

PICKERING 1 WELL WORKOVER FACT SHEET

The Wellsite

The Pickering gas field has one well site with two wells: PK1 was drilled and completed in 1996; and PK2 in 2009. They target conventional gas reserves in the naturally fractured carbonate Kirkham Abbey Formation (KAF). In May 2016 Third Energy received planning permission for a change of use for PK1 from a production well to a production and water reinjection well.

Upcoming Well and Wellsite Modification Works

A workover rig will be mobilised to the well site and rigged up to retrieve the existing well completion (production tubing and associated equipment) from the well. New production tubing, two new liners and an electric submersible pump (ESP) will then be installed inside the existing well casing/liner.

There will also be minor modifications to the well site: an upgrade to the electricity supply and installation of surface equipment, pipework and instrumentation to allow gas and water to be produced separately from the well and for the produced water to be reinjected into the well.

Length of Operations and Timing

The workover operations will be 24 hours a day and it is anticipated that it will take approximately three weeks including two days at the beginning and the end of the operation for mobilisation of equipment to the site and two days for demobilisation.

After the workover rig has left the site, there will be some minor site works and commissioning of the well to hook up the flowline and test the downhole equipment. These minor operations will take place between the hours 7am to 7pm, Monday to Saturday.

Water Monitoring

The Environment Agency permits issued in 2015, covering the sub-surface aspects of this project, require an ongoing programme of groundwater monitoring, necessitating three shallow water monitoring bore holes. These were drilled in 2016 and three rounds of baseline water sampling have taken place; the EA were on site for the most recent sampling exercise. Once production from the modified well restarts, ground water monitoring will resume. The British Geological Survey has also been taking water samples as part of its independent monitoring programme across the Vale of Pickering.

Production Challenge

PK1 is not currently producing gas because of water breakthrough. Over time, the natural fractures in the KAF reservoir have become flooded with the formation water. As a result, as the water moves towards the well bore it bypasses the gas which remains in the pores in the rock. The increasing proportion of water to gas has restricted the well's production potential – eventually reaching the point where it has ceased to flow or been “killed” by the weight of water in the well.

Solution

Of the estimated gas initially in place (GIIP) only about 14-18% has been produced to date. It is believed that by applying different technology, the gas recovery could be increased to around 50% of the GIIP.

The plan to restore production from the well has two parts. An Electrical Submersible Pump (ESP) will be installed at the bottom of the well to provide “artificial lift”, bringing the water to the surface separately from the gas. This well-established technique uses a higher tech version of pumps found on farms to produce water from bore holes. Technical and reservoir engineering studies have shown that producing the formation water, with the aid of the pump, will create the right conditions for gas to flow to the surface in increased quantities.

A solution was also needed for the sustainable disposal of the larger quantities of produced water. Re-injection of this produced water back in the KAF reservoir in the longer term (as currently happens via pipeline to the KM3 well) would be counter-productive to improved gas recovery.

Therefore, the second part of the solution is the conversion of the current production well to a production and injection well. Disposal of the produced water will be by re-injection into the Sherwood Formation which sits above the KAF and has similar characteristics to the formation water. The Sherwood formation water in the Vale of Pickering is much more saline than seawater and has no value for human consumption, either as a source of potable water or farm water.

Design of New Well Completion

The new completion has been designed, so that the formation water and gas are separated at the bottom of the well. The formation water will flow to surface via a new 2 3/8" tubing and the gas will flow up the well via an "annulus" between the 2 3/8" tubing and a new 5.5" liner [casing]. A new 7" casing which will have been run and stabbed into the existing 7" liner top, will create a second annulus for the water re-injection. This design allows a "monitoring annulus" between the new 7" and the existing 9 5/8" casing to ensure that the re-injected water cannot leak into shallower formations.

Ongoing production

If the concept proves viable, following a six to twelve month trial period, the PK1 well will continue to produce gas and re-inject produced water. The removal of water from the KAF reservoir is also expected to improve gas recovery from PK2. Both wells will then continue to produce gas until cessation of gas production, anticipated to be up to 15 years.