ACCURACY OF FLOW MONITORING USING TFT MICROMOD IN SNGPF

Joeny Q. BERMEJO[1]
[1]Energy Development Corporation, Ortigas Center, Pasig City, Philippines
e-mail: Bermejo.jq@energy.com.ph

ABSTRACT

Well mass flow data is important in the management of a geothermal filed. In Southern Negros Geothermal Production Field, TFT Micromod System is the technology widely used to determine mass flows in production wells. It is important that data derived from this technology must be accurate and reliable. Evaluation of the accuracy of this system when compared to online metered steam flow measurement showed that TFT Micromod results are within 5% deviation.

Keywords: accuracy, mass flow, metered, Micromod, Tracer Flow

1. INTRODUCTION

Bore output measurement is important in geothermal field operation. Well mass flow data is important in making an informed decision in field development and management, strategic planning and problem solving (Sarmiento, 2011). There are different methods used for flow-testing geothermal wells like the Single-phase measurements, Total-flow calorimeter, Separator, James-Lip pressure method and Tracer dilution method (Grant & Bixley, 2011). The methods used in Southern Negros Geothermal Production Field (SNGPF) are the James-Lip pressure method and Tracer dilution method. The Tracer dilution method is the most widely used because flow measurements can be conducted while the well is online thus eliminating power revenue losses and environmental impacts (Thermochem, Inc., 2013).

TFT Micromod System

The Micromod Tracer Injection System developed by Thermochem, Inc. is being used to regularly monitor the output of production wells in SNGPF. The process involves the injection of liquid (Thermotrace) and vapor tracer (SF6) into a two-phase pipeline with concurrent sampling of each phase downstream after the tracers have dispersed in the flow stream.
The author's name(s) and affiliation(s) should be centered in the appropriate locations as shown in the sample. Center the word ABSTRACT at the top of the text; leave one blank line and then begin the abstract. The text of abstract should be clearly separated from the main text that follows by one blank line.

2. METHODS

TFT Accuracy Evaluation

Testing geothermal wells to obtain accurate and reliable data remains more of an art rather than a standard engineering exercise (Grant & Bixley, 2011). In order to determine the accuracy of TFT Micromod flow measurement in SNGPF, comparative evaluation between TFT results and metered steam flows are being done in all sectors.

Nasuji Steamline Calibration

Prior to start of quarterly TFT flow measurement survey of production wells, the TFT Micromod Unit is being evaluated for its accuracy in metering steam flow in the main steamline of Nasuji Modular Power Plant as compared to the metered steam flow using online orifice measurement. The required percent deviation is 5%.

3. RESULTS OF EXPERIMENTS

In Table 1, TFT versus metered steam flow comparison was consistently below the 5% difference limit. This shows the accuracy of the gas metering system module or the Mass Flow Controller (MFC) in metering steam flow.

Date	METERED	TFT	Difference	
	kg/s			
4-Feb-2012	47.1	46.1	-1.01	-2.14%
8-Aug-2012	46.6	48.7	2.14	4.60%
2-Oct-2012	47.3	48.8	1.51	3.19%
14-Jan-2013	47.5	46.4	-1.10	-2.32%
2-Apr-2013	47.7	49.5	1.74	3.65%

Table 1: TFT vs. metered steam flow result

Total steam flow per sector based on the cumulative steam of all wells based on TFT Micromod survey was compared to metered online capacity and result shows that percent deviation was also within the 5% limit at normal steam field and power plant operations.

Date	TFT	Metered	Difference		Remarks
	kg/s				
04-Feb-11	290.4	280.6	9.8	3.5%	
11-Apr-11	294.3	280.6	13.7	4.9%	
15-Aug-11	285.7	207.6	78.2	37.7%	most wells are throttled
15-Sep-11	285.5	277.8	7.7	2.8%	
14-Mar-12	305.1	287.5	17.6	6.1%	
25-Apr-12	300.6	290.2	10.4	3.6%	
09-Aug-12	300.2	279.3	20.9	7.5%	OB PN6RD
04-Oct-12	287.5	277.4	10.2	3.7%	
11-Feb-13	283.2	202.8	80.4	39.7%	two-unit operation only

Table 2: PAL 1 TFT vs. metered steam flow result

Date	TFT	Metered	Difference	
	kg/s			
07-Mar-11	49.5	51.1	-1.60	-3.1%
29-Jul-11	50.9	51.4	-0.46	-0.9%
22-Sep-11	48.8	49.8	-0.98	-2.0%
22-Nov-11	47.3	49.7	-2.45	-4.9%
21-May-12	54.4	55.8	-1.37	-2.4%
03-Jun-12	54.0	49.5	4.52	9.1%
24-Jun-12	52.0	51.8	0.20	0.4%
07-Aug-12	50.0	49.2	0.76	1.5%
10-Sep-12	51.2	48.3	2.92	6.0%
03-Oct-12	42.2	46.8	-4.57	-9.8%
11-Oct-12	45.7	45.9	-0.23	-0.5%
18-Oct-12	44.4	45.6	-1.25	-2.7%
25-Oct-12	44.3	46.2	-1.91	-4.1%
08-Nov-12	44.5	46.5	-2.02	-4.4%
19-Jan-13	43.3	44.4	-1.14	-2.6%
04-Feb-13	42.6	43.6	-1.01	-2.3%
31-May-13	42.7	43.333	-0.63	-1.5%

Table 3: Balasbalas TFT vs. metered steam flow result

Date	TFT	Metered	Difference		Remarks
	kg/s				
19-Nov-11	53.7	52.2	1.6	3.0%	
23-Jun-12	49.2	49.8	-0.5	-1.1%	
11-Sep-12	51.4	50.9	0.5	1.0%	
4-Oct-12	48.7	48.8	-0.1	-0.1%	
17-Jan-13	57.47	55.3	2.2	4.0%	OK6 at 6% open only

Table 4: Nasuji TFT vs. metered steam flow result

Date	TFT	Metered	Difference	
	kg/s			
11-May-11	99.7	97.3	2.4	2.5%
02-Nov-11	92.4	90.8	1.6	1.7%
01-May-12	93.2	92.2	1.0	1.0%
07-Sep-12	95.7	91.4	4.3	4.7%
22-Oct-12	91.9	90.8	1.1	1.2%
22-Jan-13	92.7	89.2	3.5	4.0%

Table 5: Sogongon TFT vs. metered steam flow result

4. CONCLUSION

The result of the comparison of TFT Micromod versus Online Plant Metered steam flow showed that TFT Micromod flow data was within the 5% difference limit. In this sense, TFT data can be relied for in resource management for whatever purposes it may serve. The accuracy and reliability of flow measurements are affected by many factors, the most important being test method, test equipment design, instrumentation, test procedures, and well characteristics (Grant & Bixley, 2011) and the TFT Micromod System is not an exception. Thus, it is only important that good quality control, monitoring of parameters and maintenance of instruments must be followed.

REFERENCES

Grant, M. A., & Bixley, P. F. (2011). *Geothermal Reservoir Engineering* (2 ed.). United States of America: Academic Press.

Sarmiento, Z. F. (2011, January 16-22). Application of Well Testing in Assessing Geothermal Resources. San Tecla, El Salvador: United Nations University.

Thermochem, Inc. (2013, January 24). Tracer Flow Testing Two-phase Flow Standard Operating Procedures. *1.10*, 1. Santa Rosa, California, United States of America.