear up during and afterwards, leaving as little mess as possible

## ABOUT ENGINEERS WITHOUT BORDERS UK

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Engineers Without Borders UK brings people, ideas and engineering together to deliver solutions to the world's most pressing problems. Our vision is a world where everyone has access to the engineering they need for a life free from poverty. Where engineering is for everyone, everywhere.

We are inspiring change in engineering education at all levels and we are working in collaboration with our partners to overcome global challenges by bringing access to engineering technology and infrastructure: We believe that together we can create a new generation of globally responsible engineers.

This resource is part of our Outreach Initiative. This initiative is shifting the perception of what engineering is about in the youngest members of society through delivering engagement activities in schools and youth groups, in doing so inspiring them to become the next generation of globally responsible engineers.

For more information please visit our website: [www.ewb-uk.org](http://www.ewb-uk.org)

## ACKNOWLEDGEMENTS

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This workshop builds on our previous resource 'Power for the World' and sister resource 'Water for the World'. It is therefore the result of many years of collaborative effort between Engineers Without Borders UK, our volunteers, teachers and other partners such as Engineers Without Borders Canada, Arup and Practical Action. We'd like to thank everyone who has been involved to date and in particular our current Outreach Initiative sponsors - EuropeAid and the Alcoa Foundation - for helping to make 'Power for Everyone Everywhere' a reality.



This resource and the accompanying materials are available to download from:  
<http://www.ewb-uk.org/power-for-everyone-everywhere>.



This project has been funded by the European Union.