Can the school use new technology and renewable energy resources to reduce both its energy bills and its carbon footprint?

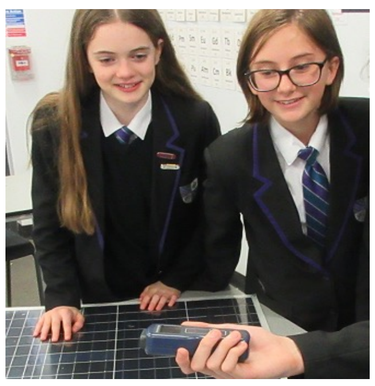
Magnus Church of England Academy
Fujitsu; University of Birmingham

Overview

The project is trying to quantify by how much the school's use of electricity from the grid could be reduced if it undertook both energy reduction and energy generation programs. It will look at the use of renewable energy sources including solar panels and wind turbines. The project will also consider the school's carbon footprint and which steps to reduce it would be the most effective. New technologies for the smart management of energy use in buildings will be investigated with the support of Fujitsu and the University of Birmingham.

Aims

- Examine the school's energy bills and determine the main drivers of energy use.
- Estimate the energy that could be generated by using solar panels on school buildings.
- Estimate the energy that could be generated by wind turbines installed around school.
- Validate the estimates by collecting primary data using equipment bought for the project.



Solar panel and solar irradiance meter

Background information

One way of understanding the school's energy use is by examining the bills from electricity and gas suppliers, however this does not show us where the energy is being used – therefore a means of measuring the consumption of different devices is required. Also, knowing the maximum output of a single solar panel or wind turbine does not give us a realistic view of how much electricity they can generate – so we need to estimate both how many panels and turbines could be fitted along with how their output would vary throughout the year.

Methodology

1. **Energy usage**. Students have looked at energy bills and installed energy monitoring devices in various locations to measure the consumption of different devices over time.
2. **Solar panels**. Students have attempted to measure the amount of suitable roof space on school buildings by making measurements at ground level. They have used estimated irradiance figures to calculate daily generation figures for each month of the year.
3. **Wind turbines**. Students will repeat the solar panel calculations for small wind turbines to estimate daily generation figures.
4. **Weather station**. Data will be collected by a weather station recording the wind speed and direction and solar irradiance over time.

Energy monitor

Wind turbine

Results and conclusion

Early results show the estimates of significant potential cost savings made by installing solar panels.

Daily Irradiance		Monthly	Annual	Daily Output (kWh)	Monthly Output (kWh)
Jan	1.1	34.1		83.6	2591.6
Feb	1.96	54.88		148.96	4170.88
Mar	2.57	79.67		195.32	6054.92
Apr	3.36	100.8		255.36	7660.8
May	3.91	121.21		297.16	9211.96
Jun	3.78	113.4		287.28	8618.4
Jul	3.85	119.35		292.6	9070.6
Aug	3.65	113.15		277.4	8599.4
Sep	2.93	87.9		222.68	6680.4
Oct	2.16	66.96		164.16	5088.96
Nov	1.33	39.9		101.08	3032.4
Dec	0.94	29.14		71.44	2214.64
			960.46		
Single Panel (kWp)	0.38			**Total**	72994.96
Panel capacity (kWp)	76				
Number of panels	200				
Annual output (kWh)	72994.96				
Potential Saving	£ 24,818				

Conclusion

Students have estimated that more than 300 solar panels could be fitted to the roof of various school buildings. They have calculated that even if 200 panels were installed, they could potentially generate more than £24,000 worth of electricity per year at current rates.

Anemometer

Next steps

Students will log data from the weather station to build up a picture of solar irradiance and wind for different times of the year. A classroom system with a battery and inverter connected to solar panels and a wind turbine will be installed and used to verify the project's findings.

Weather station

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