Sun|trek project provided by Alan J. Yate

SOLAR FARMS – A CASE STUDY


One of the best examples of a solar farm can be found in Cambridgeshire, near the village of Wilburton.

The solar farm now has an area of about 117.5 acres (2014) and produces about 19.3 Megawatts (MWp) which will supply 4,800 homes with renewable electrical energy for the next 25 – 30 years.

This project started in 2011 with a 31-acre site and 20,000 photovoltaic panels (PV panels) and has now grown to 117.5 acres and a total of nearly 96,000 PV panels.

When the PV panels are built, the spacing between them is very important because, if they are too close to each other, one panel may cast a shadow over the next panel as the Sun moves across the sky. This would obviously result in less sunlight being collected and converted into electricity.

Of course, if you have completed the other part of this resource (Collecting Energy from the Sun), you will already know that PV panels produce direct current (dc) from light energy. In order to send this electrical energy through the National Grid system (pylons), it has to be changed to alternating current (ac). This is done with ‘inverters’. Wilburton Solar Farm has a total of 28 inverters.

To find out more about dc and ac current follow this link.

http://science.howstuffworks.com/electricity8.htm
https://www.youtube.com/watch?v=xyQfrzBfnDU

To find out more about inverters, follow this link:

http://www.gosolar.net/residential-solar-power/what-is-solar-energy/

Click on the ‘Featured Video’ in the box on the right of the screen.
An interesting thing about the Wilburton solar farm is that the original site of 31 acres (2011) had the panels at a tilt of about 25°, but the new part of the site (2014) has the panels at a tilt of 35°. This allowed the engineers to reduce the spacing between the rows, so putting in more PV panels, whilst still making sure that there were no shadows produced. As a result the overall power generation per hectare increases.

The company who produced the solar farm (Lightsource) says that the many thousands of connections and kilometres of cables on site means that maintaining and repairing the plant has a much larger impact on annual electricity generation than anything else. There is also the issue of dust and other airborne pollution e.g. algae and bird droppings. If the panels get a coating of dust and dirt then less light is absorbed by the PV cells and so less light is converted into electricity. Therefore the panels are cleaned four times a year with water and a soft brush. The solar farm is also visited 12 times a year by an Operations and Maintenance team.

Monitoring performance of the solar farm is very important, so every 30 minutes performance data are sent to the main office so that engineers can study how efficient the solar farm is over a year. The company has also noticed that over the two year period separating the installation of the different arrangements of panels, the efficiency of the PV panels has increased because of improvements in the making of the panels, the angle of tilt and the spacing between the panels.

Solar Farms – A Case Study - Questions.

Now you have completed this section, please answer the following questions:

1. If 1 hectare (Ha) = 2.471 acres – how many hectares is the solar farm in Wilburton in 2015?
2. What is the area of the new site built in 2014?
3. A Megawatt = 1,000,000 Watts (1 million or $10^6$ Watts). A kilowatt (kW) = 1000Watts ($10^3$ Watts). A one bar electric fire uses 1 kW. How many 1 bar electric fires will the solar farm in Wilburton power?
4. How many PV panels per acre are there on the 31-acre site? Hint: the word ‘per’ means ‘divided by’ (as in percentage meaning divided by 100 e.g. 50% = 50/100 = ½ or 0.5).
5. How many panels are there per acre on the site built in 2014? Hint: remember that the whole solar farm consists of two sites built at different times and the description does not tell you the area of the ‘new’ site built in 2014 – you have to work it out!
6. What conclusion can you come to from your answers to Questions 4 and 5?
7. How many PV panels per acre are there on the whole solar farm?
8. The angle of tilt of the panels has been changed as the solar farm has been developed. What effect has this had on the efficiency of the PV panels system?
9. What other variables do you think has improved the efficiency of the solar farm?
A WALK ON THE WILD SIDE – Questions

1. How big is the solar farm in acres?
2. How many solar PV panels are there on the solar farm?
3. How much power does the solar farm produce?
4. What does MWp stand for?
5. What does ‘PV’ stand for?
6. Where is the solar farm situated?
7. Why is a solar farm helpful in increasing biodiversity in the countryside?
8. List the names of animals which have benefitted from the shelter of the solar farm.
9. How many acres of the site are occupied by the PV panels? Show all your working clearly.
10. (i) What has been the increase in English Partridge breeding pairs on the solar farm?
    (ii) What is the percentage increase? Show all your working clearly.
    (iii) Write down 3 advantages that the solar farm has provided for the English Partridge.
11. How many households does the solar farm provide electricity for?
12. How much CO₂ does the solar farm save each year?
13. What is the angle of tilt of the PV panels?
14. How high are the PV panels?
15. Write down the advantages of solar farms. Hint: you should find about 6.
16. Write down the disadvantages of solar farms. Hint: you should find about 5.
Plans have been entered to expand Mingay Farm in Wilburton

With thanks to LightSource Renewable Energy Limited,
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