

What are the sources of energy and how do they vary in their global pattern?

The study of the global pattern of energy supply to illustrate:

- The availability of finite and renewable resources in different parts of the world;
- The physical, economic and political reasons for the variable pattern of energy supply over time and space

“The global energy mix is made up of both finite and renewable sources, which vary in their availability over time and space.”

What is the relationship between energy use and economic development?

The study of two contrasting countries to illustrate:

- the energy use and mix associated with a highly developed economy;
- the energy mix associated with a country at the lower end of the development spectrum;
- why these differences occur.

“As economies develop, there is an increased demand for energy”

Examples

UK (MEDC)

Mali (LEDC)

UK

- UK is running out of its fossil fuels resources and by 2020 will be imported $\frac{3}{4}$ primary energy.
- 2004: 42% gas consumption, 32% petroleum, 18% coal, 8% nuclear and <1% other. Use of gas increased from 1990 whilst use of coal decreased.
- Government under pressure to reduce amount of pollution (target 60% reduced by 2050).
- Energy mix:
 - Oil and gas: already used $\frac{3}{4}$ of available, difficult to get to remaining resources (technology developing) and have to rely on European supplies.
 - Nuclear: back on the agenda (although maybe not after Japan) as other energy resources decrease but it takes 10yrs to build a plant and there are significant environmental problems. 9/12 plants due to close by 2018.
 - Coal: start C20 coal mining was UK's biggest employer but only 9300 in 2005. Use of coal declined significantly due to pollution and inflexibility. Little coal exported but significant imports (36.2m tonnes in 2004). Could come back with clean coal technology.
 - HEP: 0.8% UK's electricity produced mainly in Scottish Highlands, most commercial opportunities already exploited. Small scale projects could increase production to 3%
 - Biomass: 87% renewable energy, 1.55% electricity supply.
 - Geothermal: small plant at Southampton
 - Wind: lots of funding for wind energy (£1bn), Scroby Sands is the largest current wind farm offshore from Great Yarmouth
 - Microgeneration: increasing in use with Energy Saving Trust estimating it could meet 30-40% of UK's electricity needs by 2050.

Mali

- 65% of the country is desert or semi-desert and has no fossil fuel resources
- Depends on environment for farming, herding and fishing
- Population 12 million is growing at 3% a year
- Imported petroleum accounts for 8% of the country's trade balance
- 80% of energy needs are supplied by firewood and charcoal with less than 12% population having to formal electricity – impacting on low quality of life
- Woodcutting rural industry and leads to much employment
- Renewable possibilities:
 - Formulated a new International Domestic Energy Strategy
 - Solar power a big possibility with 5-6hrs sunlight per day. Mali Folke Centre (MFC) installed solar panels on 30 schools
 - MFC has helped developed plantations of jatropha (stabilises areas prone to desertification and provides a biofuel)
 - African Rural Energy Enterprise Development is a UN programme to develop new sustainable energy enterprises e.g. fuel briquettes from agricultural by-products

What are the social, economic and environmental issues associated with the increasing demand for energy?

The study of two contrasting examples to illustrate:

- the social and economic opportunities created by the exploitation of energy resources, including employment, community development and economic development
- the problems created by the exploitation of resources for people and the environment, including conflicts with indigenous populations, economic issues and environmental degradation.

“The exploitation of energy resources brings both opportunities and problems for people and the environment”

Examples

Norway (MEDC)

Nigeria (LEDC)

Norway

- Discovery of oil in Norwegian waters in 1960s has brought many opportunities
- 4.5 million population so relatively small so impact per person is huge
 - Standard of living is much higher in Norway because of oil and gas revenues
 - One of the best welfare systems in the world
 - Community development – spend on sports, youth and transport.
 - Focus on urban and isolated communities
- Energy is responsible for 1/3 of Norway's export earnings – third in the world and less than 1/3 resources have been used
- 80 000 people employed in the oil related businesses and it has developed its own from foreign expertise
- A global leader in sub-sea technology – can be a maritime problem if spillages
- They use 99% of electricity generation from HEP and it is one of the cleanest nations in energy production
- Cheap HEP has attracted heavy industries – creating a cycle of cumulative causation – can be a worry to environmentalists
- Their money is invested abroad valued at more than \$150 billion

Nigeria

- Oil makes up 90% of export earnings – is gaining importance- now a member of OPEC
- 80% of total Nigerian of its revenue
- Used to be self sufficient in food but now import it as people abandoned farming for oil. It has the lowest quality of life of the oil producing countries
- Refineries are old and poorly run – and it also imports much of its own energy
- Corruption siphons off 70% of annual oil revenues – nationalised in 1971
- Oil spills, acid rain from gas flares and the stripping of away mangroves
- Construction and increased ship traffic has changed local wave patterns causing shore erosion and the migration of fish
- Only had an environmental protection team since 1988 – local people have been forced to give up fishing because fish stocks gone
- Local rebel groups have attacked the oil industry either out of frustration or in order to gain payouts e.g. Movement for the Emancipation of the Niger Delta

How can energy supply be managed to ensure sustainability?

The study of at least one example to illustrate how energy demand can be satisfied in an increasingly sustainable way – including the development of renewable energy resources.

“Managing energy supply is often about balancing socio-economic needs and environmental needs. This requires detailed planning and management”

Examples

Germany

Iceland

Germany

- 2010: almost 17% electricity supply, 10% primary energy from renewable energy
- Renewable Energies Act (2007) introduced an obligation to use renewable energy sources for heat supply in new buildings
- Wind: 21,164 wind turbines (2009) making Germany 2nd biggest user (after USA). Plan to increase usage by repowering and offshore wind farms (first online 2009)
- HEP: 13.4% share in energy production
- Biomass: used in solid, liquid and gas forms, 2007 69% renewable energy = biomass. 10% agricultural land used to grow energy crops esp. rapeseed for biodiesel
- Geothermal: 2007 8.4MW
- 2009 electric power: 12% biogas, 20% biomass, 20% HEP, 7% solar, 40% wind

Iceland

- 81% total primary energy supply comes from domestically produced renewable energy sources
- HEP: 2007 15% primary energy, still a large amount of untapped HEP even taking the environment into consideration
- Geothermal: 2007 66% primary energy, main use is for space heating (85% all houses heated by geothermal), use of geothermal heating reduced CO2 emissions by 37%, still untapped geothermal sources
- Electricity production is 100% renewable (70% HEP, 30% geothermal)
- Hydrogen: developing industry with hydrogen fuel cell buses tested, would be viable to introduce hydrogen as Iceland has a small infrastructure