Costing The Earth: TEACHER'S NOTES

National Curriculum
Maths – Problem solving, calculations
Science – Energy resources and communications

Electrical appliances use energy which is measured in units. A unit of electricity is a kiloWatt hour (kWh).On electrical devices there is a label that tells you how much power the device requires. Using this information you can calculate how much it costs to run the device. This tells you the power it needs in watts or kilowatts. 1 kilowatt = 1000 watts. To work out how many units of electricity you have used multiply the wattage of the appliance by the number of hours used.

Power(kW) x time (hours) = Energy used (kWh)

Aims
- To highlight the financial cost of electricity.
- To lead on to the topic of waste and its reduction.
- To reinforce the relationship between power and energy.

Resources
Collection of electrical equipment for example, a light bulb, 2 bar electric fire, mobile phone, laptop, telephone etc.

Timing
40 mins – 1hour

Outcomes
Every student should understand that wasting energy is not only bad for the environment but also expensive. Every student will understand how electricity is measured and the relative costs of different activities.

Task
Explain that in the UK electricity is measured and paid for in units.

1 kiloWatt = 1000 watts. (1 Watt is 1/1000 or 0.001kW)

One unit of electricity is equal to 1 kiloWatt hour (kWh)

There are 10 bulbs. Each bulb is 100 watts
10 x 100 watt light bulbs left on for 1 hour would use 1 unit of electricity or 1kW

A 2kW fan heater left on for half an hour would use 1 unit of electricity. (power x the time in use)
2000W x ½ = 1000 watts per hour = 1kWh

Use Table 1 below and look at the first row.

Background Information
For more information on the amount of electricity we use and the cost see

DUKES Digest of UK Energy Statistics 2011 (DECC)
http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx

Answers:
1 watt = 1 /1000kW or one thousandth of a kiloWatt = 0.001kW
x 24 hours in a day
x 7 days in a week
x 4 weeks in a month
x 12 months in a year
x 15p per unit

Table 1. Translating Watts into units of energy and costs

	kWh	kWh/day	kWh/week	kWh/month	kWh/year	Cost at 15p per unit
1W	1/1000= 0.001	0.024	0.168	0.672	8.064	£1.21
5W	5/1000=0.005	0.12	0.84	3.36	40.32	£6.05
100W	100/1000=0.1	2.4	16.8	67.2	806.4	£120.96
1 kW	1	24	168	672	8064	£1209.60
2 kW	2	48	336	1344	16128	£2419.20
3.5kW	3.5	84	588	2352	28224	£4233.60

Questions:
1a) The average tumble drier uses 3.5kWh.
If you put your wet jeans into the drier four times a week for 2 hours each time how much money would drying your jeans cost?
3.5 x 8 = 28kWh x 0.15 = £4.20 per week

1b) How much would it cost to dry your jeans per year?
4.20 x 52 = £218.40 per year

2. The average mobile phone uses 5W. If you left it on charge overnight for 8 hours how much would it cost you per year?
0.005 x 8 = 0.04 x 0.15 = £0.006 x 365 = £2.19 per year

3. An Xbox uses 180W. If you use it for 4 hours a night for 6 weeks how much would it cost you?
0.18 x 168 = 30.24 x 0.15 = £4.54 for 6 weeks

Discuss with the class how they could reduce their electricity consumption.

Costing the Earth: WORKSHEET

Electricity in the UK is measured and paid for in units.

1unit = 1 kiloWatt hour (kWh) = 1000 watts

So 10 x 100 watt light bulbs left on for 1 hour uses 1 unit of electricity.

10 x 100 x 1 = 1000 watts per hour = 1kWh

2kW fan heater left on for half an hour would use 1 unit of electricity.
2000 x ½ = 1000 watts per hour = 1kWh

Using these examples complete Table 1.

Table 1. Translating watts into units of energy and costs

	kW Hour	kWh/day	kWh/week	kWh/month	kWh/year	Cost at 15p per unit
1W	1/1000= 0.001	0.024	0.168	0.672	8.064	£1.21
5W				3.36		
100W		2.4				
1 kW	1				8064	
2 kW						
3.5kW						

Now answer the following **questions**:

1. The average tumble drier uses 3.5kWh.
If you put your wet jeans into the drier four times a week for 2 hours each time, how much money would drying you jeans cost?

2. The average mobile phone uses 5W. If you left it on charge overnight for 8 hours, how much would it cost you per year?

3. An Xbox uses 180W. If you use it for 4 hours a night for 6 weeks, how much would it cost you?

Extension:
How much energy did you use before arriving at school today?

Appliance	**Power (Watts / kilowatts**
Colour TV	300W
Kettle	2.5kW
Computer	120 W
Immersion heater	3kW
Hair tongs	200W
ipod/mp3 player	30W

Think about hidden energy such as pumps for showers, electricity for toasters or the grill, lights etc.