**P3.1. How much energy do we use?**

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| **Learning Statements** | **Rating** | **Revised** |
| Understand that the demand for energy is continually increasing and that this raises issues about the availability of energy sources and the environmental effects of using these sources |  |  |
| Recall the main primary energy sources that humans use: fossil fuels (oil, gas, coal), nuclear fuels, biofuels, wind, waves, and radiation from the Sun |  |  |
| Understand why electricity is called a secondary energy source |  |  |
| Understand that power stations which burn fossil fuels produce carbon dioxide which contributes to global warming and climate change |  |  |
| Understand that when electric current passes through a component (or device), energy is transferred from the power supply to the component and/or to the environment |  |  |
| Recall that the power (in watts, W) of an appliance or device is a measure of the amount of energy it transfers each second |  |  |
| Use the following equation to calculate the amount of energy transferred in a process, in joules and in kilowatt hours:  **energy transferred = power x time**  (joules, J) (watts, W) (seconds, s)  (kilowatt hours, kWh) (kilowatts, kW) (hours, h) |  |  |
| Use the following equation to calculate the rate at which an electrical device transfers energy:  **power = voltage x current**  (watts, W) (volts, V) (amperes, A) |  |  |
| Understand that a joule is a very small amount of energy, so a domestic electricity meter measures the energy transfer in kilowatt hours |  |  |
| Calculate the cost of energy supplied by electricity given the power, the time and the cost per kilowatt hour |  |  |
| Interpret and process data on energy use, presented in a variety of ways |  |  |
| Interpret and construct Sankey diagrams to show understanding that energy is conserved |  |  |
| Use the following equation in the context of electrical appliances and power stations:  efficiency = energy usefully transferred x 100  total energy supplied  or  efficiency = power usefully transferred x 100  total power supplied |  |  |
| Suggest examples of ways to reduce energy usage in personal and national contexts. |  |  |

**P3.2 How can electricity be generated?**

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| **Learning Statements** | **Rating** | **Revised** |
| Understand that electricity is convenient because it is easily transmitted over distances and can be used in many ways |  |  |
| Recall that mains electricity is produced by generators |  |  |
| Understand that generators produce a voltage across a coil of wire by spinning a magnet near it |  |  |
| Understand that the bigger the current supplied by a generator, the more primary fuel it uses every second |  |  |
| Understand that in many power stations a primary energy source is used to heat water; the steam produced drives a turbine which is coupled to an electrical generator |  |  |
| Label a block diagram showing the basic components and structures of hydroelectric, nuclear and other thermal power stations |  |  |
| Understand that nuclear power stations produce radioactive waste |  |  |
| Understand that radioactive waste emits ionising radiation |  |  |
| Understand that with increased exposure to ionising radiation, damage to living cells increases eventually leading to cancer or cell death |  |  |
| Understand the distinction between contamination and irradiation by a radioactive material, and explain why contamination by a radioactive material is more dangerous than a short period of irradiation from the radioactive material |  |  |
| Understand that many renewable sources of energy drive the turbine directly e.g. hydroelectric, wave and wind |  |  |
| Interpret a Sankey diagram for electricity generation and distribution that includes information on the efficiency of energy transfers |  |  |
| Recall that the mains supply voltage to our homes is 230 volts |  |  |
| Understand that electricity is distributed through the National Grid at high voltages to reduce energy losses. |  |  |

**P3.3 Which energy sources should we choose?**

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| **Learning Statements** | **Rating** | **Revised** |
| Discuss both qualitatively and quantitatively (based on given data where appropriate), the effectiveness of different choices in reducing energy demands in:   * domestic contexts * work place contexts * national contexts |  |  |
| Understand that the choice of energy source for a given situation depends upon a number of factors including:   * + environmental impact   + economics   + waste produced   + carbon dioxide emissions |  |  |
| Describe advantages and disadvantages of different energy sources, including non-renewable energy sources such as:   * fossil fuels * nuclear * and renewable energy sources such as: * biofuel * solar * wind * water (waves, tides, hydroelectricity) * geothermal |  |  |
| Interpret and evaluate information about different energy sources for generating electricity, considering:   * + efficiency   + economic costs   + environmental impact |  |  |