



Name ..... Class ..... Date .....

You are a Renewable Energy Consultant working with INEOS TEAM UK to measure the output of their solar array. Complete the tasks to help them make the most of their renewable energy and increase their sustainability.



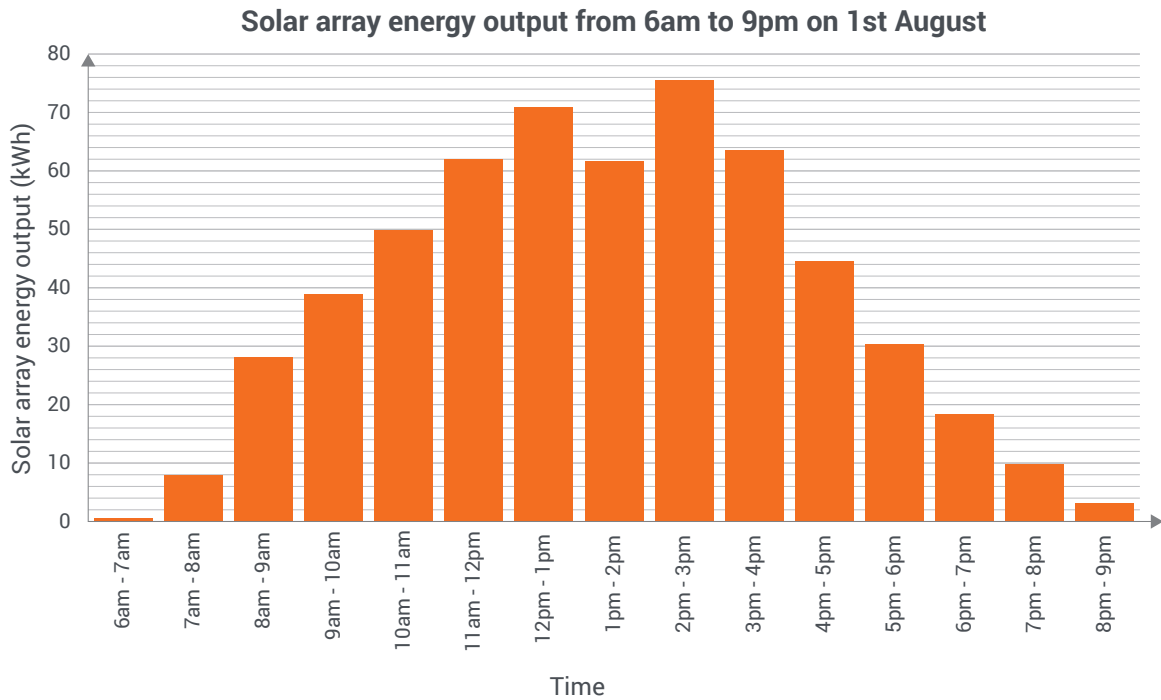
**Mark Rogers: Facilities Manager at INEOS TEAM UK**

Mark helps to ensure the INEOS TEAM UK base is as energy efficient as possible.

The INEOS TEAM UK base has a fantastic solar array on the roof. To ensure they are reaching their sustainability goals, Mark and the team need to ensure it's working at its best, and understand the impact that it has.

**Task 1: Changes With Time**

**1** The chart below shows the hourly energy output of the base's solar array, in kWh.



**a** How much energy was produced between 12pm and 1pm?

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**b** How much more energy was produced between 2pm and 3pm than between 9am and 10am?

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**c** Which two one-hour time periods produced the same amount of energy?

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**d** At what times does the base produce more than 70kWh of energy?

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## 2

**a** Describe and explain what happens to the power output throughout the day.

- When does it increase? When does it decrease?
- When does it reach a maximum?
- What causes these changes?
- What could have caused the dip between 1pm and 2pm?

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### 3

The table below shows equipment used in the base's offices.

- a Calculate the total power needed to run all the equipment. The first line is done for you.

80 desktop computers x 110Wh = 8800Wh

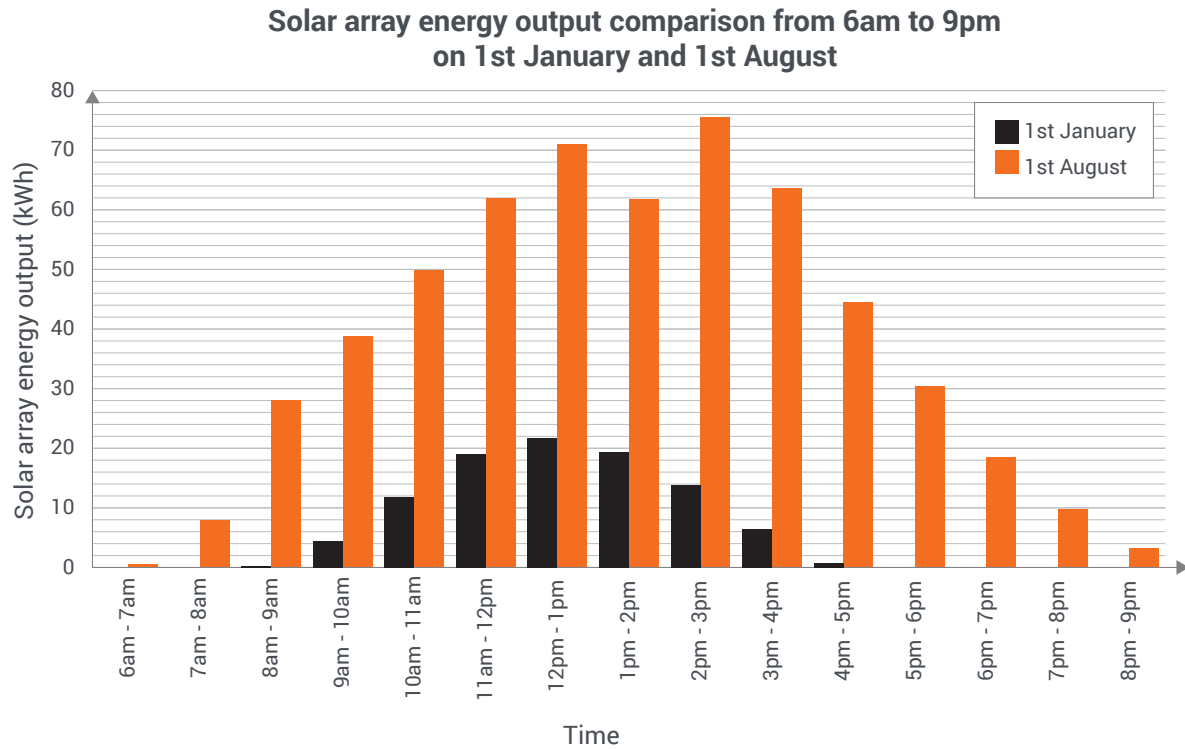
Equipment	Quantity	Energy used in 1 hour (Wh)	Quantity x energy (Wh)
Desktop computer	80	110	8800
TV screen	12	75	
Lights	22	25	
Air conditioner	8	1000	
		<b>Total energy over 1h</b>	

- b What is the total energy in kWh (remember kilo = 1000)?
- .....
- c Draw a horizontal line on the chart in question 1 to show the total power that all these devices require.
- d At what times do the solar panels produce enough power to run all the equipment?
- .....



## Task 2: Changes With Season

The chart below compares the solar array's output on a single day in summer (1st August) and winter (1st January).



- 4**
- How much more energy is produced on 1st August than 1st January between 10am and 11am?  
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  - How many hours does the base produce energy for on 1st January? Ignore hours where solar output is below 1kWh.  
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  - During which one-hour time period is there the biggest difference between the energy output on 1st January and on 1st August?  
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  - Between 12pm and 1pm, the base produces more than three times as much energy on 1st August than 1st January. True or false?  
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# 5

**a** Describe and explain the difference between the energy output on 1st January and 1st August. For both days, think about:

- the difference in maximum output
- the time of the maximum output
- the number of hours power is produced for.

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**b** At what times could the equipment in **question 3** be run using only solar power on 1st January?

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### Task 3 (Extension): Electricity At Home

The INEOS TEAM UK base uses a large solar panel array, but lots of people also choose to have smaller arrays on their homes. These may consist of just a few panels.

**6** Some power requirements for common household devices are in the table below.

Device	Power requirement	Number of panels needed in summer (110W each)	Number of panels needed in winter (30W each)
42" TV	75W	$75 / 110 = 0.7$ panels	$75 / 30 = 2.5$ panels
Xbox One	110W		
PlayStation 4	137W		
Laptop	70W		
Washing machine	500W		
Kettle	2200W		

The output of one panel at 11:30am is 30W on 1st January and 110W on 1st August.

- Complete the table above to find out how many solar panels you would need on your roof to run each device completely on solar energy at 11:30am on 1st January and 1st August.
- Using your knowledge of solar panels from the previous graphs, if you had one solar panel would you be able to run your Xbox all day (7am–7pm) on 1st August on solar energy? Explain your reasoning.

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**c** Extension: what could you do to reduce your electricity bill at other times?

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