THE ROYAL SOCIETY

Can we reduce our school's use of fossil fuels by generating renewable energy on site?

1. Project overview

Duration of project
2 terms minimum to cover seasonal variation. Easily repeatable year-on-year
Can be considered as part of the Tomorrow's Climate scientists programme

Through this project students will be able to investigate the production of renewable energy on their schools' grounds and whether this can offset or completely replace the use of fossil fuels They will discover and gain a greater understanding of domestic energy consumption, energy transfer and storage, learning about how to create or capture energy through two common renewable sources. Working with their STEM partner, the students will be able to explore solar and wind power, evaluating the best conditions and locations for renewable energy sources to be used onsite and communicating their findings with the wider school community. Linking strongly to the curriculum, this project will enable teachers to inspire the next generation of engineers and renewable energy specialists. Details of the investigative work required to support this project can be found in section 4.

2. Student involvement

This project is aimed at secondary school students aged between 11 – 16, however, it could be adapted to suit other age groups and abilities. This project can be adapted to suit large groups, from clubs to whole year groups or larger, and we encourage projects to be as inclusive as possible. The project can be used to engage a wide variety of students in the school. For example:

1. older students mentoring younger years to engage with the observation and monitoring sections of the investigation
2. students with an interest in art and design helping to communicate the findings of the project to the wider school community via media such as video, posters etc.
3. students with an interest in design helping to locate or build the renewable energy systems to test.

3. STEM partner involvement

Funding will only be offered to schools that can demonstrate a strong partnership. The partnership can either be with one individual STEM partner or a team of STEM partners. If there is a team of STEM partners, one must be identified as the lead STEM partner for the application process and must have sustained and meaningful engagement (in-person or online) with the students and teacher throughout the duration of the project. Other STEM partners in the team can support the project, if needed, to provide specialist knowledge or to help spread the time commitment and ensure the students have regular STEM partner engagement. For a two-term project such as described here, we would expect a ***minimum of 7 in-person visits over the course of the project***, undertaken by any of the STEM partners involved. The STEM partner(s) will provide the students with relevant guidance and knowledge to help them with their investigations, as well as an insight into potential careers.

The main role of the STEM partner(s) is to support the planning, design and implementation of the investigation that the students will carry out. Examples of how the STEM partner(s) could support the implementation of the investigations include (but are not limited to):

- supporting students to form their own hypotheses
- supporting students to set up their investigations following the scientific method

- helping provide secondary research sources and support the understanding of technical information
- helping with data collection and identification
- helping the development and implementation of student plans to locate and explore the efficiency of different renewable energy supplies
- helping with any building or design elements

Other activities that the STEM partner could get involved with are:

- arranging a visit to their place of work
- providing an introductory talk to the project group, or whole school, regarding their career and the relevance of this to the project being undertaken; and
- supporting the students end of project presentations.

Examples of STEM partners that could support this project are university or industry-based researchers, with a degree or equivalent background in a subject such as renewable and sustainable energy, mechanical engineering, aeronautical engineering and electrical engineering. Professionals who are working in the energy sector, especially regarding new and emerging renewable technologies or innovation and technology development.

For more information about the STEM partner eligibility requirements and guidance on how to find a STEM partner, please read the What is the partnership page on our website.

4. Investigation options

The following investigations described in the plan below will underpin this project and help the students answer the project title question. Please note some of the investigations may need to take place in parallel rather than sequentially throughout the year. The individual investigations suggested may need to be adapted or altered, dependant on the school grounds and space available. Teachers can also add in additional investigations and other project elements as required.

Project plan	Equipment suggestions
Initial survey: Identify how much energy the school consumes and what proportion is from fossil fuels. Research alternative energy providers/tariffs to recommend options that could increase the energy provided from renewable sources at the same or less cost.	
Baseline data collection: Explore energy wastage in the school, looking at areas such as heating, lighting and power usage. Estimate how much energy could be saved through simple behaviour changes and suggest an approach to communicate these to school attendees to affect change. If suggestions are implemented measure the real-world effect this has on school energy use.	Thermal camera Temperature data loggers Poster supplies
Secondary research:	Mini solar panels cells Mini wind turbines

Carry out secondary research to learn about the efficiency of the solar panels and mini turbines purchased. Using local weather data, estimate the potential energy that could be produced on site.	
Main Investigations: 1. Consider the variables that could affect energy production via the solar cells, deciding on locations within the school grounds to measure the energy collected. Collect data on energy production and estimate the average energy production for the year to help identify the best site(s) to maximise energy capture. Common variables include: location, angle to sun, height, time of day, time of year, weather conditions (especially cloud cover). 2. Repeat the investigation above for the mini wind turbines. Common variables include: height, time of day, time of year, weather conditions, movement of wind on site (especially considering the effect of buildings and large trees). 3. Compare the data gathered onsite, the cost of equipment, maintenance and replacement to determine if wind or solar power would be the best option for the school to long term to reduce the use of fossil fuels, and by how much. a. Different sizes of solar panel or wind turbine could be researched or tested to see if there is a correlation between the size of the equipment and the energy being harnessed. b. A comparison of different types of solar panel and wind turbine could also be undertaken to explore if there is a more efficient design that should be used.	iPads/software to capture data from solar panels. Mounting equipment to ensure panels are securely installed Wi-Fi connected weather monitoring station iPads/software to capture data from mini turbines. Mounting equipment to ensure turbines are securely installed Anemometer Alternative size wind turbines and solar panels.
Wider communication: Communicate the results to the wider school community; methods could include information leaflets/posters, school assemblies, getting other years practically involved in the project, or a short film.	Please note: additional film grants towards a camera / software / microphones etc. are available to grant holders.

A suggestion of essential equipment and supplies needed to undertake each of the parts of the project has been listed to assist you when putting together your budget. Please also consider any relevant additional costs permitted within the scheme, such as teacher cover, essential teacher CPD and/or travel costs for project related visits. For more guidance, please read the eligibility and judging criteria page on our website.

5. Benefits and skills

Involvement in a long-term investigative project should enable students to have an in-depth experience of working scientifically as well as developing their general team working and communication skills.

Through this project the students will specifically learn about energy use, transfer and generation/capture in a real-world context, gaining detailed knowledge about solar and wind energy production as well as a broader understanding of energy bills, energy resources and the impact they can have on their use. They will learn skills in research, observation and monitoring, data capture, data analysis and problem solving. Dependant on the exact investigations and activities you propose to undertake, there may be additional benefits and skills you can identify in your application.

6. Legacy activities

It is important that Partnership Grant projects are sustainable, providing long-term benefits to your students and wider school community in terms of the teaching and learning of STEM subjects.
Your legacy activities could include (but are not limited to):

- repeating the project with successive year groups
- re-using the equipment to test additional conditions or locations or gather evidence on the long-term impact of the student's renewable energy interventions
- testing out new renewable energy sources such as water, tidal or heat sinks to determine their suitability, energy production and efficiency onsite
- expanding the project to include other schools in the area, loaning out the solar panels and mini wind turbines to collate more evidence to compare with your own.

7. Next steps

1 - Securing your STEM partner

Using the information about STEM partners above, search for universities and businesses within reasonable travelling distance to you that might have suitable contacts to approach. A good route to finding these contacts is often your own school's Governors and student's parents, another is the national STEM Ambassador scheme. Once you have a few contacts in mind, write an email/letter inviting them to be involved in the project, providing clear and concise information about areas you need support with, the time commitment you are expecting, and the duration of the project. If you need further advice as to how to find a STEM partner, please contact the Schools Engagement team directly via education@royalsociety.org .

2 - How to start an application

This project is ideally started in the spring term to allow the project to run at least two terms across strong seasonal changes. To get the funding secured and paid in time, you will need to submit the full grant application for the June deadline in the academic year before. An example timeline is given below, and more information about The application process and timelines can be found on our website.

You can access the application form via the Royal Society's grant management system called Flexi Grant: https://grants.royalsociety.org/. When you first create your log-in and access Flexi Grant several grants will be visible on the screen. Please make sure you choose the ***Partnership Grants stage 1*** form to start.

3 - Where to get more information

You can find full information about the Partnership Grants scheme, including eligibility and judging criteria, application guidance and exemplar forms via our website: www.royalsociety.org/partnership

If you have specific questions about your project idea, STEM partner or application, please either attend one of our online training sessions or please contact the Schools Engagement team directly via education@royalsociety.org .