WJEC CBAC

GCE A level

1204/01-B

GEOGRAPHY - G4
SUSTAINABILITY

Pre-Release Material.

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RESOURCE FOLDER

INSTRUCTIONS TO CANDIDATES

A new copy of this Folder will be given out in the examination. **This copy must not be taken into the examination**.

Work through this Folder to make sure you understand all the resources. You may seek help from your teachers or any other sources in this context. You have to apply your critical understanding to an unfamiliar situation.

ADVICE TO CANDIDATES

The materials in this Resource Folder focus on energy, with some links between energy and water supply. The sources of energy supplies for Botswana, Malaysia and France are presented. For each country, some of the major sources of energy are examined. There is also a section which introduces some of the issues surrounding current and future energy sources that must be considered by all countries.

VP*(S10-1204-01B)

Guidelines for using the pre-release materials

The contents of the booklet should be studied carefully. The examples given will help in answering some of the questions on the question paper. To give a fuller answer, it is advisable to look at other material before the examination. This could be similar topics, related to information in other countries, or may be the same countries but in greater depth or on closely related topics. It would be particularly useful to note if other case studies seem similar in nature, or if they show contrasting perspectives to those from the material in this Resource Folder.

Some of the resource materials come from Geography textbooks, but others come from companies, pressure groups, research organisations, governments and private individuals. In some cases they are using information to promote their own interests rather than to represent an impartial view. It is worth considering if they are trying to support a particular interest group and persuade readers to agree with them. In finding other materials it is worth bearing in mind that they might not be presented in an impartial and objective way.

Material in the Resource Folder may often be related to other themes found in G4, and to other units in Geography AS and A2. These links should be noted, as there will be opportunities to refer to such connections with other work in some of your answers. Being able to link together different parts of your Geography studies is important and will be credited. Such linkages are sometimes referred to as ‘synopticity’.

Textbooks, journals, good quality newspapers and television and radio programmes are good sources of information. Probably the most accessible source of geographical information is the Internet, but it is also the one which may be most susceptible to bias and lack of impartiality. Many of the resources are extracted or adapted from sources on the Internet. These sources have the web addresses provided. Many are only extracts or shortened versions of fuller documents. It is well worth following these links for greater depth of reading and for more recent updates of material.

Each candidate will be provided with a copy of the Resource Folder, for use in the examination, at the same time as the question paper is issued at the beginning of the examination on the day set for the paper.

Contents

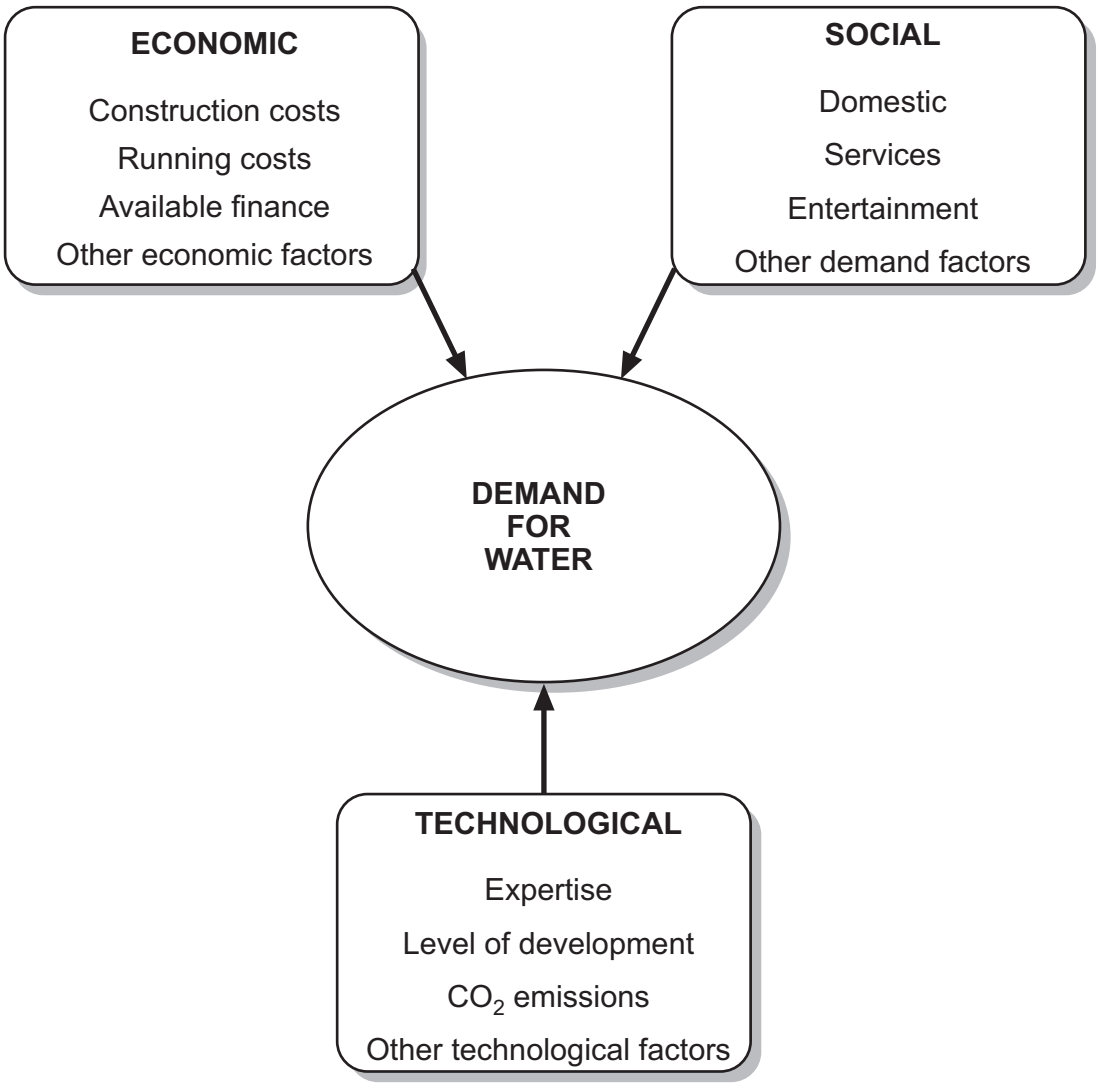
THE NEED FOR ENERGY AND WATER

Figure 1 A statement made by Tony Blair in 2006, when he was Prime Minister, in a review of energy in the UK

A clean, secure and sufficient supply of energy is simply essential for the future of our country. We need energy to heat and light our homes, to power our businesses and to transport people and goods. Without it, we could not function as an economy or modern society. Even minor disruptions in supply, after all, can cause major problems for communities and businesses. Ensuring we have a sustainable, secure and affordable energy supply is one of the principal duties of Government.

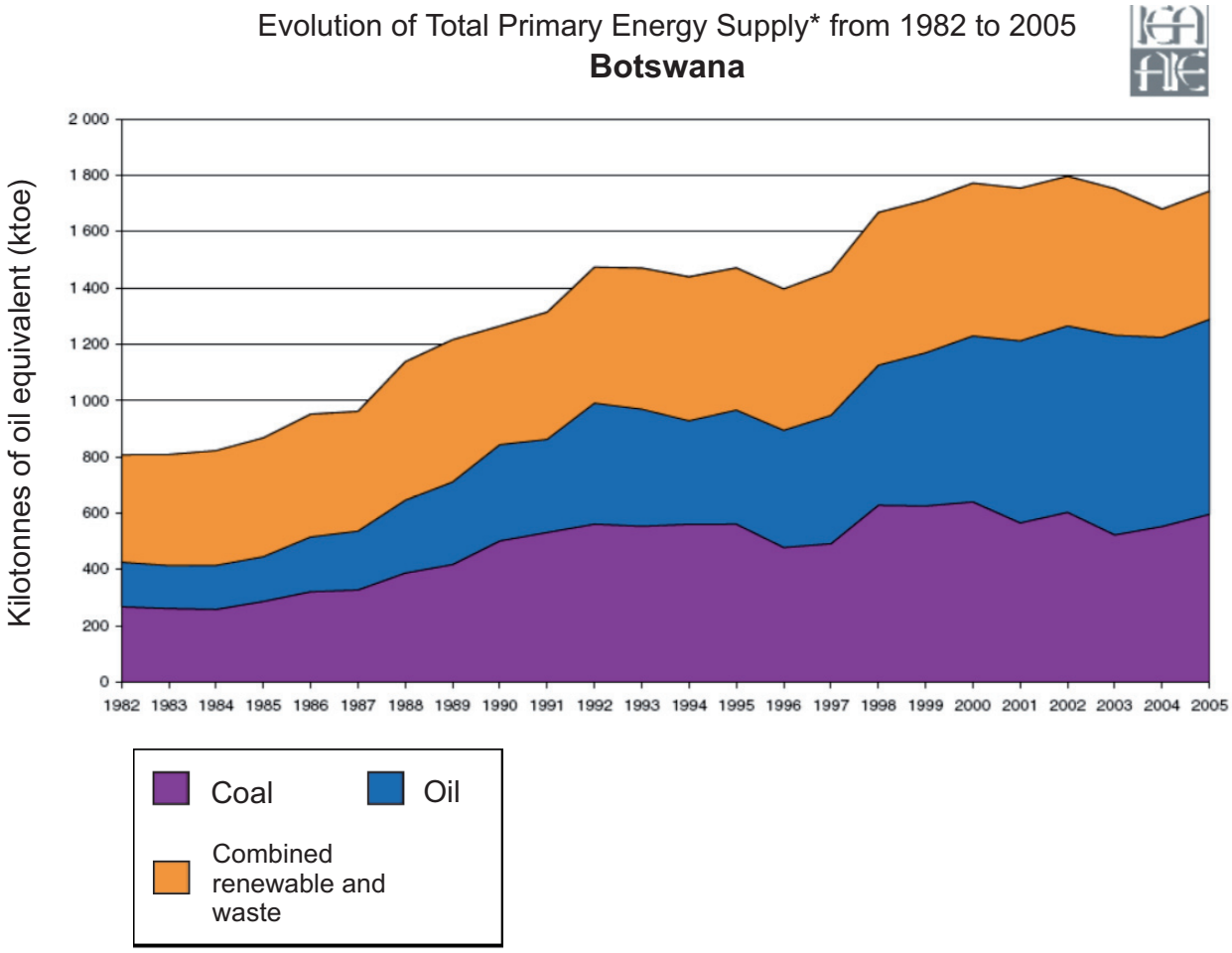
Source: The Energy Challenge, DTI (UK)

Figure 2 Factors influencing the demand for water



SOURCES OF ENERGY

Figure 3 Sources of energy in Botswana



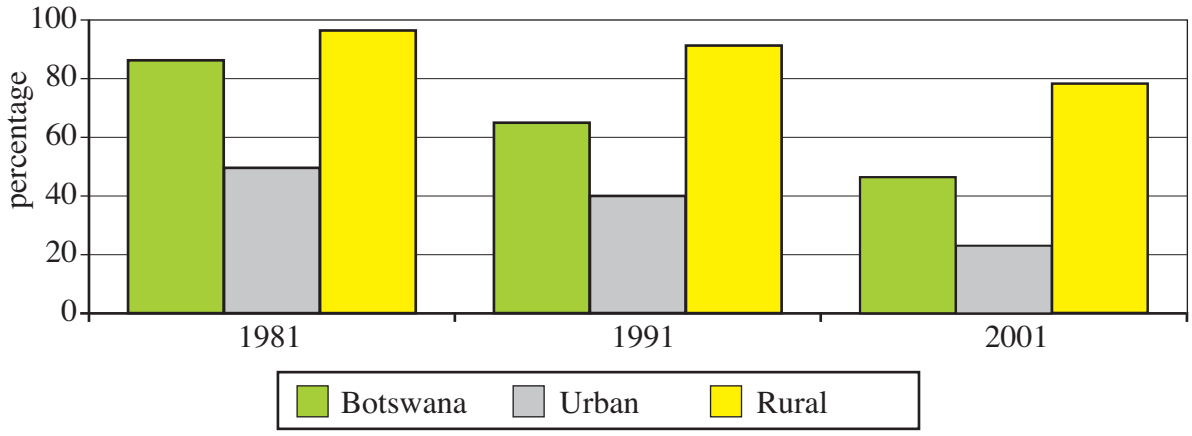
Source: iea.org

Figure 4 Fuelwood is the main part of the combined renewable and waste energy source in Botswana

In many parts of Botswana the 'other energy crisis', i.e. a shortage of fuelwood, is being felt as it is in many other countries. In order to procure fuel for their cooking and heating, people look for dead wood and it appears that more and more time has to be spent to satisfy the needs for this energy source. Longer walks are required and often only low quality wood (light, fast burning wood and thin branches) can be found, forcing people to make more frequent collection trips.

Source: A Pain in the Neck: The Firewood Situation in South-Western Kgatleg, Botswana

Figure 5 Percentage of households using fuelwood for cooking in Botswana



Source: cso.gov.bw

Figure 6 Woman collecting fuelwood in Botswana

Source: Gender Mainstreaming in Botswana, Energy Policy

Figure 7 The importance of fuelwood in Botswana

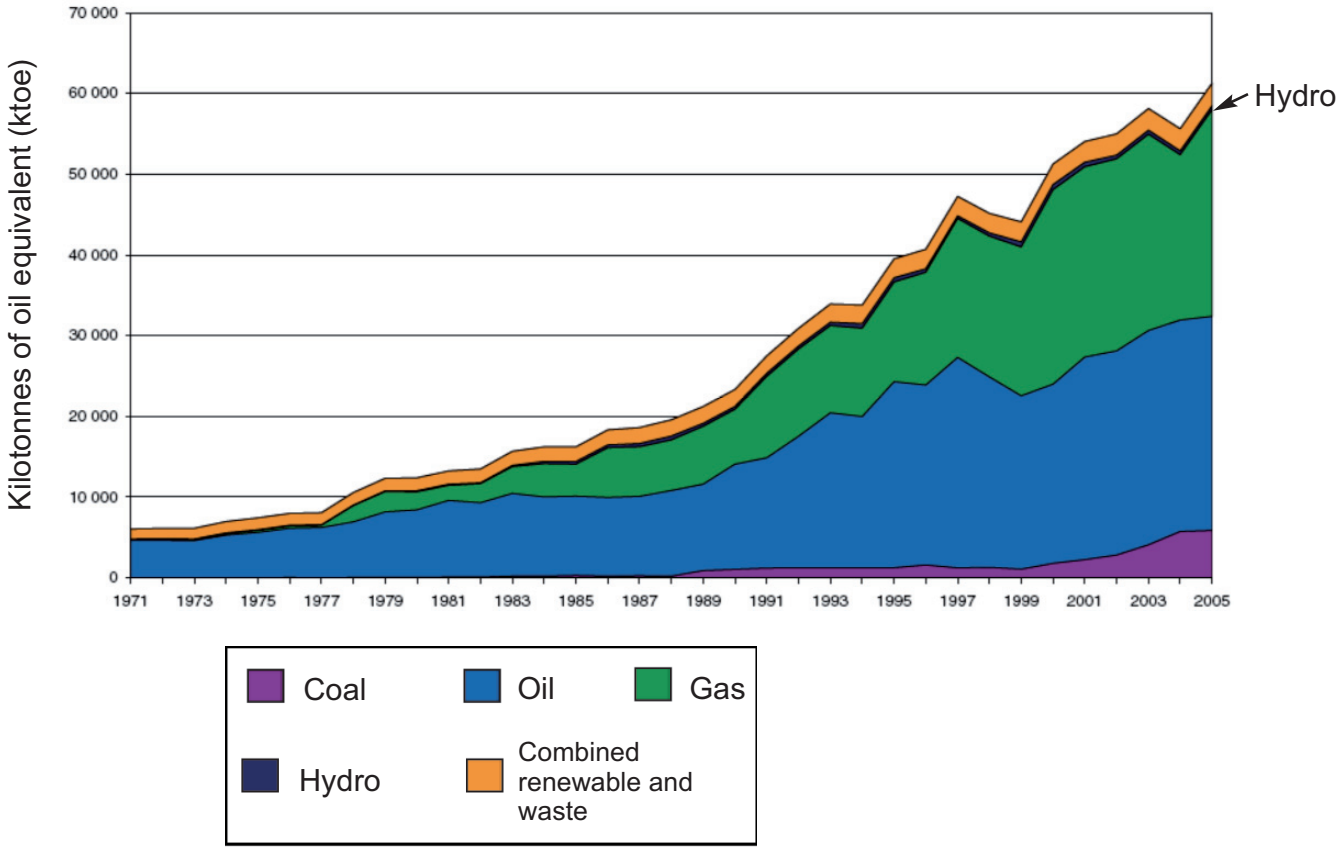
Biomass fuels in Botswana include fuelwood, cow dung, crop waste and charcoal. Fuelwood is the main source of biomass used in Botswana; the use of other sources is negligible. Fuelwood is mostly used by rural households for cooking and in some instances for lighting. Government institutions like Community Junior Secondary Schools also use fuelwood for cooking. Fuelwood contributed 30.3% to the total primary energy supply in 2000.

Source: Report of the Proceedings of the Workshop on the Establishment of Gender and Energy Networks in Botswana

Figure 8 Sources of energy in Malaysia

Evolution of Total Primary Energy Supply* from 1971 to 2005

Malaysia



*Excluding electricity trade

Source: iea.org

Figure 9 Recent developments in energy in Malaysia

Energy production, consumption and marketing have changed tremendously since the early 1970s. Historically, three state firms dominated electricity generation and distribution, but in 1994 the government allowed private producers into the market, and 15 independent producers were in operation by 2005. All oil and gas resources are still controlled by the state owned Petroliam Nasional Berhad (Petronas).

From 1971 to 2001, energy production increased from 4 770 kilotonnes of oil equivalent (ktoe) to 77 623 ktoe. In the same period, the percentage of electricity generated from oil fell from 72.4% down to 8.6%, whilst electricity generated from natural gas increased from 0% to 78.1%. By 2001 the remainder of the electricity production came from hydro-electric power and coal.

Malaysia's proven oil reserves declined from a peak of 4.3 billion barrels in 1996, to 3.0 billion barrels in 2005. Malaysia has since engaged in offshore development to increase oil production. Malaysia also has 75 trillion cubic feet of proven natural gas reserves, and liquefied natural gas production increased from 12.9 million tonnes in 1996 to 20.9 million tonnes in 2005, most of which is exported.

In official Malaysian statistics, employment in electricity, gas and oil supply is combined with employment in water supply. From 1980 to 2005, percentage share of total employment in these industries rose from 15.7% to 28.4%.

Source: US Library of Congress

Turn over.

Figure 10 Biofuel in Malaysia

Three Malaysian palm oil producers to merge

18th December, 2006

Three of Malaysia's largest palm oil producers are to merge. This is a fusion that could potentially create the world's biggest biofuels company, and is the largest publicly-traded palm oil organisation. It is an initiative by the state owned Permodalan Nasional Berhad (PNB).

The deal will create the biggest listed palm oil producer in the world in terms of output and market value, analysts said. The three merged producers will operate as a new company called Synergy Drive.

The government has said it would attempt to streamline its enterprises in a bid to cut costs and reduce overlap with other businesses. It has also said it would encourage and assist Malaysia's palm oil producers to develop its biofuels industry, which has attracted world-wide attention as all countries try to reduce their dependence on fossil fuels.

Palm oil and soybean oil are the world's top edible oils, but palm oil is becoming one of the top ingredients in biofuels as well. A combination of the three companies' palm oil businesses will yield annual revenue of at least US$2.02 billion and yearly operating profit of around US$248 million.

If biofuels take off, and start to replace crude oils, profits could be astronomical.

Source: biofuels-news.com

Figure 11 HEP in Malaysia

Malaysia has a great potential for hydro-electric power (HEP). Many dams have already been built, but most of these are small to medium sized schemes.

One very large hydro-electric scheme, the Bakun Project, has produced much controversy because of both short term and long term social and environmental damage.

Supporters of the scheme point out that it can supply huge amounts of electricity with no carbon emissions.

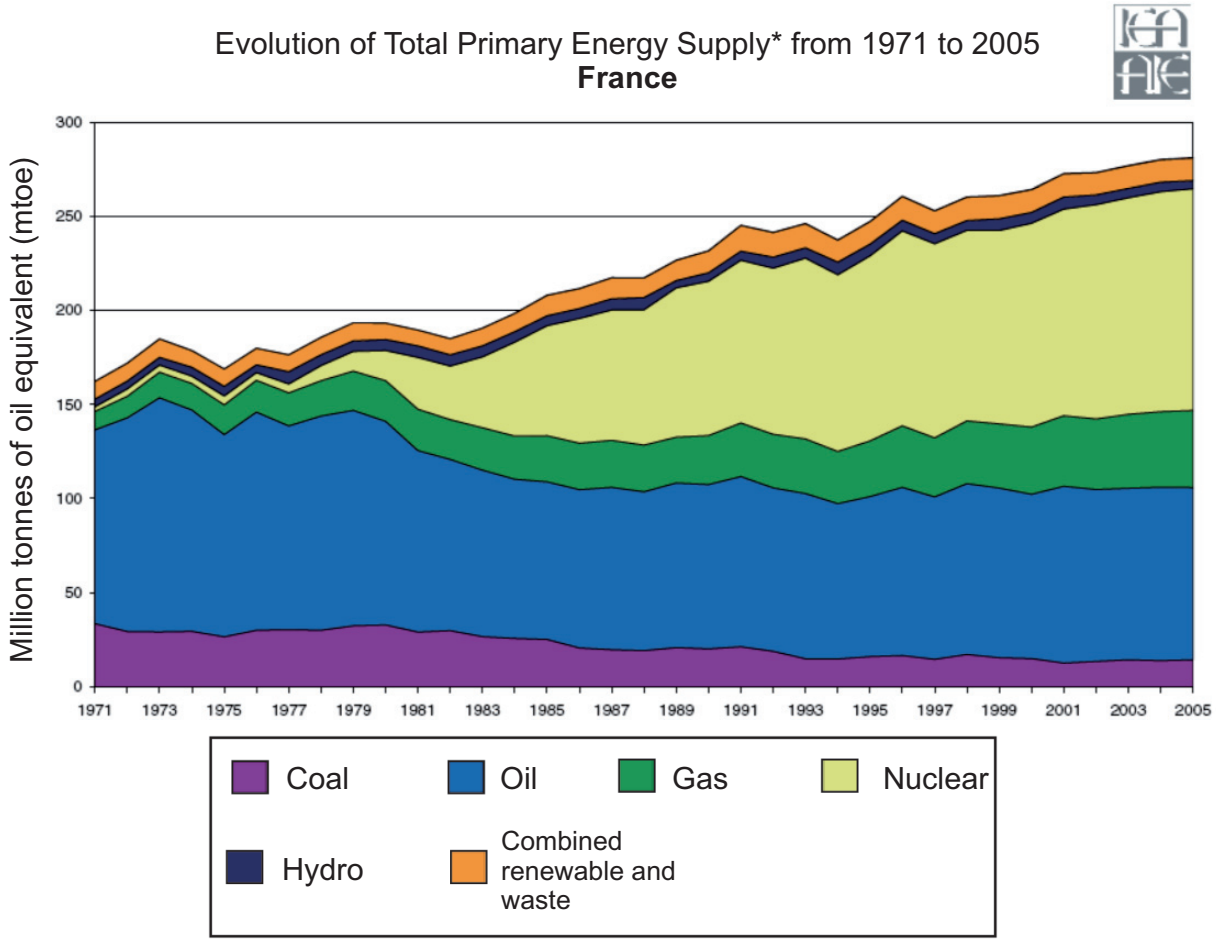
But the dam has drowned huge areas of tropical rainforest. The submerged vegetation could produce huge amounts of methane in time, which many experts contend is a far more active greenhouse gas than carbon dioxide.

Source: flickr.com

Currently, just under 10% of electricity comes from HEP, but this could rise to as high as 30% or more if further dams are built.

It would also increase the supply of water by an enormous amount. Water supplies already easily meet demand in Malaysia, but the government can earn income by selling water to nearby states that are experiencing difficulties with supplies, e.g. Singapore.

Figure 12 Sources of energy in France



*Excluding electricity trade

Source: iea.org

Figure 13 The energy situation in France

France is poor in energy resources compared with several other European countries that benefit from raw materials (coal in Germany and Spain, oil, gas and coal in the United Kingdom, gas in the Netherlands, hydro power in Switzerland, geothermal in Iceland etc.).

Since the end of the 1970s, French coal production has fallen from 40 million tonnes per year to less than 3 million tonnes in 2003, mining having ended altogether in April 2004 with the closure of the last pit at Creutzwald, in Lorraine.

Up to the end of the 1970s, the natural gas field at Lacq supplied between 6 and 7 million toe (tonnes of oil equivalent) of gas per year, contributing up to 15% of France's primary energy production, but this has now fallen to 2%, and is expected to be exhausted soon.

Oil production within the country has barely exceeded 3 million toe per year, depending on how interested operators were in investing in exploration-production on French territory, and now stands at less than 1.5 million toe per year, or slightly more than 1% of TPES (total primary energy supplies).

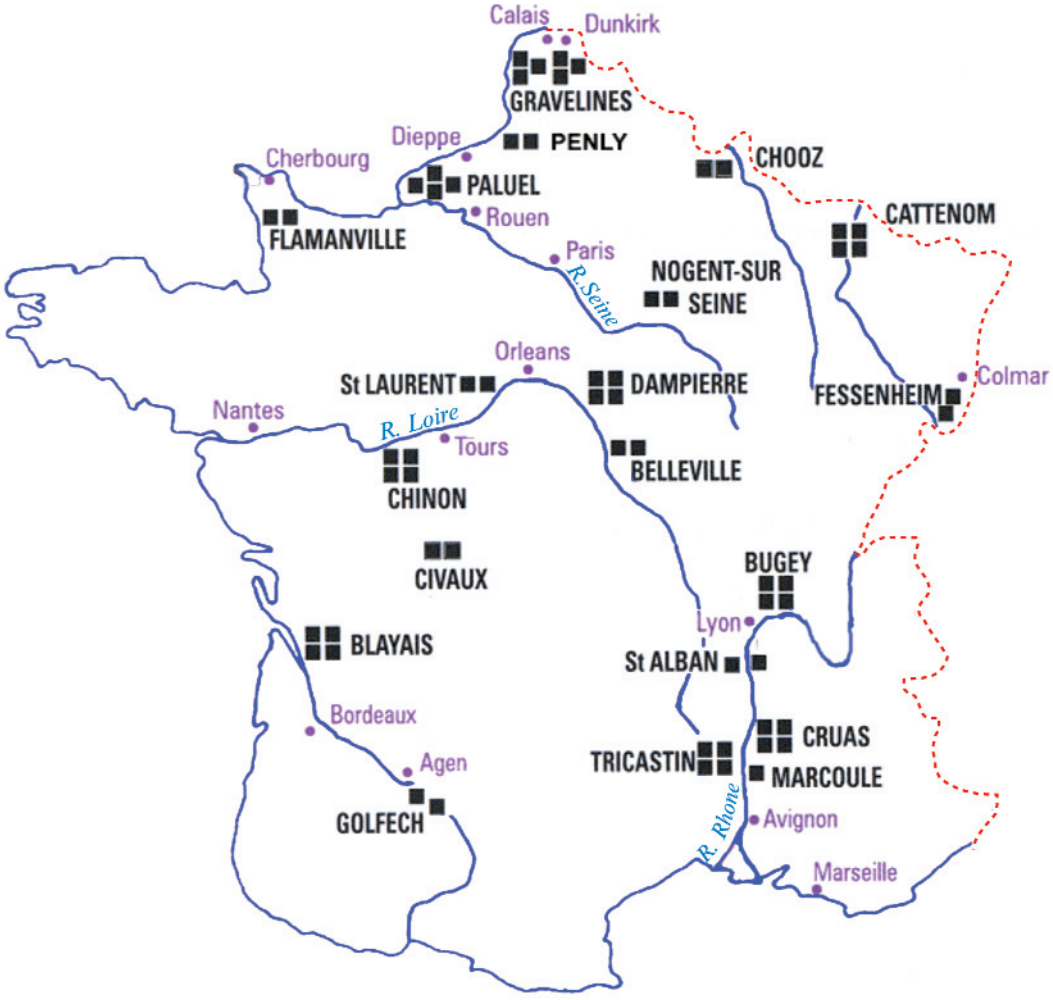
In order to ensure the security of its energy supplies, France's energy policy has given priority to the development of a national energy supply from nuclear energy and renewable sources.

In the 1950s a major dam construction programme was put in place, and a nuclear programme, now comprising 59 reactors, was launched in the 1970s.

Source: industrie.gouv.fr

Figure 14 The French nuclear power programme

- France derives over 75% of its electricity from nuclear energy. This is due to a long-standing policy based on energy security.
- France is the world's largest net exporter of electricity due to its very low cost of generation, and gains over €3 billion per year from this.
- France has been very active in developing nuclear technology. Reactors, nuclear fuel products and nuclear industry services are a major export.



Key: ■ represents one reactor
----- national boundary

France has 59 nuclear reactors operated by Electricité de France (EDF) with a total capacity of over 63 GWe (gigawatt electrical), supplying over 430 billion kWh (kilowatt hours) per year of electricity, 78% of the total French production. In 2005, French electricity generation was 549 billion kWh and consumption 482 billion kWh, resulting in a huge surplus. To take advantage of this, over the last decade France has exported 60-70 billion kWh each year, and EDF expects exports to continue to grow up to 65-70 TWh (terawatt hours) per year.

Source: world-nuclear.org

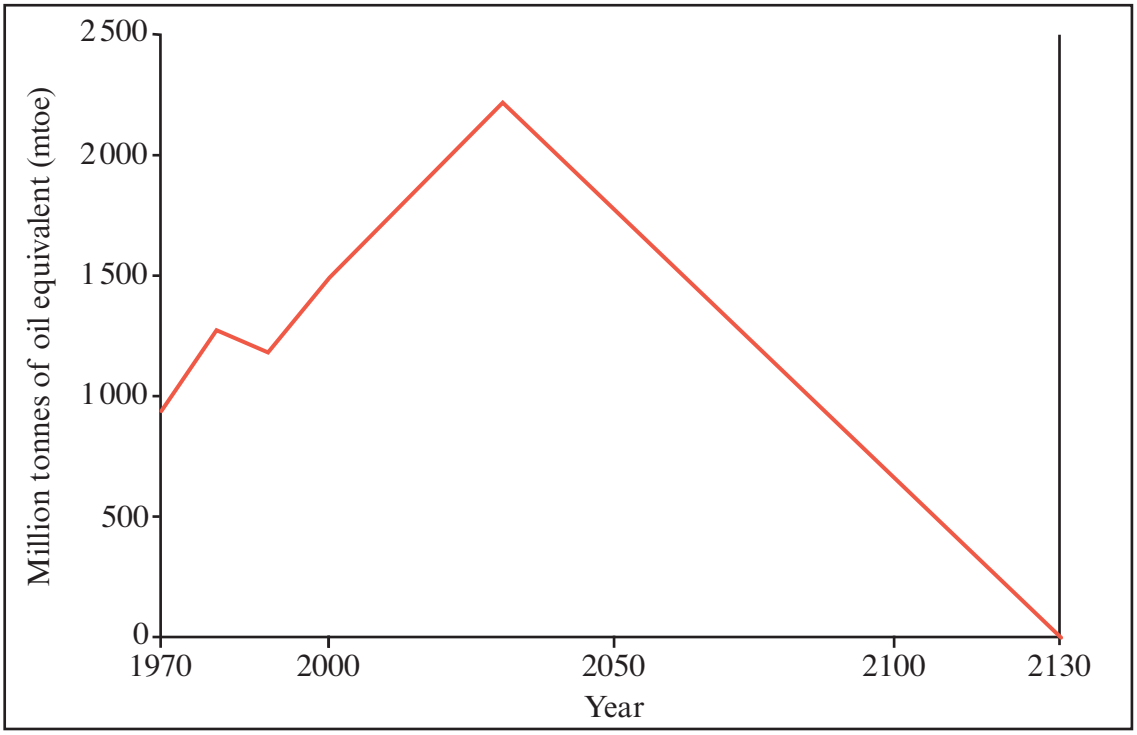
WIDESPREAD ENERGY CONCERNS

Figure 15 The advantages of fossil fuels

- Very large amounts of electricity can be generated in one place using coal, fairly cheaply.
- Transporting oil and gas to the power stations is easy.
- Gas-fired power stations are very efficient.
- A fossil-fuelled power station can be built almost anywhere, so long as you can get large quantities of fuel to it. Didcot power station, in Oxfordshire, has a dedicated rail link to supply the coal.

Source: carbonneutralnewcastle.com

Figure 16 World supplies of fossil fuels



Source: dailytemperaturecycle.com

Figure 17 Clean coal technology

Fossil fuels can all be used in ways that produce virtually no pollution. Between them, coal, oil and natural gas can give us energy for hundreds of years. But, and it is a big 'but', they must be burned in much more careful and efficient ways than in the past.

The worst offender was once coal, but it is capable of being used with virtually no impact on the environment. A series of 'clean coal technologies' have been developed. All MEDCs can afford to adopt these. It is important to use all the technologies developed in order to avoid any damaging impact. These technologies are:

- Carbon capture and storage - this prevents a build up of CO_2 in the atmosphere
- Coal preparation - this removes harmful pollutants such as SO_2, NO_x and particulates
- Gasification - this produces a gas from coal that is extremely efficient with zero-emissions

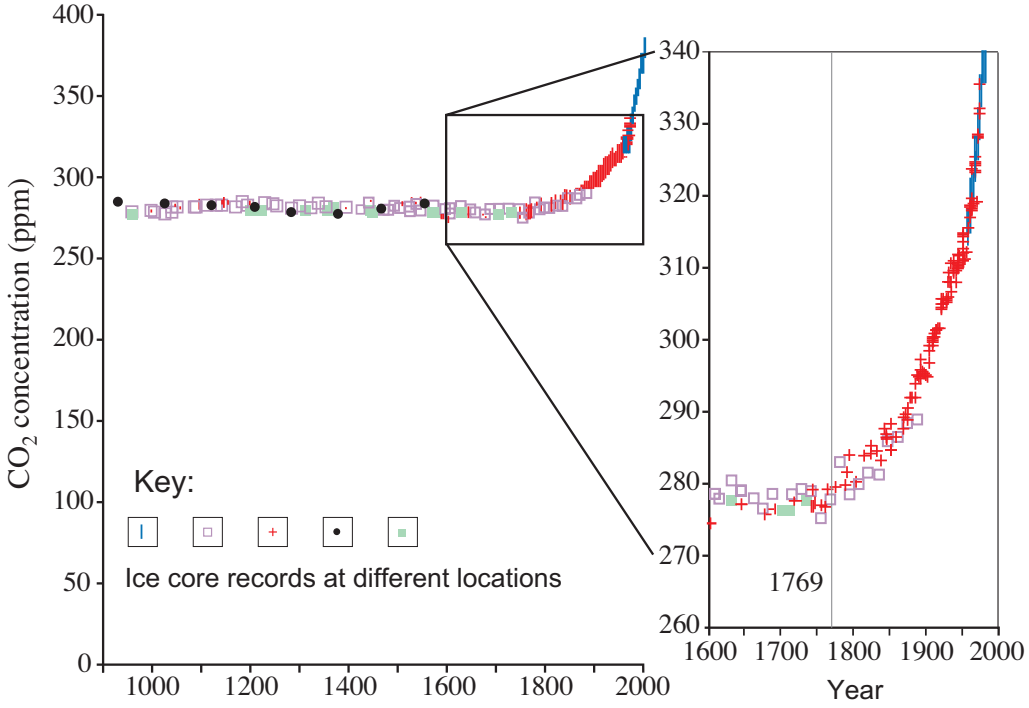
Source: news.bbc.co.uk

Figure 18 Global warming and fossil fuels

"The scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response."
Stern Review, Report on the economics of climate change, HM Treasury, UK Government 2006

The greenhouse effect - some basics
The Earth's atmosphere, like our own bodies, cools or warms until the energy 'inputs' (radiation from the sun) are in balance with energy lost 'outputs' through cooling. Certain gases in the atmosphere (called Greenhouse Gases or GHGs)) act like feathers in a duvet – they trap and hold heat in the atmosphere and influence the temperature at which the global atmosphere is in balance. The more GHGs in the atmosphere, the higher the global temperature (the more feathers in a duvet, the warmer it is).

Carbon dioxide (CO_2) concentrations (in parts per million) for the last 1100 years, measured from air trapped in ice cores (up to 1977) and directly in Hawaii (from 1958 onwards).



"I think something new may have happened between 1800AD and 2000AD. I've marked the year 1769, in which James Watt patented his steam engine. (The first practical steam engine was invented 70 years earlier in 1698, but Watt's was much more efficient.)"

Source: Sustainable Energy - without the hot air David J C MacKay

The root cause of climate change?
The principal GHG is carbon dioxide (CO_2). Over billions of years, organic matter from dead plants and animals transformed into coal, oil, and natural gas in the outer layers of the earth's crust. Since 1750, mankind has extracted these fossil fuels, and used them to power rapid industrial development. Carbon dioxide from the combustion of fossil fuels accounts for about two thirds of the human induced warming effect. Methane, nitrous oxide and other gases emitted from industrial and agricultural activities account for the remaining third.
CO_2 concentrations in the atmosphere have risen one third since the industrial revolution and are set to double in the next 100 years. Temperatures which have varied less than 1 degree Celsius since the dawn of civilisation, are projected to rise between 2 and 4 degrees Celsius over the next century. This is a very rapid transformation in comparison to the longer-term warming and cooling cycles naturally experienced over past millennia. Scientists predict that such rapid changes will cause major and severe harm to the social, economic and environmental systems upon which mankind depends for its sustained survival.
"Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values."
Intergovernmental Panel on Climate Change; Climate Change 2007:
The Physical Science Basis: Summary for Policymakers, February 2007

Source: carbonneutral.com

Figure 19 The nuclear power debate

FOR	AGAINST
• Does not emit CO_2 • Technology already developed • Huge amounts of electricity from one plant • Expertise can be sold for huge profits	• Waste is highly dangerous • Waste is toxic for thousands of years • Uranium is a finite resource • Target for terrorists • Decommissioning is expensive

Source: timeforchange.org

Figure 20 Sizewell advanced gas cooled reactor in the UK

Figure 21 A statement from John Howard, former Prime Minister of Australia

There is a growing body of evidence to suggest that nuclear power has an important role to play in stabilising atmospheric concentration of carbon dioxide. This, along with energy security concerns, has led to a revival of interest in nuclear power.
Greenpeace founders James Lovelock and Patrick Moore are among those urging a re-examination of the case for nuclear power.
Nuclear power emits virtually no greenhouse gases. The International Atomic Energy Agency states that the complete nuclear power chain, from uranium mining to waste disposal, and including reactor and facility construction, emits only 2-6 grams of carbon per kilowatt-hour. This is about the same as wind and solar power, and two orders of magnitude below coal, oil and even gas.

Source: world-nuclear.org

Figure 22 Hydro electric power and water supplies in India

Latest scientific estimates show that large dams in India are responsible for about a fifth of the country's total global warming impact. The estimates also reveal that Indian dams are some of the worst global warming contributors compared to all other nations.

This study estimates that total methane emissions from India's large dams could be 33.5 million tonnes (MT) per annum, including emissions from reservoirs (1.1 MT), spillways (13.2 MT) and turbines of hydropower dams (19.2 MT). Over time, the total generation of methane from India's reservoirs could be as high as 45.8 MT.

Estimates from the study suggest that emission of methane from all the reservoirs of the world could be 120 MT per annum. This means that the total global emissions from large dams alone could be 24% of all the methane emitted as a result of human activities. The study does not include the emission of nitrous oxide and carbon dioxide, which are also greenhouse gases, that are emitted from large dams. If all these were to be included, the global warming impact of large reservoirs would be even greater.

The methane emission from India's dams is estimated at 27.86% of the methane emission from all the large dams in the world, which is a greater share than that of any other country in the world.

These findings, along with the latest round of studies, should further help shatter the myth that power from large hydropower projects is clean. Indian hydropower projects are already known for their serious social and environmental impacts on both communities and the environment. The fact that these projects also emit global warming gases in such a significant proportion should further destroy the myth.

Many dams are built with several purposes in mind. Water for irrigation is of vital importance in many parts of India. Without irrigation, much of the 'Green Revolution' could not have taken place. They have also allowed cheap transport to be developed along navigation channels.

The Damodar Valley Project benefits the states of West Bengal and Bihar. An important feature of this project is the 692 metres long and 11.6 metres high barrage constructed across the Damodar at Durgapur. The Right Bank canal and the Left Bank canal, originating from the barrage, are used for irrigation and navigation respectively.

To meet water supply demands for the rapidly growing cities in India over 3000 dams have been built in the last 60 years. Most of these dams have been more small scale and serve only the purpose of water supply. They do not hold back large or powerful flows of water that can be used for HEP.

India has some areas that have ample rainfall, but other areas where supplies of water are short.

Demand for water is growing rapidly. Industrialisation depends on water supplies for cooling and processing. Agriculture increasingly relies on irrigation to ensure crops grow well. The increasing number of middle class residents in all the major cities demand continuous supplies of clean water, not only for drinking and cooking, but cleaning, washing and keeping gardens well watered.

Industry, agriculture and the urban middle classes also demand reliable supplies of electricity. As a result, multi purpose dams are likely to become even more common in years to come.

For example, construction work is due to start on three hydro power projects on the Chenab River in Indian-held Kashmir as soon as the 2009 Indian parliamentary elections are over.

Source: South Asia Network of Dams, Rivers and People

Figure 23 Problems with fuelwood

Woman cooking with fuelwood in Ghana

Source: ehs.sph.berkeley.edu

Figure 24 The risks from fuelwood smoke

In poor developing country households, wood, charcoal and other solid fuels (mainly agricultural residues and coal) are often burned in open fires, or in poorly functioning stoves. Incomplete combustion leads to the release of microscopic particles and a range of chemical compounds that have been shown to be damaging to human health in confined spaces such as the household environment. Too little is known, however, to distinguish any differences in health effects of smoke from different kinds of biomass.

With proper stoves and good fuel burning practices, fuelwood and charcoal as well as other biomass can be burned cleanly, producing mostly carbon dioxide and water. Such conditions are difficult to achieve in poor urban and rural areas where small-scale inexpensive wood-burning stoves are used. Fuelwood that is not burned properly produces a range of materials characteristic of incomplete combustion. The primary dangerous product is carbon monoxide, but also there may also be benzene, butadiene, formaldehyde, polyaromatic hydrocarbons and many other compounds posing health hazards. The main culprit causing a health hazard in the smoke is thought to be small particles, which are damaging in themselves, and can carry many of the dangerous chemicals.

Many developing country households use fuelwood stoves that have no working chimney or hood for venting the smoke out of the house. Although there have been no large-scale statistically representative surveys, hundreds of small studies around the world in typical local situations have shown that such stoves produce concentrations of small particles way above safe levels – typically 10 to 100 times the long-term levels recommended by the World Health Organization in its recently revised global air quality guidelines for protecting health (WHO, 2005). Even stoves with working chimneys, however, do not completely eliminate indoor pollution, as there is often substantial leakage into the room and some smoke returns into the house from outside.

Source: fao.org

RENEWABLE ENERGY

Figure 25 Geothermal power station, New Zealand

Hot rock under the surface of the earth can heat water converting it to steam. This then generates electricity in the same way as coal, oil, gas or nuclear powered stations.

It is inexpensive and non-polluting where hot rocks are not too far down. Costs, and the risk of environmental damage, increase if the heat source is at greater depth.

Source: nzpics.com

Figure 26 Wind turbines off the Norfolk coast, UK

Wind power offers a great potential for energy in countries that experience strong winds, such as the UK.

There are opponents who see wind turbines as ugly eyesores.

Many conservationists claim that they kill birds and disrupt their migration patterns.

One practical point is that they can only generate power when the wind blows. In the UK, winter anticyclones bring the coldest weather. They also bring very still conditions - reducing output when it is most needed.

Source: srcf.ucam.org

Figure 27 Solar power in Alabama, USA

Solar power depends on the availability, and intensity, of sunlight. Many countries in the developed North, have short hours of daylight in winter and frequent cloud cover throughout the remainder of the year. This means that it is unreliable. To be useful, energy must be available when it is needed. However, it could help to reduce the amounts of fossil fuels needed for energy.

Source: msstate.edu

Figure 28 Biofuels v Food

Biofuels – oilseed rape, wheat, barley, sugarbeet
Energy crops – willow, miscanthus
Biopolymers – linseed, high erucic acid rape, cereals
Biolubricants – crambe
Pharmaceuticals – borage, crambe, poppy, echium, chamomile
Construction – hemp

Some crops cannot be eaten and are only useful as biofuels, such as willow.

Other crops are only suitable as food, such as lettuce, tomatoes or celery.

Many crops can serve as food or be converted into biofuels, such as wheat, barley and sugar beet.

With a growing world population, and some areas becoming deserts, it has to be decided if land should be used for food or energy production.

Such competition for land use is already an issue in Brazil and the USA.

Source: news.bbc.co.uk

Figure 29 Reservation over biofuels by Friends of the Earth

Biofuels are touted as being 'green' fuels, but the Government's dash for biofuels could:

- Destroy forests and valuable habitats.
- Produce more greenhouse gases than they save.
- Threaten the food supply and livelihoods of some of the world's most vulnerable people.

Biofuels can be used in place of petrol and diesel. But they can only play a limited role in reducing greenhouse gas emissions. To convert plant materials into ethanol or biodiesel requires large amounts of conventional energy, which give off nearly as much CO_2 as they save.

The UK Government's Renewable Transport Fuel Obligation (RTFO) could see businesses producing biofuels by destroying rainforests and wetlands. If farmers in the USA are given subsidies to grow biofuels, they will not be growing crops like maize and soya which we eat. This will then make it economically viable for countries with tropical rainforests to cut them down to grow these crops that are no longer being grown in developed countries. This will remove one of the best carbon sinks that the planet has. In the process of clearing rainforest, it would also release far more carbon into the atmosphere than could ever hope to be saved by replacing fossil fuels.

Clearing rainforests would also threaten the planet's biodiversity and almost certainly make extinct many endangered species. Without question, clearing land for biofuels would destroy valuable habitats.

Source: foe.co.uk

CONSERVATION

Figure 30 Conserving energy and water

TIP > Use energy saving devices such as low energy lamps. These last up to ten times longer than ordinary bulbs and use far less electricity. Remember to turn off lights when you leave a room for long periods.

TIP > Use a kettle to boil water for cooking - they're more efficient at getting up to temperature. Avoid over-filling the kettle, but be sure to cover the element.

TIP > Where you need to use saucepans - use the lid! Less energy is lost that way.

TIP > Use a toaster rather than the grill to make toast.

TIP > Make sure your hot water tank and hot water pipes are fully lagged; this can pay for itself in a few months and go on saving you money for years to come.

TIP > Put draught strips around windows and exterior doors. If possible fit a flap across the letter-box.

TIP > Where possible wait until you have a full load before using your washing machine.

TIP > Use water saving equipment in the bathroom, such as cistern displacement devices that are placed in your toilet cistern and can save up to three litres of water per flush, or flushing systems that allow you to control the duration of the flush, and flow restrictors that are fitted into existing basins and showers, which can reduce water wastage by up to 70% whilst still enabling you to have the normal full flow.

TIP > If you use a dishwasher select the low-temperature programme unless you have very soiled dishes.

TIP > Fix dripping taps - they can waste as much as 90 litres of water a day!

TIP > Switch off your TV, video and Hi-Fi at the set. Standby can use between 10%-60% of the power used by the device if it was switched on.

TIP > Defrost fridges and freezers regularly to keep them running efficiently.

TIP > Have a shower instead of a bath - they use a third of the water it takes to have a bath (*this excludes power showers, which use the same amount of water as a bath)

TIP > At night, pull all curtains to stop heat loss through the windows. Take care not to close curtains over radiators as this will funnel heat straight out of the windows.

TIP > Don't set your water thermostat too high; 60°C/140°F is usually adequate for bathing and washing.

TIP > Reducing your room temperature by just 1°C can cut as much as 10% off your heating bills.

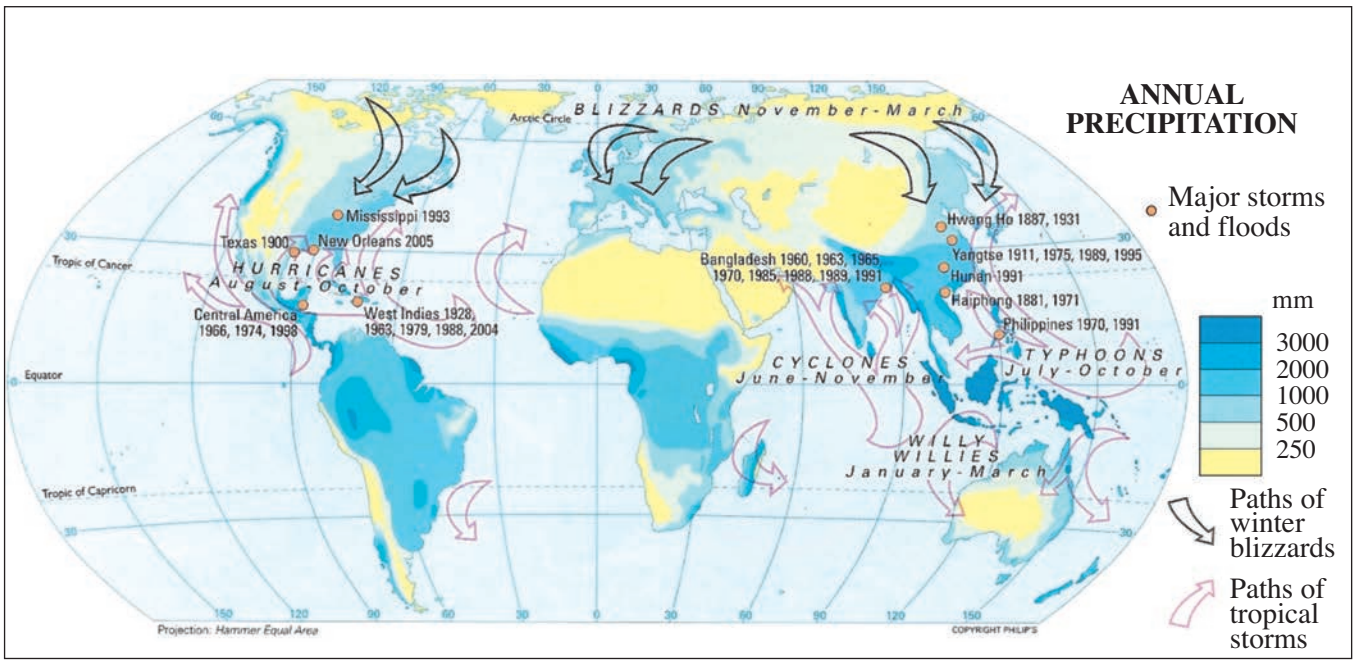
TIP > Don't let the tap run while brushing your teeth - you will save almost five litres of water a minute.

TIP > Before buying a new water appliance, like a dishwasher or washing machine, check for its water efficiency rating.

TIP > Avoid using hoses and sprinklers which can use up to 1,000 litres of water per hour - instead, collect rainwater in water butts and buckets for use in the garden.

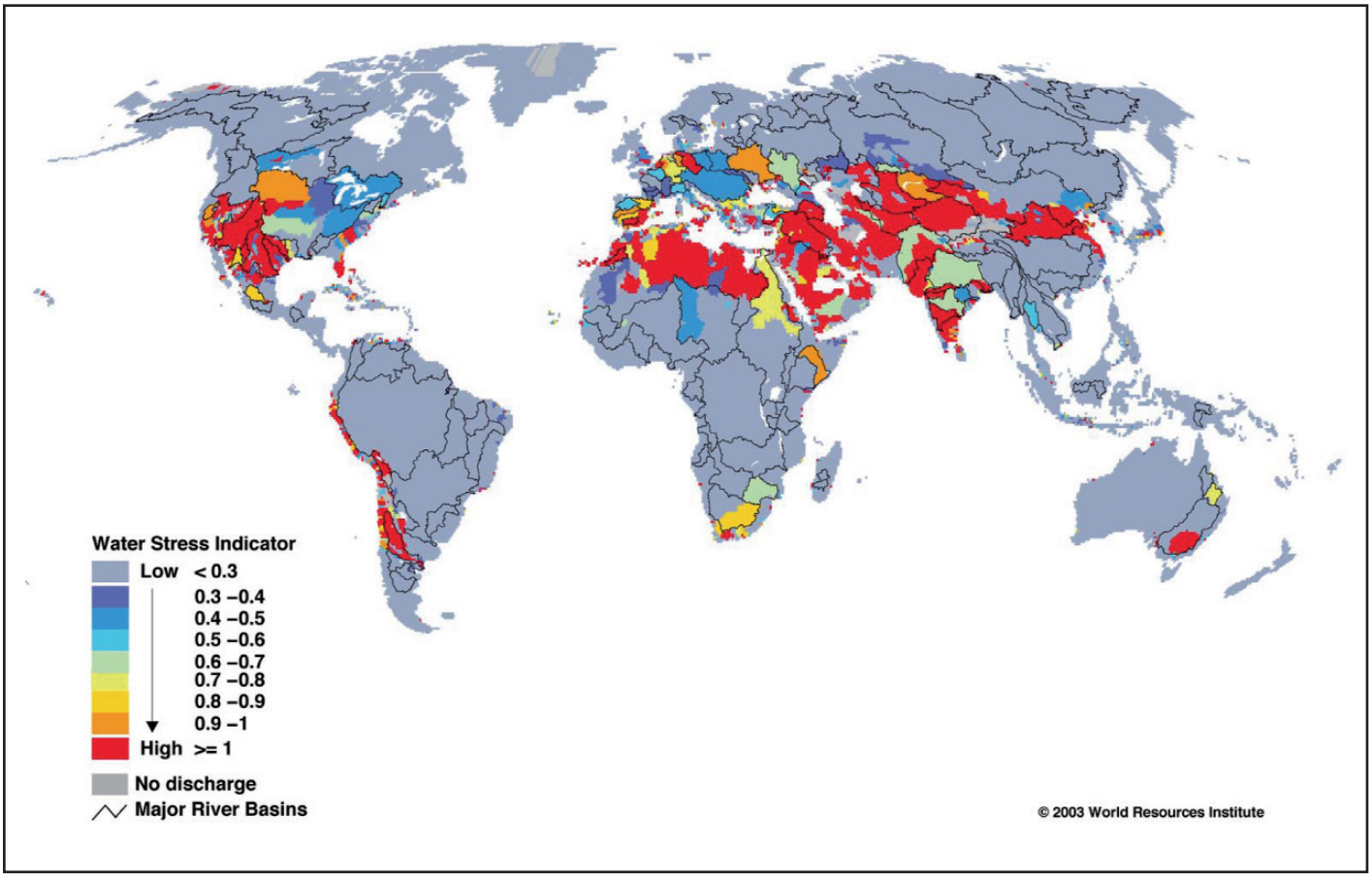
Source: homeenergysaver.co.uk

Figure 31 World precipitation



Source: Philip's Modern School Atlas

Figure 32 World levels of water stress



Source: earthtrends.wri.org

Sources of information

Figure 1	The Energy Challenge, DTI (UK), July 2006
Figure 3, 8 & 12	http://www.iea.org/Textbase/stats/index.asp
Figure 4	A Pain in the Neck: The Firewood Situation in South-Western Kgatleg, Botswana, Jelenic & Van Vecten, University College of Botswana, Gaborone, 2001
Figure 5	www.cso.gov.bw
Figure 6	Gender Mainstreaming in Botswana Energy Policy, Masego Kealotswe, University of Twente, 2006
Figure 7	Report of the Proceedings of the Workshop on the Establishment of Gender and Energy Networks in Botswana, Botswana Technology Centre, March 2004
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