ENERGY

Introduction

- Energy is the power needed to run a machine/do some work

Sources/Types of Energy

- Energy emitted from different sources are grouped into:
  (a) Renewable sources
  (b) Non renewable sources

Renewable Energy Sources

- Can be regenerated and used over a long period of time/has the natural ability to reappear after being in use
- Include the following:

(i) **Solar Energy**

- Is energy from the sun
- Can be converted into heat/chemical/electrical energies

Advantages

- Cheap because absolutely free
- Available in most parts of the world
- Can be stored in batteries and used later
- Clean/environmentally friendly/free of pollution

Disadvantages

- Has limited use/cannot be used to run heavy machinery
- Expensive to install because large number of solar panels are required to produce useful energy amounts

(ii) **Wind Energy**

- Is harnesed and used to drive windmills and sea vessels
- Wind mills pump water, grind grains and generate electricity

Advantages

- Cheap
- Clean
- Land between the windmills can be used for other purposes e.g. agriculture

Disadvantages

- Expensive to maintain
- Low energy production/many windmills needed to produce significant energy
- Not very reliable as the wind may change direction

(iii) **Wave and Tidal Energy**

- Wave energy results from strong sea waves set in motion by wind
- Are common in high pressure belts/mid latitude regions
- Are used to produce electricity
- In places with high sea tides mills with turbines are set up to be driven by the tides to produce energy/electricity

Advantages

- Cheap as tides and waves are free of charge

Disadvantages

- Available only in countries with sea/coasts
- Production limited to strong waves/tides
- Generating plants may be destroyed by hurricanes/tsunamis
- Inadequate technology for their development
- Initial development costs are prohibitive

(iv) **Geothermal Steam/Energy**

- Is the power generated by the flow of heat from the crust/core of the earth through geysers where superheated steam is continuously being emitted from enclosed cavities
- The highest heat flows are found in areas characteristic of volcanic activity
- The power is harnessed through drilling and can be tapped to generate electricity

Advantages

- Cheaper compared to other sources of energy
- Its generation is continuous because it is naturally occuring
- Cost of operating a geothermal plant is relatively low compared to a HEP station

Disadvantages

- Pollution through noise
- Not available in many areas/available in areas with geysers/hot springs
- Exploration of geothermal energy requires advanced technology especially in areas without visible signs e.g. hot springs/geysers
- Energy production from hot springs is low to meet the energy needs
- Gases released together with the steam may be harmful to the environment and lead to global warming

(v) **Hydro power**

- Is the energy derived from flowing water
- Used to drive turbines that generate electricity – HEP
- Is the most widely used renewable energy source

Advantages

- Is the cleanest/most environmentally friendly energy source
- Can be transmitted over long distances using cables/doesn't have to consumed at the source
- Can be put into many uses e.g. cooking, heating, cooling, transport, lighting and running machinery
- Relatively easy to use by just switching on/off when required
- Construction of dams for HEP generation leads to creation of lakes that can be used for other purposes e.g. irrigation, control of floods, recreation

Disadvantages

- Fluctuation of water levels in the reservoirs may lead to shortage of power
- Cannot be stored once generated
- Initial costs of establishing HEP projects are prohibitive
- Construction of dams may have some negative impacts e.g. resettlement of persons
- Construction of HEP plants may lead to obstruction of river courses upstream hence interfere with fish habitat

(vi) **Biomass**

- Refers to the total organic matter found on the earth's surface in terms of plants and animals
- These plant/animal matter can be converted into energy by biological and thermo-chemical processes
- The main sources of biomass energy are agricultural wastes
- Animal waste such as cow dung and human waste is used to produce biogas – a combustible gas generated by the fermentation of organic matter e.g. cow dung
- Biogas can be used as cooking gas and in refridgerators

Advantages

- Inexhaustible as long as there is organic matter
- Available throughout the world
- Cheap because uses waste products
- Production doesn't require advanced technology

Disadvantages

- Cannot be transported over longer distances
- Contributes to global warming (pollution) if burnt directly
- Requires large spaces for construction of the bio-digesters

(vii) **Wood**

- Refers to firewood and charcoal
- Most common type of energy in developing countries
- Used domestically for cooking and heating

Advantages

- Available everywhere in the world
- Cheap because no maintenance costs required

Disadvantages

- Indiscriminate cutting down of trees lead to deforestation /soil erosion/disruption of rainfall patterns etc
- Dirty due to soot and smoke
- A lot of wood is required because of less energy output
- Pollution as the wood is burnt
- Requires big storage area

(viii) **Draught animals**

- Most commonly used animals are oxen/bulls, others are horses, donkeys, camel etc
- They are used to in plough/prepare farms, transport goods etc

Advantages

- Readily available all over the world
- Maintenance of animals is cheap – require only food and water
- Animals are flexible i.e. can go through areas that are inaccessible by other transport means e.g. roads/railway
- Some animals can be used in ASALs

Disadvantages

- Prone to diseases and fatigue
- Work that can be done by animals is restricted to rural areas

- Work that can be done by the animals is limited – they tire quickly

Non-renewable sources of energy
- Lack natural ability of regenerating/recycling
- Are likely to be exhausted if not carefully used/managed
- Include the following: -

(i) Petroleum
- Is a fossil fuel that consists of gaseous and liquid hydrocarbons from animal and vegetation matter laid down in sedimentary rocks
- Used in agriculture, cooking, lighting and heating
- When refined several bi products are realised e.g. petrol, diesel, paraffin, bitumen, liquified gas and lubricants
- Petrol and diesel are used to fuel vehicle and machinery

Advantages
- Occurs in great abundance as new oil deposits are being disocvered daily
- Has wide range of domestic and industrial uses
- Can be used to generate other sources of energy e.g. thermal electricity
- Can be transported by tankers/pipelines and stores for future use

Disadvantages
- Crude oil is bulky
- Dangerous because highly inflammable
- Burning of petroleum pollutes the environment/leads to global warming
- Petroleum is relatively expensive/not affordable to many
- Prospecting of petroleum is expensive

(ii) Coal
- Comprises of vegetative matter laid down in water bodies/swampy areas
- Once mined cannot be recreated/restored
- Used to provide heat for cooking/heating/lighting

Advantages
- More efficient in generating thermal electricity compared to oil/pertoleum
- Suitable in smelting of iron and steel

Disadvantages
- Bulky – costly/difficult to transport
- Its mining leads to environmental pollution
- Dirty/pollutes the environment

(iii) Natural gas
- Occurs in assocaition with petroleum i.e. normally found on top of upper layers of crude oil
- Composed of mixture of hydrocarbons with methane making the highest percentage
- Mainly used for domestic purposes, generating thermal electricity and for industrial activities

Advantages
- Clean
- Cheap to transport in pipelines
- Free from weather changes

Disadvantages

- Accidental fires may occur due to gas leakage/damaged pipes
- Pollution of environment through gas leaks
- Expensive for low income earners

(iv) Thermal electricity

- Is generated by burning fuels e.g. coal, petroleum and natural gas in thermal generators/specially designed surfaces
- Water is heated to produce steam or oil/diesel may also burn in combustion chambers generating heat\steam that drive turbines connected to generators that produce electricity

(v) Uranium\Nuclear Energy

- Aka atomic energy
- Derived from the alteration of atomic structures
- Involves release of heat that produces steam used to generate electricity through fission where uranium are split in nuclear reactors/power stations
- Nuclear power stations are mainly found in developed countries e.g. Britain, USA, France, Germany and Japan

Advantages

- Environmentally friendly
- Produces large amount of energy in nuclear reactors
- Relaible due to long lasting supply of uranium deposits

Disadvantages

- Requires heavy capital investment/expertise
- Radioactive materials are harmful to human (causes cancer) and the environment/ Nuclear leakages can cause environmental pollution
- Can result into disastrous accidents if not well planned/controlled

Hydro – electric power (HEP) stations in Kenya

- Hydro power is the main source of electricy in Kenya
- Most electricity produced in Kenya is generated from various hydro power stations found in different parts of the country
- Stations are maintained by KenGen then sold to Kenya Power that distributes it to consumers at a fee
- The major HEP station in Kenya is the Seven Forks Scheme which is located on River Tana
- The projects on Seven Forks include
    - ✓ Kindaruma – 40MW
    - ✓ Kamburu – 88MW
    - ✓ Gitaru – 225MW
    - ✓ Masinga – 40 MW
    - ✓ Kiambere – 144MW
    - ✓ Mutonga – 60MW
    - ✓ Grand Falls – 180MW

Draw map on page on page 84

- Other HEP projects in Kenya include
    - ✓ Turkwell – 106MW
    - ✓ Sondu – Miriu – 60MW

Hydro – electric power (HEP) stations in Uganda

- The major power source and HEP project in Uganda is the Owen Falls Dam
- On the site where River Nile flows out of Lake Victoria provided a natural waterfall from where the power generation was possible
- Produces 162MW that supplies most of Uganda's electricity and about 30MW exported to Kenya
- Was developed to an upsurge of industries in Uganda, creating a high demand for electricity and also high costs of petroleum since it is landlocked

HEP projects in Africa

- Africa has the largest concentrations and potential areas HEP generation but the potential has not been fully exploited due to
    - ✓ Inadequate financial resources to set up the project
    - ✓ Potential sites located in remote areas with sparse population – little market
    - ✓ Seasonal flactuations in the river water due to prolonged drought

- HEP projects in Africa include
    - ✓ Akosombo – Ghana
    - ✓ Kainji – Nigeria
    - ✓ Inga – DRC
    - ✓ Aswan – Egypt
    - ✓ Kafue – Zambia
    - ✓ Kariba – Zambia/Zimbabwe
    - ✓ Caborra Bassa – Mozambique

Draw Map cert geog bk 4 pg 103

Factors favouring development of HEP project

- Hard basement rocks to provide a firm foundation for dam construction
- Presence of waterfalls to provide a massive hydraulic force head for power generation
- Regular/large volume of water to ensure continuous power generation
- Non porous rocks to prevent water loss/seepage underground
- Presence of a deep narrow valley/gorge to provide a large reservoir behind the dam/reduce cost of bulding embankments
- Government policy – availaability of land/space for setting up the plant
- Market to buy the produced HEP
- Adequate capital to set up the project since it involves high capital outlay

Role of HEP in the economy

- Creation of emplyment opportunities
- Development of the communication sector
- Agricultural development
- Source of government revenue

Problems facing HEP projects

- Flactuating river regime/waters due to prolonged drought and deforestation upstream leads to production of little/less power
- Inadequate capital for HEP development and maintenance
- Siltation
- Displacement of people

Geothermal power projects in Kenya

- Generated in areas with seismic/volcanic activities with numerous hot springs and geysers and fumaroles that can be used to generate electricity
- In Kenya, it is found in the following areas
  - ✓ Eburru – North of Lake Naivasha
  - ✓ Lake Bogoria – has the highest potential
  - ✓ Ol Karia
- Geothermal plants are not well developed in Kenya because of the following: -
  - ✓ Limited number of potential sites
  - ✓ Scarcity of skilled labour
  - ✓ Inadequate capital investment

Significance of Energy

- For domestic uses e.g. cooking, lighting, heating
- Used in industrial sector e.g. to run the machines
- Transport sector
- Research in alternative energy to reduce overreliance on existing energy sources
- In agricultural sector for drying of cereals
- Pumping water

Energy Crisis

- This is a situation whereby the demand for oil is higher than the amount being supplied, leading to high oil prices

Causes of Energy Crisis

- Escalation in oil prices triggered by sharp rise in demand
- Uncertainities in oil supply/rapid depletion of oil reserves
- Control of oil reserves by a few oil producing countries
- Unequal pattern of crude oil distribution in the world
- Artificial shortages created by USA and Russia decide to conserve their resources and depend on world market for their requirements
- Economic and political embargoes (wars)
- Misuse of energy sources

Effects/Impacts of Energy Crisis

- Increased petroleum prices lead to escalation in transport costs/affects tourism
- Low rate of economic growth because of over-expenditure on oil importation
- The price of commodities rises leading to inflation
- High costs of transportation
- Foreign exchange resources are almost entirely spent on oil imports creating a deficit in balance of trade
- The demand for charcoal and wood fuel increases leading to deforestation
- Oil resources are getting depleted

Management and Conservation of Energy

- Management of energy resources refers to the effective planning and control of energy sources
- Conservation of energy involves using the available resources in the most appropriate manner to ensure minimal wastage
- The following measures are used to manage and conserve energy
  - ✓ Search and development of alternative sources of energy other than petroleum e.g. geothermal, wind, solar, gasohol, tidal, H.E.P. etc.

- ✓ Increased prospecting for oil
- ✓ Improving public transport to encourage more people to use it (reduce vehicles on the road)
- ✓ Control of the importation of vehicles with high engine capacity (high tax on high capacity luxury cars)
- ✓ Proper planning of the road network to reduce traffic jams
- ✓ Creating awareness by educating the public through mass media
- ✓ Development of energy saving techniques or technology e.g. energy saving jikos
- ✓ Development of wood fuel programmes through afforestation, re-afforestation and planting of fast maturing trees (eucalyptus)