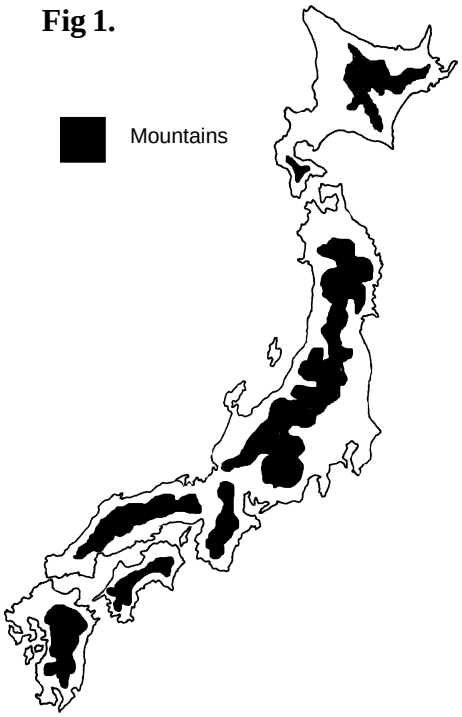
Geo Factsheet

Number 13

Energy Resources in Japan

Fig 1.

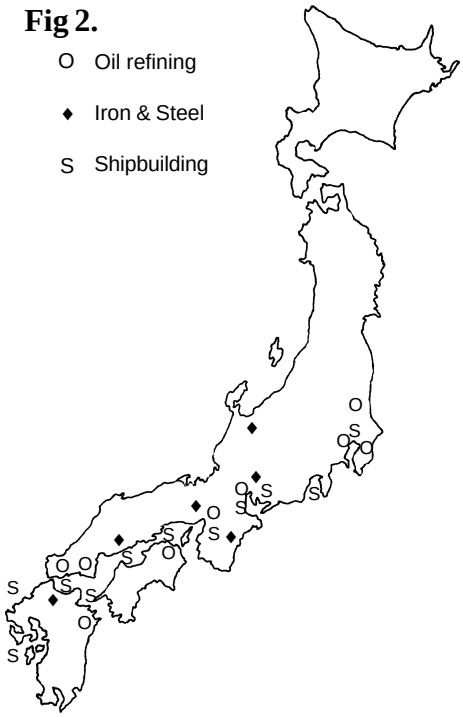


Mountains

Since most of the country is mountainous, and because Japan is very heavily dependent on imports of energy and raw materials, most development has occurred around deep natural harbours.

***Exam Hint** - Good candidates will constantly ask the question: "How does the distribution of industry relate to the physical geography of the country?".*

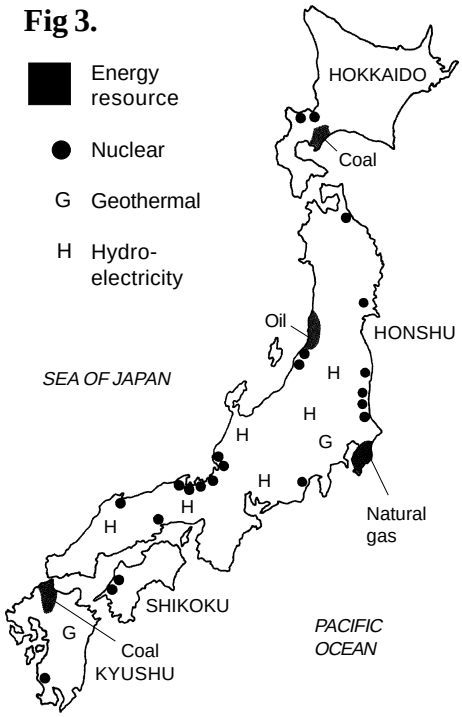
Fig 2.



Industry

Almost all of Japan's major industry (oil refineries, iron and steelmills and aluminium works), are situated on the coast. Japan still accounts for 30% of the world's shipbuilding industry.

Fig 3.



Energy Resources

Although Japan's hydroelectric plants are reliable (high mountains and the summer monsoon ensure adequate rainfall), almost every available site has been developed. Coal production is in steady decline and dependence on imported coal, mainly from Australia and Canada, is increasing. Despite growing concern, both at home and abroad, Japan is pressing ahead with an ambitious nuclear programmme.

Energy Resources In Japan

Recent energy policy in Japan has sought to address three main issues

- Stabilise supplies.
- Decrease carbon dioxide emissions, hence Japan's contribution to global warming.
- Increase the efficiency of the supply system.

Energy consumption in Japan is high and is expected to increase by at least 1.5% annually, most of which will be met by the fossil fuels - oil, gas and coal. Imports of LNG (Liquefied Natural Gas) are expected to increase and plans are being developed to import natural gas by pipeline from Siberia. However, Japan is already the most import-dependent country in Asia. Almost all of its coal, oil and gas is imported, mostly from the Middle East, Indonesia, Australia and the United States.

Following the two “oil shocks” - in 1973 when OPEC quadrupled the priced of oil and then in 1979 following the revolution in Iran- Japan began to diversify its energy supplies, build up oil reserves (now capable of lasting 5 months) and accelerated its program of nuclear power generation. Escalating oil prices damaged the profitability of many well established oil-based industries such as petrochemicals and aluminium smelting and less energy-intensive information and high technology industries expanded.

58% of the country's total energy requirement is met by oil (75% of which is imported from the Middle East and Indonesia) but the aim is to reduce this dependence on oil to below 50% by 2010. Although this will mean continued dependence on a few oil importing states,

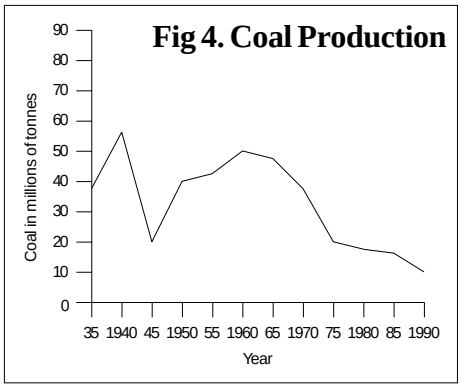
Table 1. Estimates of Japanese Primary Energy Supplies

	1992			2000		2010	
	(million kl)	Component Ratio (%)	% Imported	(million kl)	Component Ratio (%)	(million kl)	Component Ratio (%)
Oil	315	58.2	98	308	52.9	303	47.7
Coal	116.3	16.1	95	130	16.4	134	15.4
Natural Gas	40.7	10.6	99	53	12.9	58	12.8
Nuclear	34.4	10.0	100	45.6	12.3	70.5	16.9
Hydro (million kw)	21	3.8	0	22.2	3.4	26.5	3.7
Geothermal (million kw)	0.55	0.1	0	1.0	0.2	3.8	0.6
Solar, others	6.7	1.2	0	12.1	2.0	19.1	3.0

Japan believes that these countries near-dependence on oil revenues effectively safeguards supplies.

The Institute of Energy Economics (IEE) has forecast annual growth of 2.5% in Japan's Gross Domestic Product (GDP) through to 2005 and the IEE anticipate energy supplies will need to increase by 1.5% annually to keep pace. Most of this growth is expected to come from fossil fuels.

With only three of its coal mines still in operation, almost all of the coal used in Japan's steel works is imported (See Fig 2), hence their location on deep natural harbours which, along with land reclaimed from the sea, also form the major centres around which population has grown.



Combined Heat and Power

Japan has become one of the world leaders in the development of CHP - basically the use of waste heat from power stations to produce steam. CHP schemes are usually small scale (tens of kilowatts to tens of megawatts) and have been used to make factories, small industrial complexes, hotels and shopping centres completely independent of the national grid. CHP systems attract low interest loans from the Japanese government.

Japan's unique physical problem - only one third of the land area is deemed habitable - also means that it is impossible to find new sites for large thermal and nuclear power stations. Given this - and a growing, energy-hungry population of 125 million - CHP is seen as a valuable niche technology which can be used to secure the energy independence of hospitals, hotels, shopping complexes, offices and light industries such as food processing and refining.

The very factors which make such a large percentage of Japan's land area inhospitable also offer opportunities for hydroelectric power generation (HEP). However, most of the best sites have already been developed. Similarily, it has been estimated that geothermal energy could supply 15-20% of the country's energy needs. By drawing off the superheated waters beneath the islands, steam could be generated to power electricity-generating turbines.

Nuclear Power

Nuclear power currently provides 11% of primary energy supplies and 32% of electricity. This is expected to increase over the next 15 years. Nuclear power was initially developed in the 1950s as a means of increasing energy diversity and security. Japan now has 50 operating nuclear power plants and another 4 are being built. The Japanese Institute of Economics has proposed that the currently installed nuclear generating capacity of 40,000 MWe should be increased to 90,000 MWe by 2020 and to 100,000 MWe by 2030. Nuclear power generation is widely seen as the most efficient way in which oil dependency can be reduced and it is argued that this will simultaneously decrease carbon dioxide emissions. If the above targets are met, it is expected that by 2020 nuclear power will account for 30% of the country's total energy supplies.

Japan is the only country which has committed itself to using plutonium in its civil nuclear power program. Current Light Water Reactors (LWR) use low-enriched uranium but these are expected to be replaced firstly by Advanced Thermal Reactors (ATRs) or Advanced Boiling Water Reactors using mixed oxide fuel and then by fast neutron reactors using plutonium. The latter reaction can produce between 50 and 60 times as much energy from the original uranium. Currently just three of Japan's LWRs use plutonium but by 2000, this is expected to increase to ten.

Attempts to close the nuclear fuel cycle in this way have been beset with physical and social problems: nuclear power stations need flat land on the coast (for cooling water) whose underlying geology is both near the surface and stable. 83% of the country is mountainous and the entire archipelago is surrounded by volcanoes and prone to earthquakes. Japan's enthusiasm for the development of nuclear technology is therefore perhaps surprising. Nuclear power stations must be sited as far away as possible from centres of high population density and must avoid flight paths of commercial and military aircraft. Given these concerns, a very vocal anti-nuclear lobby has become established. Of perhaps even greater concern are the difficulties which Japan faces in maintaining its supplies of reprocessed nuclear material. Through plutonium, Japan has the basis of a nuclear weapons program and this is proving extremely controversial both at home and abroad.

Acknowledgements;

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