

LAMPUNG – SOUTH SUMATERA - INDONESIA



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The Analysis of PTS Surveys

For Determining Production Capacity by Using Geothermal Wellbore Simulator, WELLSIM

Indonesia has the world's largest resources of geothermal energy and its potential geothermal capacity is estimated to be 29,000 MW. However, presently only about 1,340 MW, or 5% of that potential is used for power generation.

Under these circumstances, the Indonesian government is planning new projects to increase geothermal power generation by about 9,500 MW by 2025. The construction of the Units at Ulubelu, which will be operated by PGE, is one such project.

GEOHERMAL INDONESIA



Units 1 and 2 (2 x 55 MW)
Ulubelu Geothermal Power Station



Photo: Antara



Photo: PGE

Geothermal well cluster – Ulubelu – Tanggamus – Lampung

A PTS tool is necessary for flow measurements in the wellbore and determining fluid inflow or outflow from the reservoir.

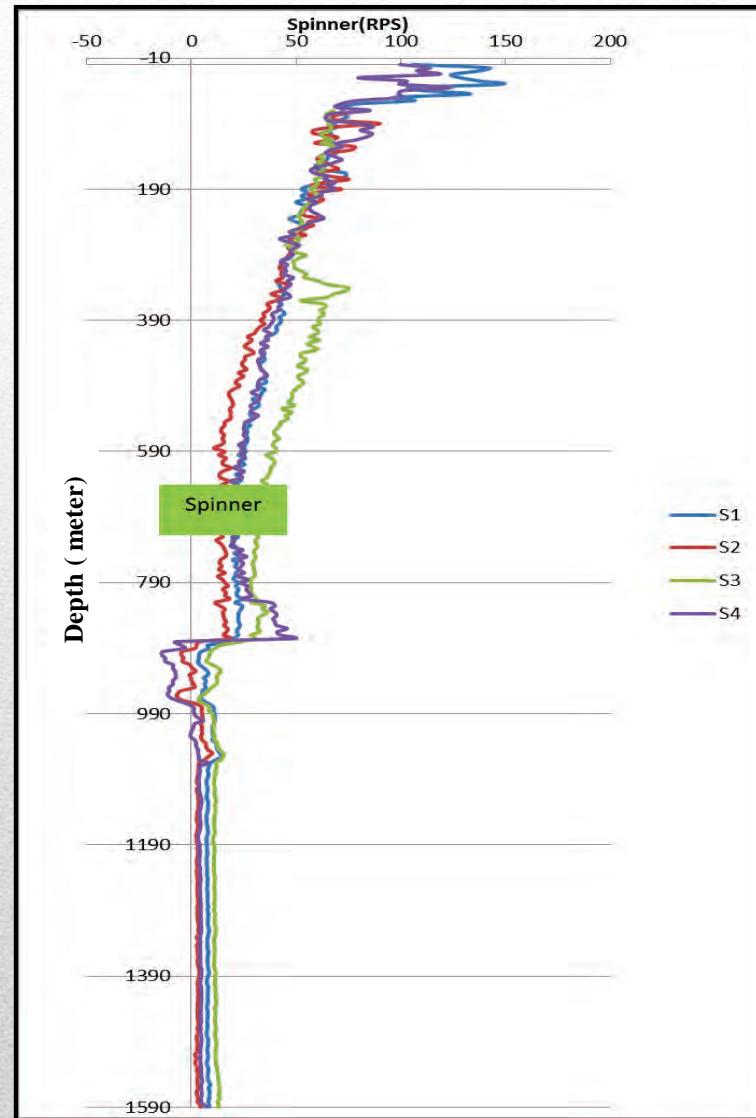
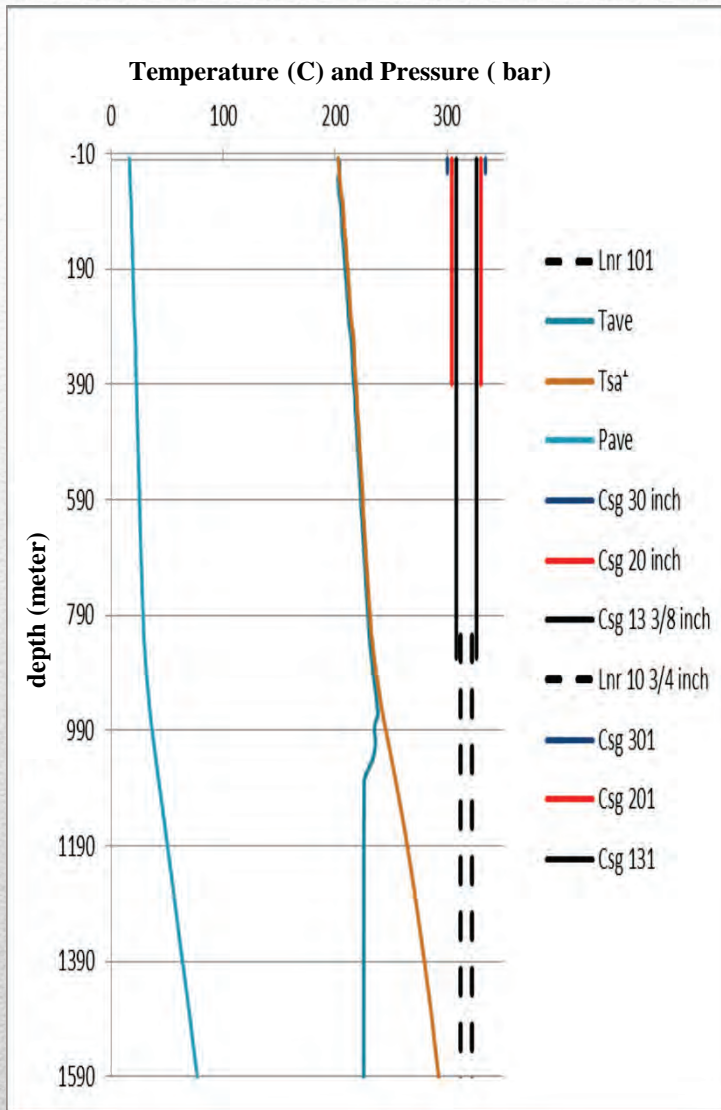
Flow capacity estimation of a feed zone is important for understanding the possibilities and function of a wellbore. Flow capacity that has been estimated from PTS logs, then has been simulated using wellbore simulator, WELLSIM for predicting the productivity capacity of the well.

The Study

The measurement is carried out during 3 (three) hours, and in 4 (four) pass or running variation:

- Downward line with cable speed of 0.5 meter per second.
- Upward line with cable speed of 0.5 meter per second.
- Downward line with cable speed of 0.75 meter per second,
- Upward line with cable speed of 0.75 meter per second.

Flowing PTS surveys



Line	Impeller /spinner) response (RPS)	Cable Speed (m/s),
S-1	7.761245621	0.519497903
S-2	3.225311174	-0514799191
S-3	11.0407235	0.751547326
S-4	4.239262556	-0747679156

TABLE 1: Well K - Spinner Data at depth 1250 m showing RPS of the spinner response against cable speed

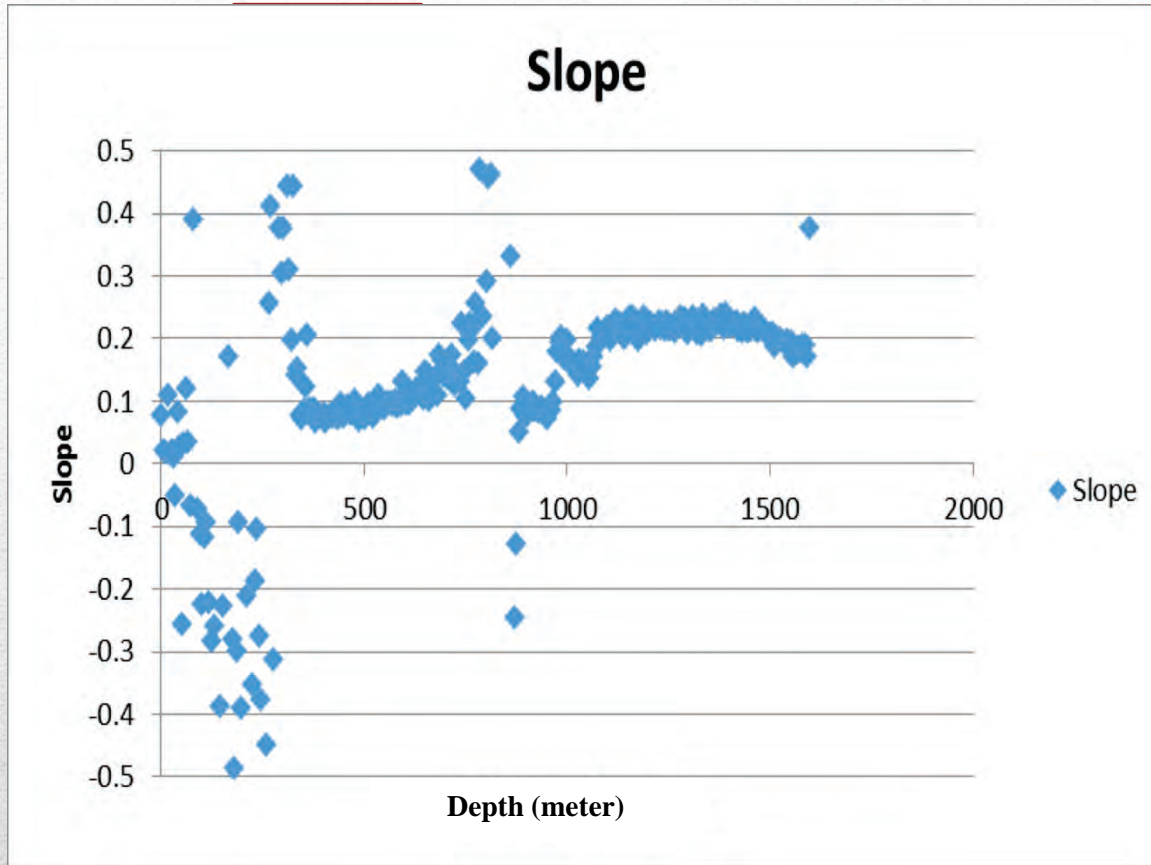
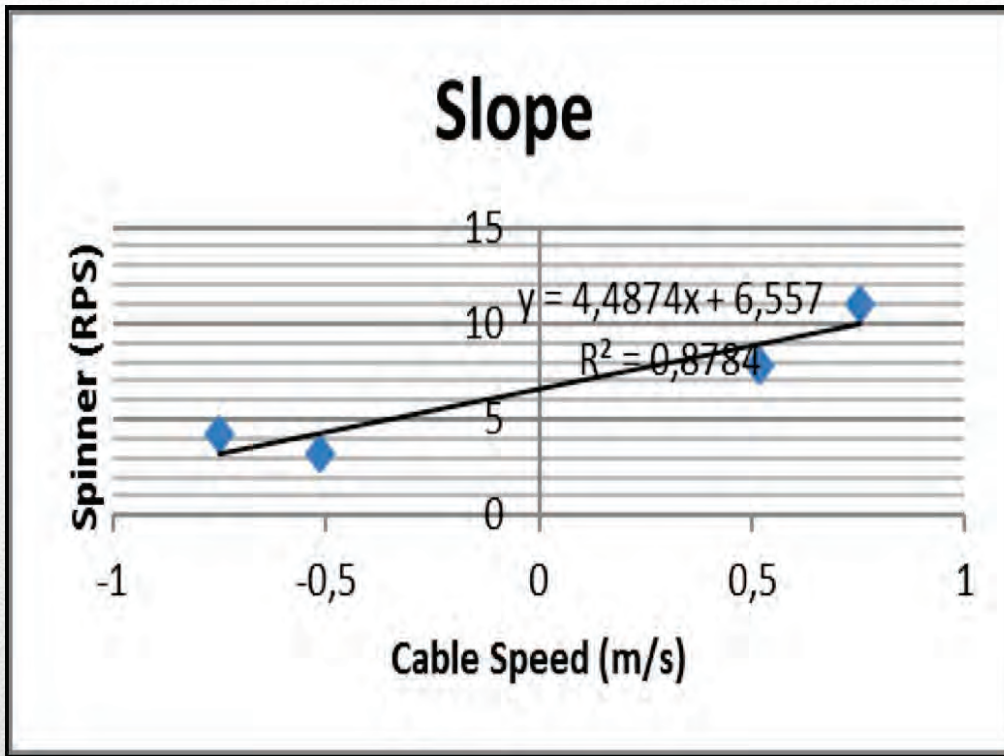


FIGURE 4: Well K - The spinner response slope against depth



Spinner response slope of Well K at 1250 meter (vertical depth) is 4,4874 RPS/meters/seconds, it has given the frequency of $1/4,4874$ or 0,22285 meters/seconds/Hertz.

FIGURE 3: Cross-plots (a linear plot) of Spinner counts (RPS) and Cable speed, at depth 1250 meters of Well K

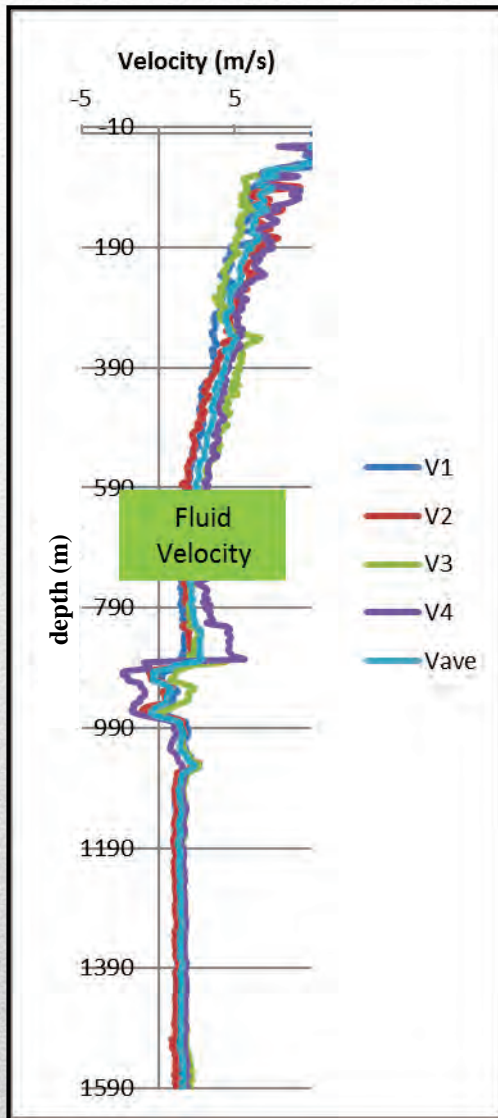
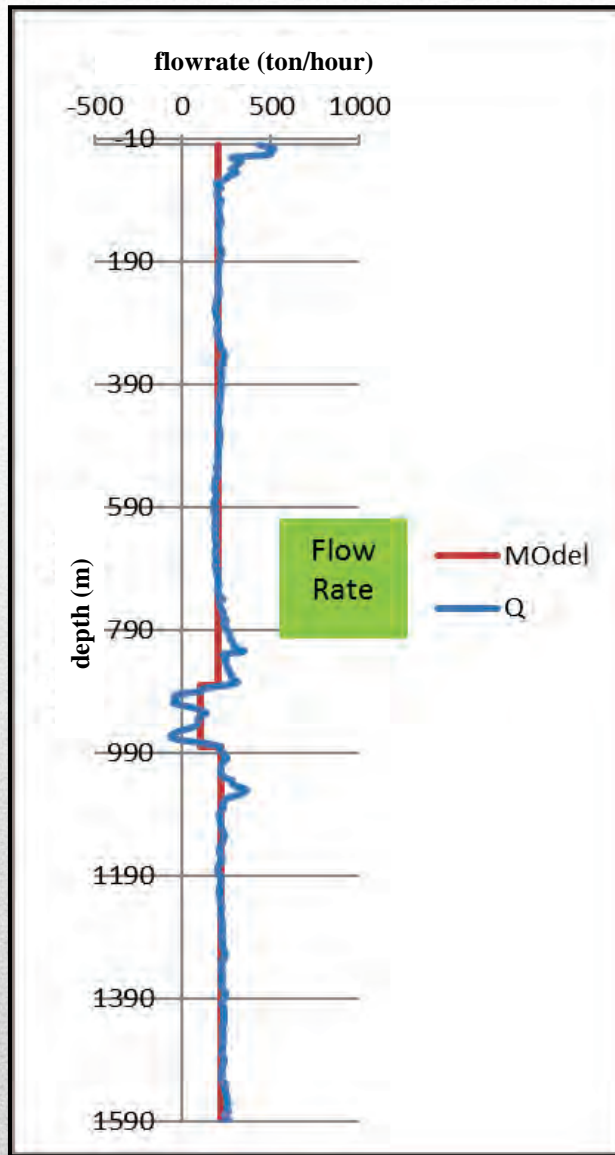


Figure 5, showing the calculated fluid velocity against depth. The average fluid velocity at depth 1250 m is 1.44 meter per second.



The calculated of mass flow rate at feed zone depth of Well-K is 41.6 kg/s or 150 ton/hour.

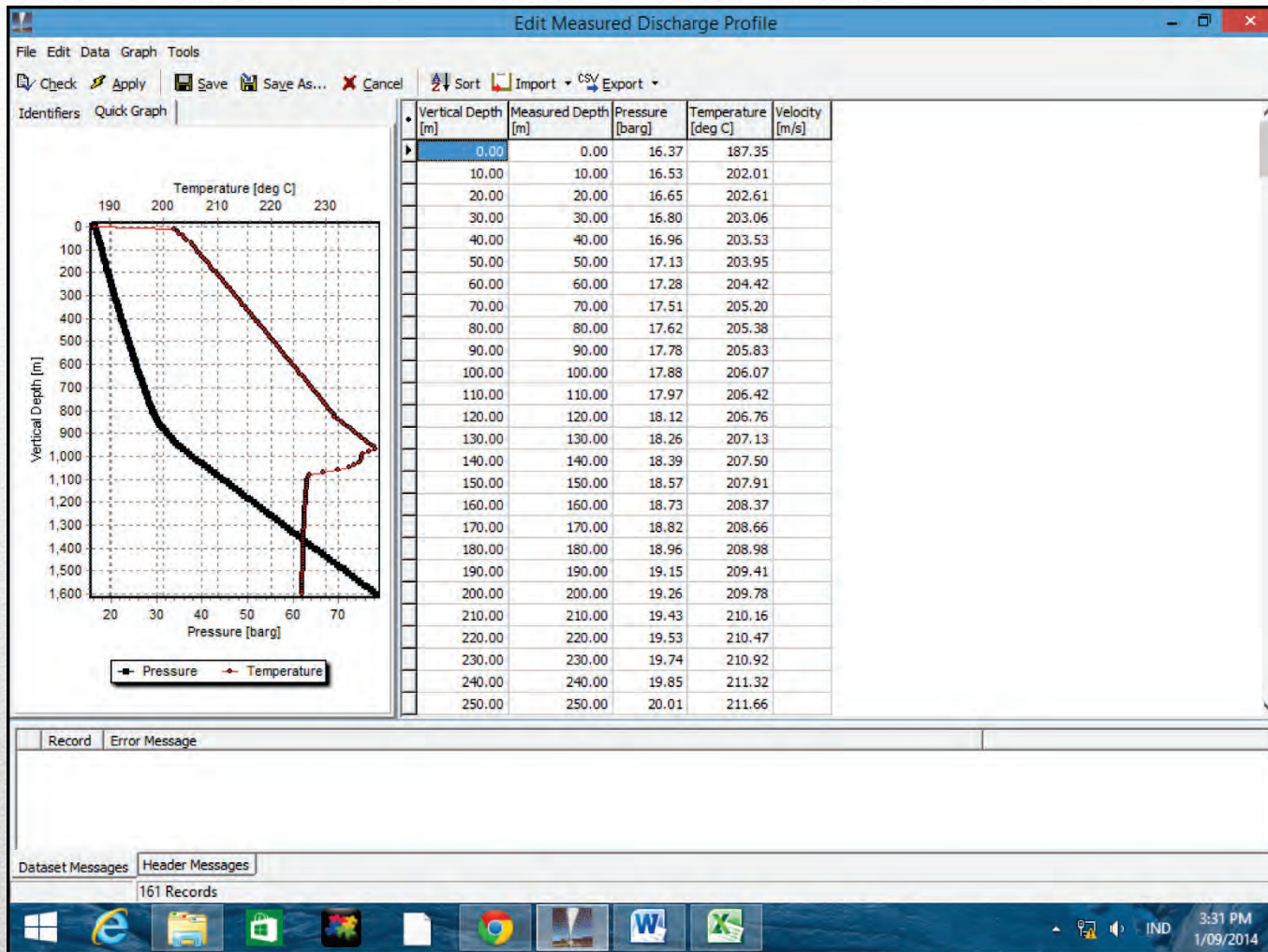


FIGURE 7: Discharge Test Simulation:
Well K - Matching Temperature

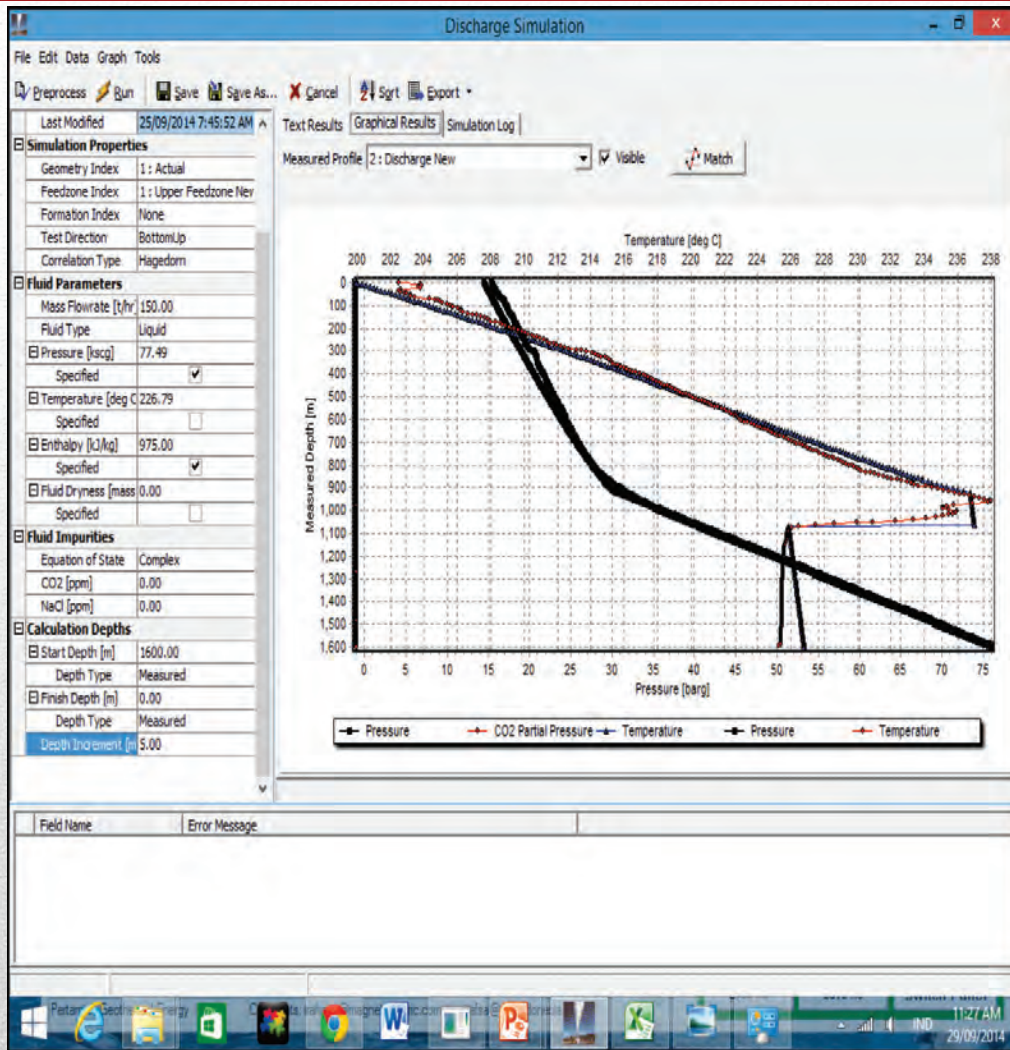


FIGURE 8: Discharge Test Simulation: Well K Matching Pressure

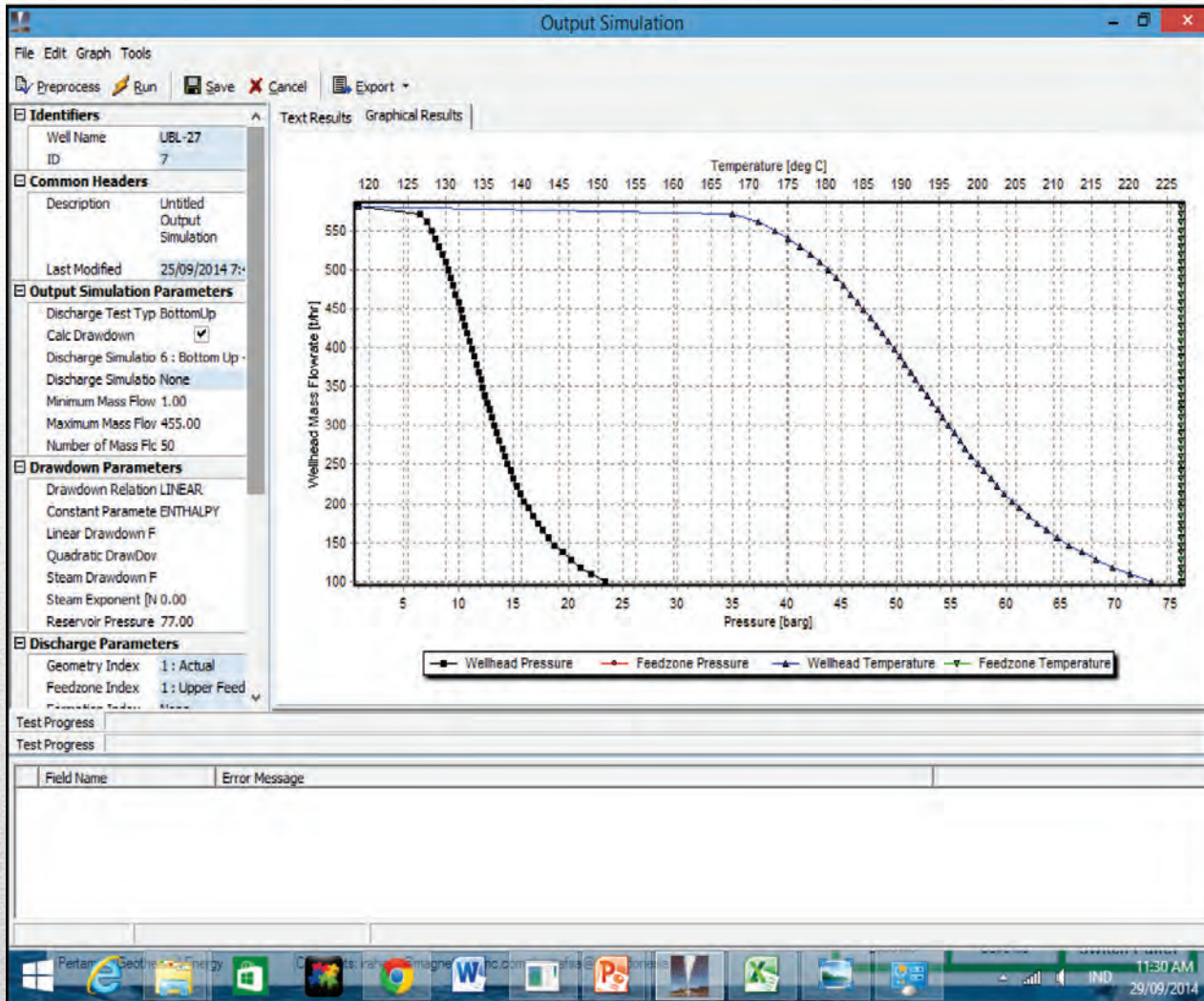
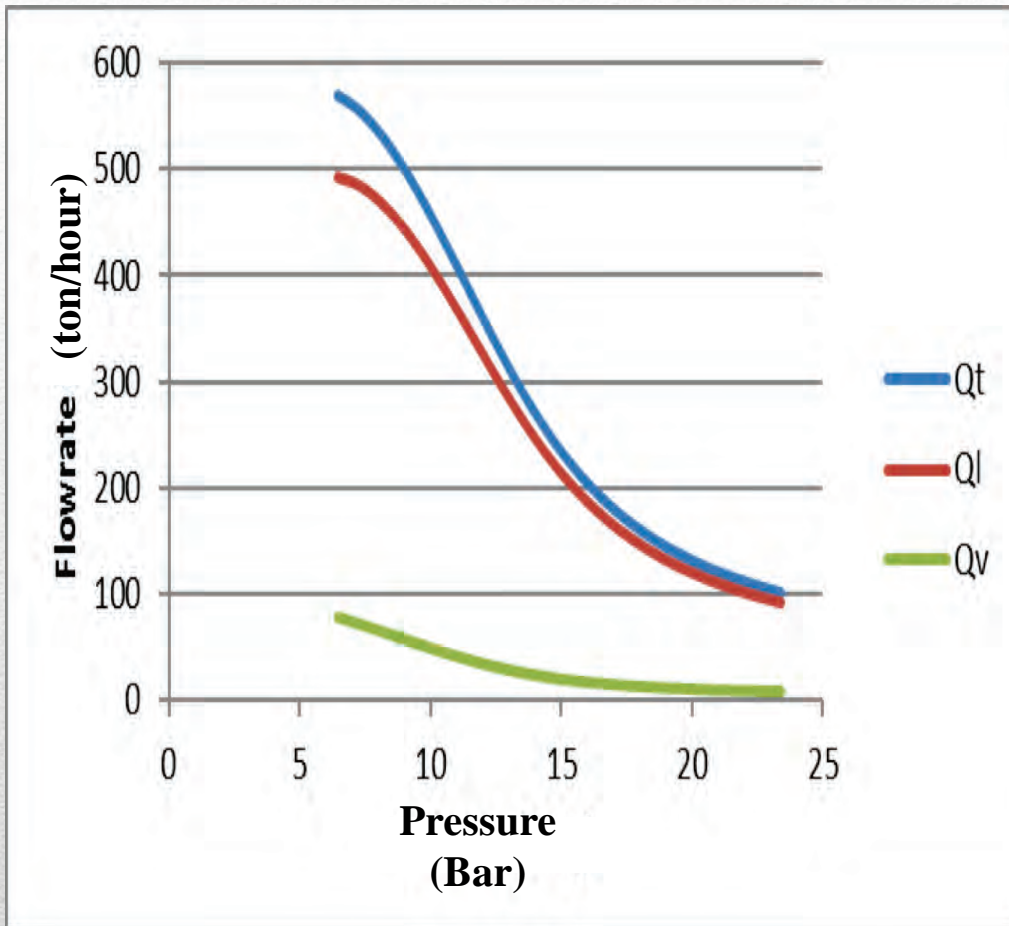


FIGURE 9: Simulated Output Curve of Well-K

Based on simulated Output Curve (Figure 9), then we could calculate the well head pressure during flowing (P_f) using equation :

$$J = Q/\Delta p$$

Where Q is the production flow rate at wellhead conditions and Δp is the necessary pressure drop ($P_{res} - P_f$) to produce this flow rate.



The curve that describes each condition of well head pressure during flowing , P_f (bar gauge) against mass output or mass flow rate, Q (ton/hour)

- Based of PTS logs, we could estimate location of permeable zone, and relative production from a feed zone, while the production-test has not been conducted.
- Location of permeable zone is at 900 m (vertical depth).
- The flow capacity at the feed zone is 150 ton /hour.
- The Flow capacity determined by PTS logs result has been simulated using wellbore simulator, WELLSIM to predict the production characteristics of wells.
- Well K productivity capacity is around 2,5 MW electric at WHP 15 bar gauge (in flowing condition).

CONCLUSION



Thank you
