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| **173** | Power can be generated from fossil fuels. They are **non-renewable** and will **eventually run out** as they were formed millions of years ago and cannot be replenished. Here are some examples of fossil fuels.1.2 fossil fuels |

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| **174** | **Coal** | Coal is converted into useful energy in power station by burning the coal to create heat. The heat is then used to turn water into steam to power a turbine.The heat from burning coal can also provide a heat source for smaller applications, such as in the home. |
| 175 | A large amount of electrical energy can be created from coal which is a reliable and stable form of energy.  |
| 176 | Power stations are efficient at converting energy and cost-effective once set up. |
| 177 | A large amount of pollution is produced, such as carbon dioxide, arsenic and sulphur, |
| 178 | The extraction of coal has environmental impacts on the landscape. |

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| **179** | Power can be generated from fossil fuels**. They are** Non-renewable and will eventually run out as they were formed millions of years ago and cannot be replenished |

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| **180** | **Gas (natural)** | Natural gas is found deep underground and is combustible. Like coal, gas can be burned in a power a station to create heat energy that will power a turbine to create electricity. Natural gas can also be used in the home for cooking and heating. |
| 181 | Large amounts of electrical energy can be created from gas, which is reliable and stable form of energy. |
| 182 | Cost-effective to extract as it is a ready-made fuel, and needs less processing and is cleaner than coal and oil. |
| 183 | Pollution is produced, such as carbon monoxide / dioxide, nitrogen and sulphur dioxide gas. |
| 184 | Extraction of gas will have an impact on the environment through emissions or damage to the countryside when **fracking.****1.2 Nuclear energy**  |

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| **185** | **Fracking** | Fracking is a way of extracting natural gas from rocks (called shale) below the Earth’s surface by injecting liquid at high pressure to force out the gas or oil. |

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| **186** | **Oil** | Oil is processed to provide different energy sources, such as petrol, diesel and paraffin. ItCan be used in power plants and for smaller factory and domestic use. |
| 187 | Power stations are efficient at converting the energy from oil and are cost-effective once set up. |
| 188 | A convenient source of power as the energy supply (petrol, diesel) is more portable, for example, in vehicles. |
| 189 | Oil processing factories produce a large amount of pollutants. |
| 190 | Impact of environmental disasters is high. |

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| **191** | Crude oil is also a key contributor to the manufacture of plastic |

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| **192** | Nuclear energy is energy that is stored in atoms of **uranium** and released by fission, in the form of heat energy |

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| **193** | Producing nuclear energy |
| 194 | Heat energy from nuclear fission produces steam to drive a turbine. |
| 195 | The turbine then drives a generator 9producing electricity). |
| 196 | A kilogram of uranium contains two to three million times the energy equivalent of oil or coal. |
| 197 | Wind farms require up to 360 times as much land area to produce the energy equivalent of a nuclear energy facility. |

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| **198** | **Advantages of nuclear power** |
| 200 | No need for a large amount of space to generate energy. |
| 201 | Does not produce carbon emissions or contribute to global warming or acid rain. |
| 203 | Reliable and not dependent on weather. |
| 204 | Low volume of waste produced so there is less pollution from the transport. |
| 205 | Nuclear power reduces demand for finite resources, such as oil. |

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| **207** | **Disadvantages of nuclear power** |
| 208 | Risk of nuclear accidents, which could be disastrous.  |
| 209 | Disposal of nuclear waste is very expensive and takes a long time to decay. |
| 210 | High levels of security are required due to the threat of terrorism. |
| 211 | Decommissioning nuclear plants safely is costly as there is a high risk of contamination. |
| 212 | Construction, operation and decommissioning of the reactor may harm the environment. |

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| **206** | Nuclear plants serving the UK are all located near the coast so that there is large water supply. |

**1.2 Renewable energy**

**1.2 Nuclear energy cont**

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| **213** | Renewable energy resources can be regenerated. They are used to make electricity without directly producing carbon emissions. They can be expensive to set up, but once these costs are paid for, the energy is very low cost. |

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| **222** | **Hydro-electrical** | Water is generally held in a reservoir and the release of the water will drive a turbine. |
| 223 | Large amounts of power are available on demand. |
| 224 | It is expensive to set up, and the construction of dams may harm the environment. |

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| **214** | **Wind** | Wind turbines create electricity through a generator and are located in areas where there is likely to be a consistent breeze. |
| 215 | They can be used in remote areas. |
| 216 | They can be unsightly or impede shipping if at sea. |
| 217 | The amount of wind can be unpredictable. |

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| **218** | **Tidal** | The movement of tidal water is harnessed to generate electricity. Artificial barrages can generate electricity. Artificial barrages can be constructed across tidal rivers and bays. |
| 219 | Large amounts of power are available and tides are predictable. |
| 220 | Barrages across estuaries cause ecological damage. |
| 221 | Only available in coastal areas. |

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| **228** | **Biomass** | Energy can be obtained from landfill gas from organisms, crops or alcohol fuels. Crops can also be grown to manufacture biodiesel (biofuel). Biomass also includes waste wood, which is burned. |
| 229 | Material that is generally regarded as waste can be used and is carbon neutral. |
| 230 | Some greenhouse gases such as methane are produced and it is less efficient as large areas of land are needed to generate enough material. |
| 231 | Growing biomass requires large amounts of water. |
| 232 | The change in land use can lead to deforestation if not managed correctly. |

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| **225** | **Solar** | Solar power can be converted directly into electrical energy (photovoltaics) or the thermal power from the sun can be used to heat fluids or produce steam to drive turbines. |
| 226 | They can provide homes with their own power supply. |
| 227 | Effectiveness depends on location and sunlight available (cloud, length of day). |

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| **233** | Energy storage is vital in an increasingly technological world. All systems that rely on electrical power to work will need to be supplied with that power. You need to know about national energy storage systems and portable systems such as batteries and cells. |

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| **234** | **Kinetic pumped storage systems** |
| 235 | On a national level, we are moving away from fossil fuels. |
| 236 | Renewable power sources such as solar and wind are not always reliable. |
| 237 | Kinetic pumped storage systems help to create a more flexible and reliable grid system. |

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| **238** | **How kinetic pumped storage systems work** | The system is based on the hydro-electric dam and has tow reservoirs (upper and lower) |
| 239 | During the day, the potential energy in the form of water is held in the dam and flows down the slope, creating kinetic energy to spin the turbine. |
| 240 | When demand is low (night), excess electricity is used to pump water from the lower dam back up to the reservoir to top up the water available to generate power. |

**1.2 Storage systems**

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| **241** | **Batteries and cells** | Batteries and cells use chemical energy to make electricity. |
| 242 | They have two terminals, one positive (+) and one negative (-). A chemical reaction produces electrons that collect at the negative terminal and when connected in a circuit will flow to the positive terminal. |
| 243 | The circuit is completed by adding a ‘loads’, which is the device that needs power. |

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| **244** | **Alkaline primary batteries** | These batteries are supplied fully charged and create power by an electrochemical reaction between two materials, such as zinc and manganese dioxide. |
| 245 | Compared to re-chargeable batteries, they have higher energy, longer shelf life and more environmentally-friendly when disposed of. |
| 245b | Only used until the charge has been drained. |

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| **246** | **Rechargeable batteries** | These batteries can be recharged many times. There is also an electrochemical reaction between two materials, most commonly lithium-ion (li-ion) and nickel-cadmium (NicD). |
| 247 | Can be used many times, cost more to purchase but cheaper in the long run, produce less waste. |
| 248 | Initial cost is higher than primary batteries. |

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| **249** | Batteries come in a range of standard sizes and shapes to suit particular products, such as mobile phones and laptops. |