



Production cycle

Ensuring safe and responsible operations



Statoil



Statoil is committed to developing our shale projects in a safe, responsible and open manner.

Statoil takes a long term perspective on the development of our shale resources. We focus on technology to recover resources in the best way, to achieve the highest recovery rates and to lower the environmental impact. In addition, we strive to identify and implement activities that benefit the local communities where we operate.

The development of shale resources can be explained in four distinct stages:

- 1) Site selection and preparation
- 2) Drilling and hydraulic fracturing
- 3) Production and marketing
- 4) Plugging and reclamation

Stage 1: Site selection and preparation

35 - 50 days

Statoil selects development sites to minimise environmental impacts and local disturbances. Once land has been selected and approved for drilling according to regulations and guidelines, land clearance begins. Construction crews then construct a well pad on the cleared land.

Stage 4: Plugging and reclamation

7 - 20 days

When a well is no longer producing oil or gas in economic quantities, the well is plugged and secured. All surface equipment is removed and the location is restored.

Stage 2:

Drilling and hydraulic fracturing

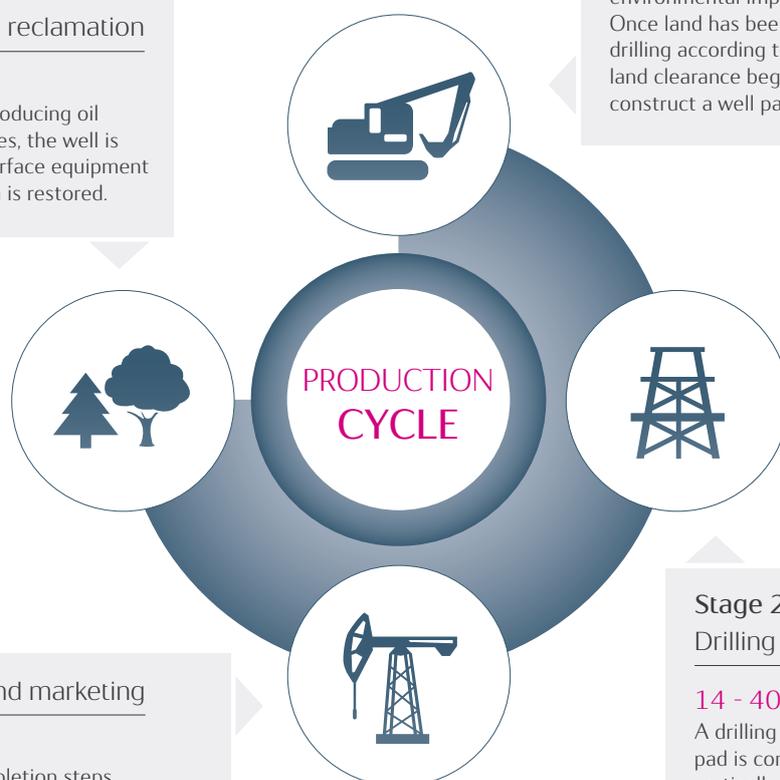
14 - 40 days

A drilling rig is set up once the well pad is set up. A well is drilled vertically, then horizontally into a shale formation. After the well is drilled, hydraulic fracturing begins, allowing oil and gas to migrate into the wellbore and up to the surface.

Stage 3: Production and marketing

20 - 40 years

When drilling and well completion steps are finished, all drilling equipment is moved out. During the production phase the bare minimum of equipment remains on site.



STAGE 1

Site selection and preparation

Statoil selects and designs development sites to minimise environmental impacts and local disturbances.

Numerous studies and evaluations are required to establish the potential for the commercial development of a shale play, including geological setting, geological trend evaluations, seismic surveys, and pilot hole drilling and testing. These studies help us understand the underground geology and potential for oil and gas.

Once the oil and gas potential is established, we evaluate the environmental footprint; considering the community, infrastructure, logistics, operations, land use, and health, safety and environmental factors.

When land has been selected and approved for drilling according to regulations and guidelines, an access road is created if required before land clearance begins. In four to six weeks, an area of roughly 5,000 square metres (54,000 square feet), the equivalent of a soccer field, is cleared for a single-well pad.

BEFORE DRILLING CAN BEGIN

After the land is cleared, we construct a well pad on the site. This step typically takes one or two weeks. Once the well pad is complete, a drilling rig is set up.

MINIMISING DISTURBANCES

Statoil drills multiple wells from one pad; this reduces surface impact and disturbance, thereby minimising the environmental footprint.

Where possible, we build pipeline gathering systems to transport oil, gas and water, reducing traffic and impact on roads and local infrastructure.

We also limit site development during local wildlife, hunting and fishing seasons, and, when appropriate, use sound dampening rig technology.



Drilling rig on a well pad, Marcellus, United States

STAGE 2

DRILLING AND PERMITS

Drilling activities are regulated and require multiple permits.

These permits can cover aspects such as well depth, completion process, potential impacts of well site construction and measures to protect freshwater aquifers.

Drilling and hydraulic fracturing

The combination of two proven technologies, horizontal drilling and hydraulic fracturing, make it possible to develop natural resources from shale formations.

A well is first drilled vertically until it reaches just above the target zone, where it curves before drilling further horizontally into the production zone. Geologists advise on the best place to begin horizontal drilling based on geological and geophysical evaluation. The total time required to drill and complete a well depends on the target depth, the length of the lateral and the geological conditions encountered. For example, a well at the shallower depth range of 4,270 metres (14,000 feet) would take about three weeks to drill, while a well of 6,700 metres (22,000 feet) would take about five weeks.

After the well is drilled, completion, which includes hydraulic fracturing, begins. This is a controlled engineering activity, in which small amounts of explosive charges are used to create perforations in the horizontal section of the wellbore. A mixture of water, proppant (sand or ceramic pellets) and chemicals is then pumped into the well at high pressure, creating fractures in the rock. These steps allow oil and gas to flow into the wellbore and up to the surface.



Hydraulic fracturing is a proven engineering activity. It is estimated that over 2.5 million wells have been hydraulically fractured since the technology was first introduced in 1949.

Journal of petroleum technology



STAGE 3

Production and marketing

When the drilling and well completion steps are finished, all drilling equipment is removed. During production the bare minimum of equipment remains on site.

According to the location, basic landscaping (replanting) may then be performed, minimising the footprint of the producing well. Pipelines are installed for the transportation of water to and from the site, as well as the produced oil and gas. In some areas, trucks or trains may be used to transport the resources to market.



Train takes oil to market in the Bakken, United States

FLARING

In the absence of suitable infrastructure or storage for the natural gas which comes out of a well, it may be necessary to burn - or "flare" - the gas. The main by-product of this burning process is carbon dioxide.

Statoil is committed to continuously working to reduce flaring at all our shale projects. By reducing flaring, we prevent wastage of a valuable energy source, and lower emissions. Our aim will always be to utilise the resource, industrially or commercially.

For example, in North Dakota, US we are taking gas that would be flared and delivering it to our rigs to be used as fuel.

AIR EMISSIONS

We gather emissions data from our operations to ensure we meet targets to minimise our environmental footprint.

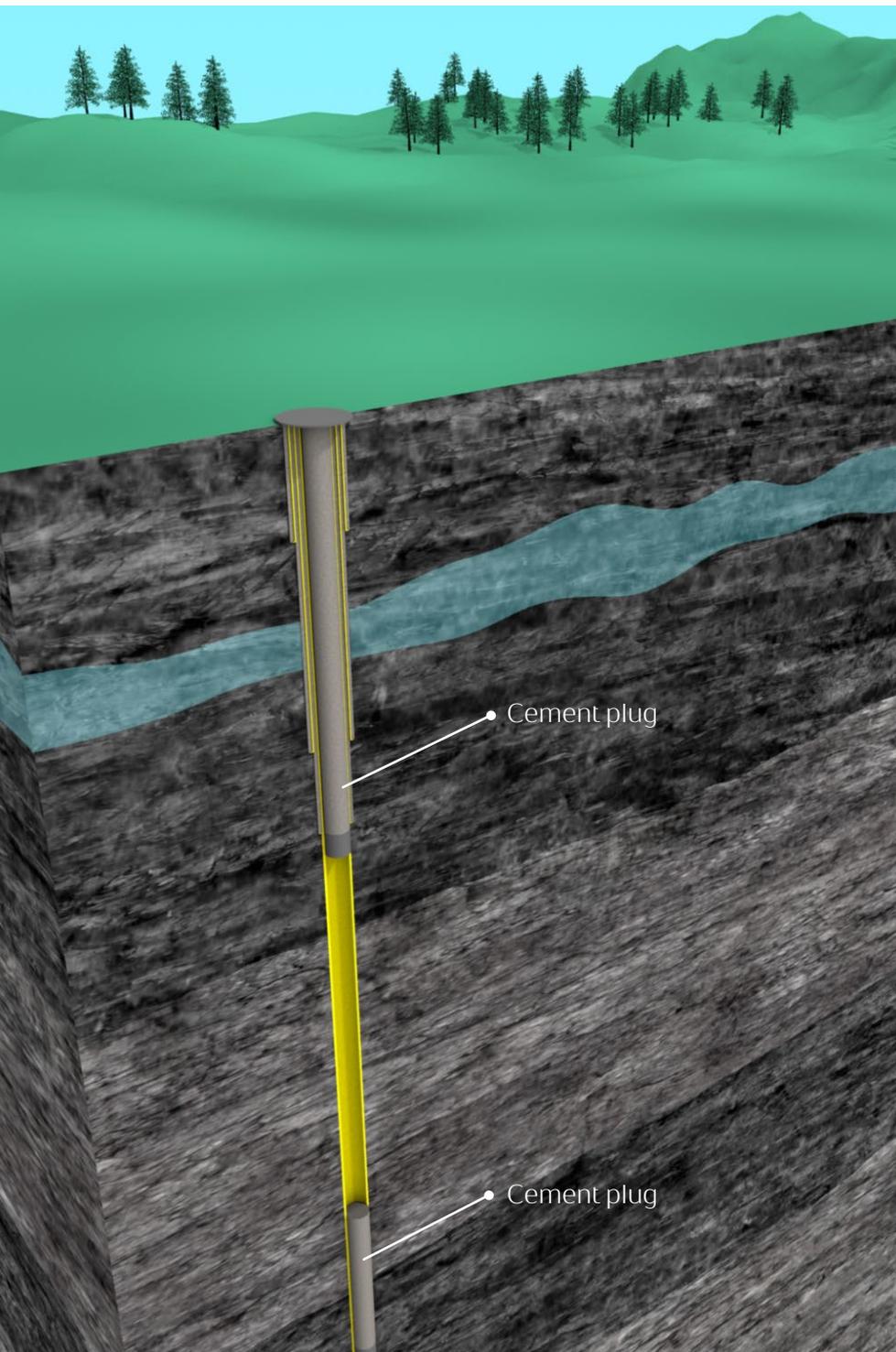
In order to reduce emissions from our operations, we are converting our rig fleet in North Dakota, US to run on bi-fuel systems that replace 60% of the diesel used with natural gas. In North Dakota we are also piloting a program where we convert our fracturing trucks to bi-fuel systems.

Once in the production stage, the well can be expected to produce for 20-40 years or more.

STAGE 4

Plugging and reclamation

When a well no longer produces oil or gas in economic quantities, the well is safely plugged.



Once a well is plugged, surface equipment is removed and the location is restored. To safely plug a well, regulatory agencies may survey and approve the placement of cement plugs into the wellbore. This isolates and prevents any movement of fluids - oil, gas or water - across reservoirs, into freshwater zones, or up to the surface.



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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.