Habanero Circulation Test – Connection Between Two Wells in Granite at 4,200 m Depth

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ABSTRACT

Geodynamics carried out open loop (venting to atmosphere) flow testing between its two geothermal wells Habanero 1 and 3 in March and April 2008. The wells are located in basement granites beneath the Cooper Basin in NE South Australia and are 550 m apart. The temperature in the reservoir which is mostly contained in what is known as the main fracture zone is 245-250°C. The testing was designed (i) to demonstrate communication between the wells along the fracture zone which was stimulated from Habanero 1 in 2003 and 2005 and (ii) to determine the impedance or friction loss associated with circulation between these wells. The impedance would govern the pumping requirement for closed loop operation which in turn dictated the operability of the pump that had been purchased for this phase. If the impedance was too high the pump would not be suitable and a number of remediations would need to be effected.

During the drilling of Habanero 3 the intersection of the main fracture zone was clearly indicated by a sudden increase in flow rate (influx) through the flow line choke, and the fracture pressure was estimated at 76.4 MPa (11,080 psi). By analyzing the response it was calculated that the productivity of the fracture zone was approximately 2.7 l/sec/MPa draw-down. The influx resulted in a small pressure decline in the Habanero 1 wellhead pressure indicating that the influx was from the reservoir connected to Habanero 1. This response was required before the well could be declared as achieving its target.

Open loop circulation testing

The testing can be divided into a number of phases as shown in the Table below:

Operation	Date	Comment
Flow testing from Habanero 3 with Habanero 1 shut-in	14 to 21 March	A stable flow of 16 kg/sec at a flowing pressure of 27 MPa was achieved with a 14mm fixed choke. Wellhead temperature reached 209°C
Main circulation	22 to 25 March	Injection 18.5 kg/sec at 51.7 MPa (7,500 psi), production of 20 kg/sec at 27.5 MPa, an increase of 4 kg/sec over the earlier test with Habanero 1 shut-in. Temperature reached 212°C
HDC injection	26 March	Slow injection of HDC barite dissolving agent in Habanero 1 to increase injectivity
Post HDC injection	26 March	Injection at 18.5 kg/sec at 50.3 MPa (7,300 psi), an improvement of 1.4 MPa. Expect further improvements with longer injection during closed loop operation.
Stimulation of Habanero 3	18-19 April	Injection of 2,173m3 of water at injection pressures up to 64 MPa, resulting in 276 microseismic events close to Habanero 3. Expected increase in productivity

Based on the testing the circulating impedance at a flow rate of about 12 kg/second will be in the vicinity of 10 MPa. This rate is expected to be high enough to operate the 1 megawatt pilot power station and re-injection pump both of which have already been purchased. Consequently, in early April 2008, the company commenced construction of a high pressure pipeline between the two wells to connect in the equipment for long term closed loop operation.

Further testing in the closed loop will be reported with operations expected to commence in early June including the introduction of chemical tracers.