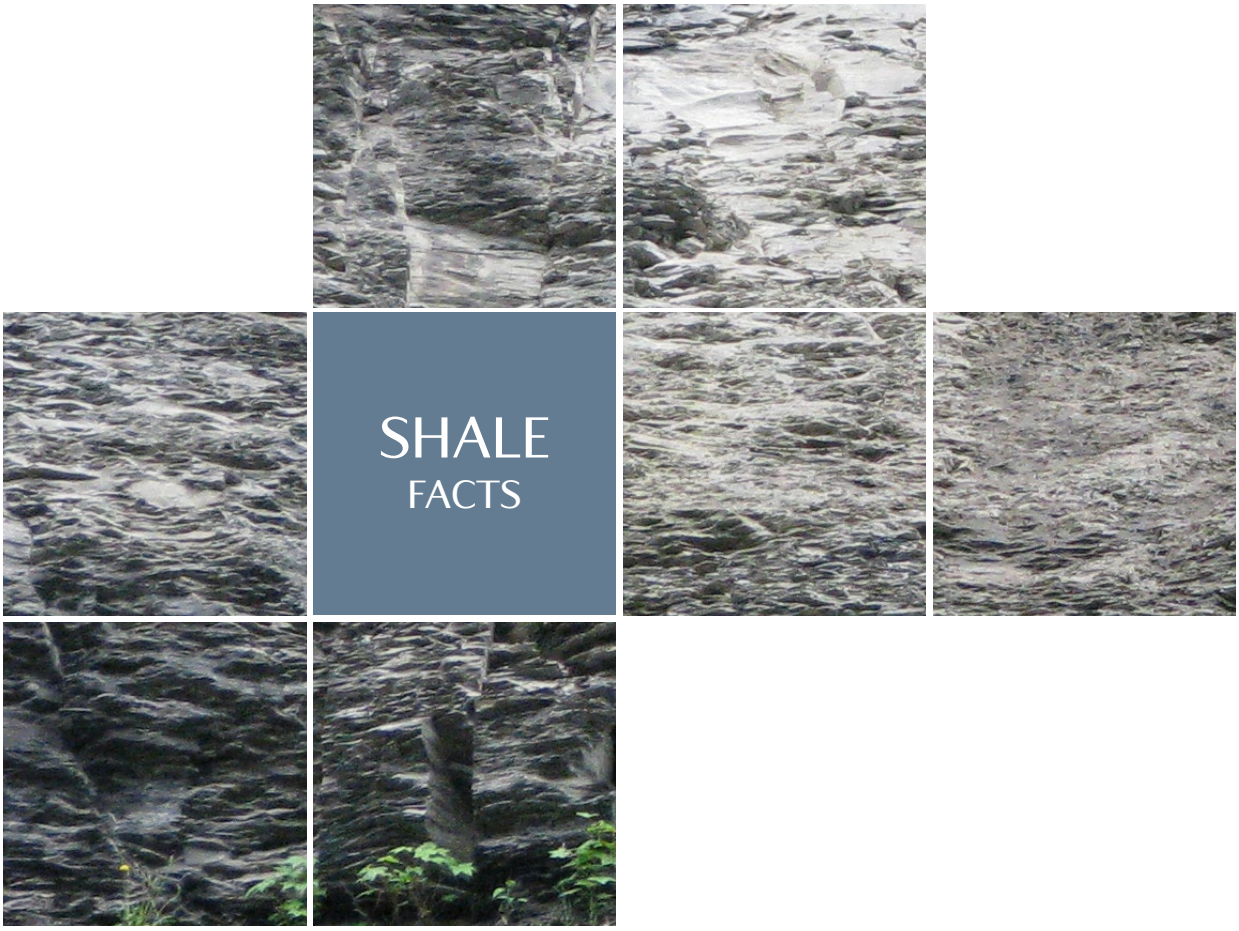

Understanding the resources

Why are they considered unconventional?

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Oil and natural gas found in **shale** and other **tight rock formations** are the same as oil and gas found elsewhere.

Hydrocarbons in the form of oil and gas are derived from sediments rich in organic matter including algae, plants and plankton. Through geologic time these sediments become buried deep within the earth and are transformed into shales. If the conditions are right, oil and gas are generated when the shales are subjected to heat and pressure.

'Conventional' oil and gas reservoirs are created when hydrocarbons migrate from the source formation into permeable reservoir rock, where they become trapped by an overlying layer of impermeable rock. Many of the hydrocarbons do however remain behind in the source rock.

Oil and gas extracted directly from the source rock are generally termed 'unconventional'.

There is no difference between unconventional and conventional oil and gas. There are however differences in the reservoirs where the hydrocarbons are found and the techniques required to extract them.

GLOBAL POTENTIAL

Shale resources have begun to transform the global energy outlook. Due to reserve additions from shales, global natural gas reserves are estimated by the International Energy Agency to last around 250 years at present consumption levels.

Source:
IEA World Energy Outlook 2011

TIGHT ROCKS

Shale oil and gas are found in source rock formations more than 1.6 kilometres (1 mile) below the earth's surface.

Because these rock formations are characteristically hard and tight, they require additional stimulation (hydraulic fracturing) to release oil and gas.

***Porosity** - open space within a rock, similar to pores in a sponge*

***Permeability** - the ability to flow or transmit fluids through the rock.*

Developing conventional reservoirs

Because conventional reservoir rocks have favourable storage porosity and flow permeability properties, the oil and gas flow naturally, creating no need for reservoir stimulation. Therefore fewer wells are needed to drain the reservoir since the oil and gas flow with relative ease.

Developing unconventional reservoirs

Unconventional resources are trapped in rock formations with very low porosity and permeability; this means the oil and gas can only flow to the wells by creating pathways to the wellbore.

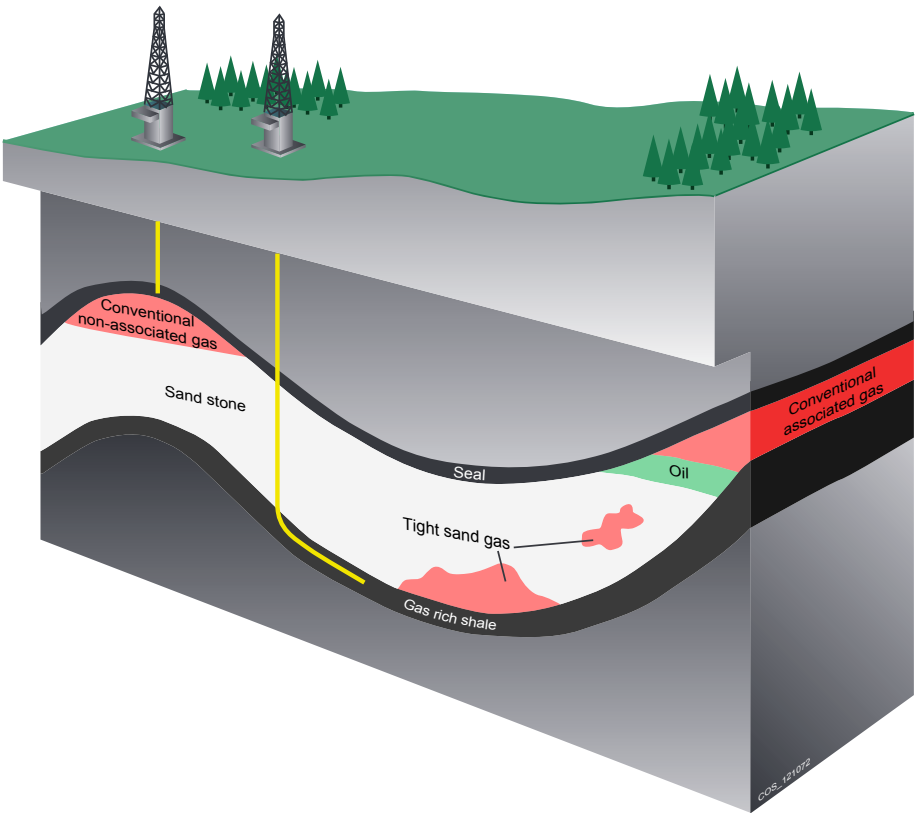
Wells are drilled vertically until they reach just above the target zone, where they curve before drilling further horizontally. Hydraulic fracturing, a proven engineering technology, is then applied to the horizontal section of the well to create small fractures in the rock. These small fractures are then held open by proppants (sand or ceramic pellets) to create pathways to allow the oil or gas to flow into the well.

Producing oil and gas from shale and other tight rocks requires more wells than in a conventional field, to allow for connectivity of the extensive reservoir. The ability to drill multiple horizontal wells from one well pad means that the overall number of surface locations is significantly reduced.

Both horizontal wells and hydraulic fracturing have been used in conventional reservoirs for decades to improve flow rates, but only recently have they been commercially applied to produce oil and gas from shale and other very tight rocks.

In conventional reservoirs, oil and gas effectively rise upwards from the source rock until they reach an impermeable layer where they become trapped and can rise no further. Wells are then drilled into these 'traps' to drain the hydrocarbon (oil and gas) resource.

In unconventional reservoirs, oil and gas are trapped within the tight source rock (shale). Horizontal wells and hydraulic fracturing are required to develop these resources.



Source modified from U.S. Geological Survey Fact Sheet 0113-01

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The natural resources found in shale are of great importance to all of us - transforming global energy supplies and creating new opportunities.

GLOBAL VERSION / APRIL 2013

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