Shale Gas

What is shale?

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- Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas.
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- Shale gas refers to natural gas that is trapped within these shale formations.
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How is it formed?

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- Conventional gas reservoirs are created when natural gas migrates toward the Earth's surface from an organic-rich source.
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- They migrate through highly permeable reservoir rock, where it is trapped by an overlying layer of impermeable rock.
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- In contrast, shale gas resources form within the organic-rich shale source rock.
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- The low permeability of the shale greatly inhibits the gas from migrating to more permeable reservoir rocks higher.
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- **Extraction** - Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas the potential of which was unutilised for long.
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- Without these, shale gas production would have been economically unfeasible because the natural gas would not flow from the formation at high enough rates to justify the cost of drilling as in the case of conventional oil.
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- **Refining** - The shale oil is used as fuel oil or upgraded to meet refinery feedstock specifications by adding hydrogen and removing sulfur and nitrogen impurities.
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- Shale oil and conventional crude oil have different kinds of impurities.
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- The catalytic processes adopted by the refineries should be able to handle these impurities.
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- **Advantage** - Natural gas is a cleaner-burning than coal or oil.
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- The combustion of natural gas emits significantly lower levels of key pollutants.
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- **Concerns** - The drilling and fracturing of wells require large amounts of water, leading to some environmental concerns.
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- The process also produces large amounts of wastewater, which may contain dissolved chemicals and other contaminants that require treatment before disposal or reuse.
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- If mismanaged, the potentially hazardous chemicals used in the fracturing fluid can be released by spills, leaks, or other exposure pathways.
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- This may lead to contamination of surrounding areas, including sources of drinking water, and can impact natural habitats.
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What is Hydraulic fracturing?

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- Also known as fracking, this is a process in which more than a million gallons of fluid is injected into rock formations.

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- This fractures the rock and stimulates the flow of natural gas or oil, thus increasing the volumes of gas or oil that can be recovered above ground.
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- The fluid used in hydraulic fracturing commonly consists of water, proppant and chemical additives.
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- A proppant is a solid material, typically sand, ceramic pellets or other small particles, designed to keep an induced hydraulic fracture open.
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- The chemically induced fractures can extend several hundred feet away from the wellbore.
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What is Horizontal drilling?

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- Vertical wells can effectively drain rock units that have a very high permeability.
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- However, where permeability is very low as in shale formations, fluids move very slowly and do not travel long distances to reach a well bore.
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- Horizontal drilling is a mechanism used for drilling non-vertical wells and can increase the productivity in low-permeability rocks by bringing the well bore much closer to the source of the fluid.
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- Horizontal drilling is done to stimulate the productivity of wells in organic-rich shales, and hydraulic fracturing is done to produce artificial permeability that is propped open by proppants.
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