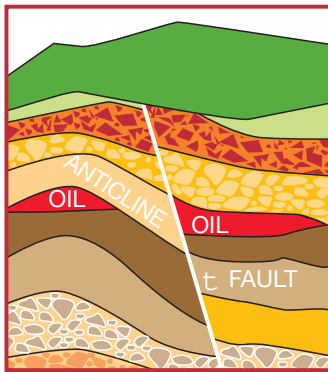


PETROLEUM



FORMATION ar

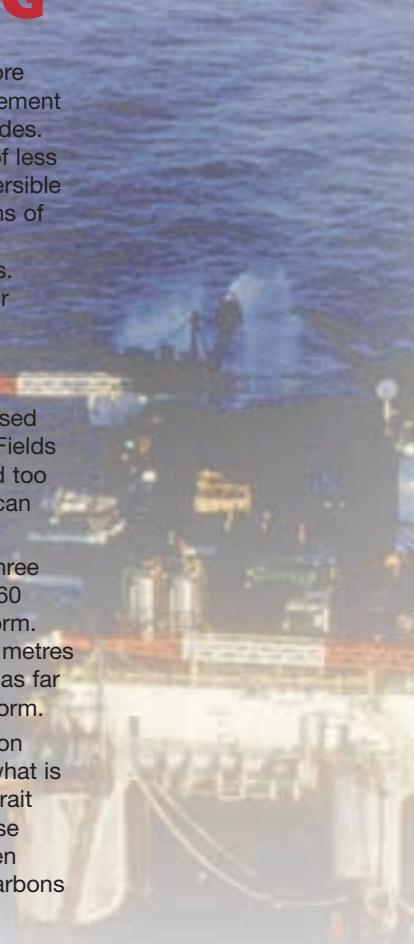


Anticline and fault traps.

- Petroleum is an organic compound made up of a variety of hydrogen and carbon atoms (hydrocarbons) that range from a light gas or methane to a number of heavy solids such as bitumen. It is formed by the decomposition of plant and animal material and is washed down with sediments to lake and ocean floors.
- Over millions of years the organic matter is trapped by layers of sediment deposited on top and the matter gradually becomes buried deeper in the earth's crust.
- The greater the depth of burial, the higher the temperature and the greater the pressure which causes chemical changes to the material. The heat and pressure converts mud and sand to shale and sandstone, and the organic matter converts into liquid hydrocarbons.
- The oil droplets fill the pore spaces in porous rocks such as sandstone and limestone and if water is present in the porous rocks, the oil will rise upwards.

EXPLORATION and DRILLING

- Seismic surveys are the most common exploration tool used in the search for oil and gas. Geophysicists record sound waves reflected back to the surface from structures kilometres below the seabed. They produce maps of the sub-surface showing the location of geological features such as sedimentary basins, faults and hopefully petroleum traps such as anticlines.
- Gravity and magnetic aerial surveys are also used to indicate the extent of sedimentary rocks over wide areas.
- Drilling is the only way to be sure if a structure identified by seismic surveys actually contains hydrocarbons.
- Onshore the drilling process is relatively simple. A drill bit, made of either industrial diamonds or tungsten carbide, is attached to a length of drill pipe and rotated at high speed. Extra pipe lengths are added as the drill bit penetrates deeper into the rock. Specially prepared heavy mud is circulated through the pipe and drill bit, to cool and lubricate the drill bit and carry rock cuttings to the surface for analysis and to reduce the risk of high pressure petroleum blowing out at the surface.
- Offshore exploration drilling is more complicated because of the movement of the rig caused by swells and tides. Jack-up rigs are used in waters of less than 100 metres and semi-submersible rigs are designed for use in depths of up to 300 metres. They are most efficient in calm, protected waters. Drill ships are used extensively for deep water drilling in depths of more than 300 metres.
- Horizontal drilling is common these days, which enables increased production from thin reservoirs. Fields which previously were considered too small to be economically viable, can now be tapped.
- A large field may require two or three production platforms, with up to 60 production wells from each platform. Wells can be drilled to over 5000 metres below the sea-bed. Some reach as far as eight kilometres from the platform.
- The recovery of hydrocarbons is on average only about one third of what is actually in a reservoir. In Bass Strait and the North-West Shelf, because of excellent quality reservoirs often two-thirds or more of the hydrocarbons are recoverable.



1859

First oil well drilled in Titusville, Pennsylvania, USA.



1892

First bore sunk in Coorong area (South Australia) in the search for oil.



1916

The bowser kerbside petrol pump is introduced to Australia.



1919

First exploration for oil in Western Australia takes place in the Kimberley.



1953

Flow of oil discovered in WAPET's Rough Range No. 1 well at Exmouth Gulf (WA), provided stimulus for continuing search in ensuing years and heralded modern phase of exploration in Western Australia.



1961

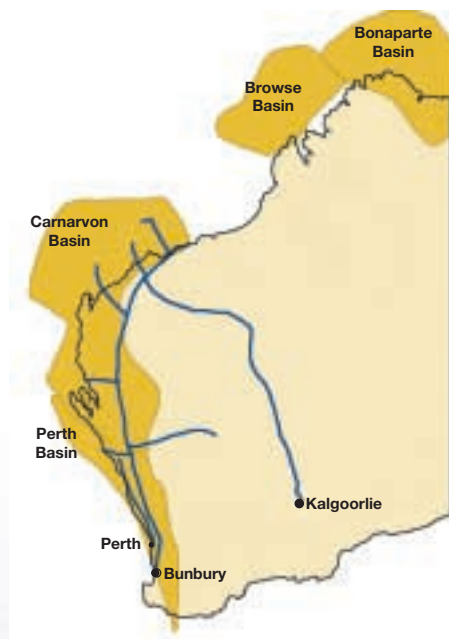
Flow of oil in Moonies No. 1 well about 80km from Tara (Queensland). Australia's first commercial oil field by Union-Kern-AOG group on a field around this well.

and LOCATION

When petroleum is trapped by an impermeable rock against faults or in anticlines, it is prevented from moving any further and forms a trap. Petroleum trapped in porous sedimentary rocks can occupy between 5% to 25% of the rock volume. Rocks containing hydrocarbons are called reservoirs. Much of the petroleum produced is not trapped and escapes to the surface where it forms seeps, evaporates, or is oxidised by bacteria.

Most of Australia's oil and gas is found in offshore sedimentary basins around 2 to 3 km below the seabed. More than 300 offshore production wells produce 70% of Australia's oil and 100% of Australia's gas needs.

Gas and oil are also drawn from a number of small onshore fields in southern Queensland and South Australia. Western Australia produces gas from the northern Perth Basin however, the largest oil and gas field is the Carnarvon Basin off the north-west coast. Most of Western Australia's petroleum is found in rocks of the Jurassic and Triassic Eras (formed 130 - 220 million years ago).



■ Major petroleum resource areas

— Major gas pipelines

REFINING

Fractionation - Crude oil is separated into its various components in a fractionating column. The oil is passed into the base of the tower where the temperature is at its highest. The various fractions vaporise and rise up the column. The heaviest fractions with the highest boiling points such as lubricating oils, diesel oils and bitumen, condense low down in the tower and are extracted nearer the base.

Catalytic Cracking - Heavier less valuable parts of the oil mixture that come from the distillation plant are 'cracked'. Larger molecules are broken into smaller molecules using a catalyst (a substance which speeds up a process) of alumina silica. Today, catalysts can extract 80% of light oil from heavy crude. A few years ago only 40% would have been possible.

Purification - The removal of sulphur, oxygen, nitrogen, trace metals such as vanadium, silicon, sodium and other unwanted elements and compounds.

Blending - Many individual components are mixed together to produce finished products.

Liquefied natural gas (LNG) is produced by removing carbon dioxide and water and cooling the dry gas at a temperature of minus 161°C until it is liquefied. It can then be transported by sea over long distances in LNG tankers.



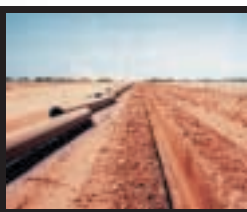
1964/65

Many significant oil and gas strikes made throughout the country including the discovery of gas and oil in Bass Strait (Victoria).



1971/72

Discovery of North West Shelf gas fields off the north west coast of Australia.



1984

Domestic Gas from North West Shelf comes on stream to Perth.



1994/5

The Griffin, Scindian and Skate fields commence production and first oil flows from the Wanaea and Cossack fields.



1996

Goldfields gas pipeline became operational.



2002

Australia's largest single export deal, to supply China with 3 million tonnes of LNG per year for 25 years, is signed.

PETROLEUM STATISTICS

Value of Petroleum Produced in Western Australia

The value of oil and gas produced in WA during 2003 was \$9.69 billion which makes oil and gas the single largest contributor to WA's Gross Domestic Product.

Employment

Australia wide there are 13,000 people directly employed by the petroleum industry.

Principal Petroleum Producers in Western Australia

APACHE ENERGY LTD

East Spar, Harriet, Stag, Campbell, Agincourt, Wonnich, Sinbad, Tanami, North Herald, South Pepper.

ARC ENERGY NL

Dongara.

BHP BILLITON PETROLEUM (NORTH WEST SHELF) PTY LTD

Chinook/Scindian, Griffin.

CHEVRON TEXACO AUSTRALIA PTY LTD

Barrow Island, Cowle, Roller-Skate, Saladin, Yammaderry.

KIMBERLEY OIL NL

Blina, Boundary, Lloyd.

ORIGIN ENERGY RESOURCES LTD

Beharra Springs, Tubridgi.

WOODSIDE ENERGY LTD

Cossack, Goodwyn, Hermes, Lambert, Laminaria, Legendre, North Rankin, Perseus, Wanaea.

Current statistics are available from the Statistics Digest on the Department of Industry and Resources website at www.doir.wa.gov.au



PETROLEUM FACTS

Petroleum comes from 'petros' (Greek for stone or rock) and 'oleum' (Latin for oil).

The earliest records of its use go back to 4000BC. Ancient people found it in tar pools (seeps) and they used it for waterproofing boats and houses. The ancient Chinese used bitumen when building the Great Wall of China.

A barrel of oil is the industry's standard measurement. One barrel contains 159 litres. Petroleum today has a greater variety of uses than perhaps any other substance in the world.

The chemical industry relies on the petroleum industry for over 90% of the source material for the thousands of chemicals it produces. Ethanol, styrene, ethyl chloride, butadiene and methanol are intermediate chemicals in the production of substances such as plastics, synthetic rubbers, refrigerants, fertilisers, resins, solvents, detergents, nylon, explosives, insecticides, dyes, some medicines and paints.

Petroleum fuels ignite and burn steadily and produce a great amount of heat and power in relation to their weight. They are also easier to handle, store and transport.

61% of the world's energy requirement is met from oil. Fuels for transportation include petrol, diesel fuel and jet fuel. 45% of all crude oil is refined into petrol, 7% into diesel fuel and 7% into jet fuel, the remainder is used for lubricating oil and chemicals.

By-products of petroleum refining are also used as raw materials. These include asphalt, the principal road building material and wax, an essential ingredient in such products as candles, milk cartons and furniture polish.

Oil makes a good lubricant as it dissipates heat, reducing the effects of friction. Oil also gives physical and chemical protection to the surface it is lubricating.

Oil and gas provide 53% of Australia's energy needs with coal and renewables providing the rest.

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