



Geothermal Power Plant Monitoring Using FBG Temperature Sensors

A Micron Optics Case Study

Yi-Lan, Taiwan 2012



The Challenge

- Geothermal power is a significant source of cost effective, reliable, sustainable and environmentally friendly green energy¹
- A 60kW, 1000 m well-depth pilot geothermal power plant is commissioned in Yi-Lan, Taiwan. Continuous and accurate monitoring of down-well temperature profile is critical to peak generator performance and efficiency
- Temperature profile must be measured at a depth of 300 m up to 230 C and conventional methods are not suitable



The Solution

- A fiber optic sensing solution from Micron Optics composed of an sm125 Optical Sensing Interrogator combined with optical fiber Bragg grating (FBG) sensors from 3L Technologies (Taiwan)
- Accurate, reliable and robust field-installed system for continuous down-well temperature measurements to maximize energy production
- Represents approximately 50% reduction in capital investment versus competing optical technologies

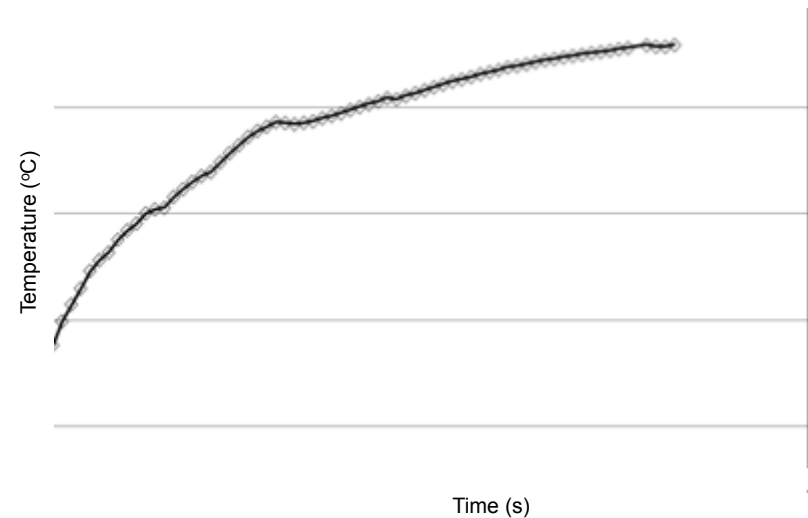


sm125 Field Module



The Result

- Fiber optic sensing system from Micron Optics and 3L Technologies successfully installed in December 2011
- Providing continuous, robust and accurate down-well temperature monitoring ensuring maximum heat exchange and energy production from pilot plant
- The FBG temperature monitoring system provides other important benefits like determining the depth of flashing and prevention of scaling
- The success of the system is driving the use of Micron Optics solutions and FBG-based optical sensing in future geothermal projects in Taiwan



FBG Temperature Monitoring system



sm125 Field Module

Right – FBG Temperature Sensing Probe



Below - Fiber optic stainless steel cable



Below – Micron Optics sm125 FBG Sensing Interrogator



FBG Temperature sensing probe winding system

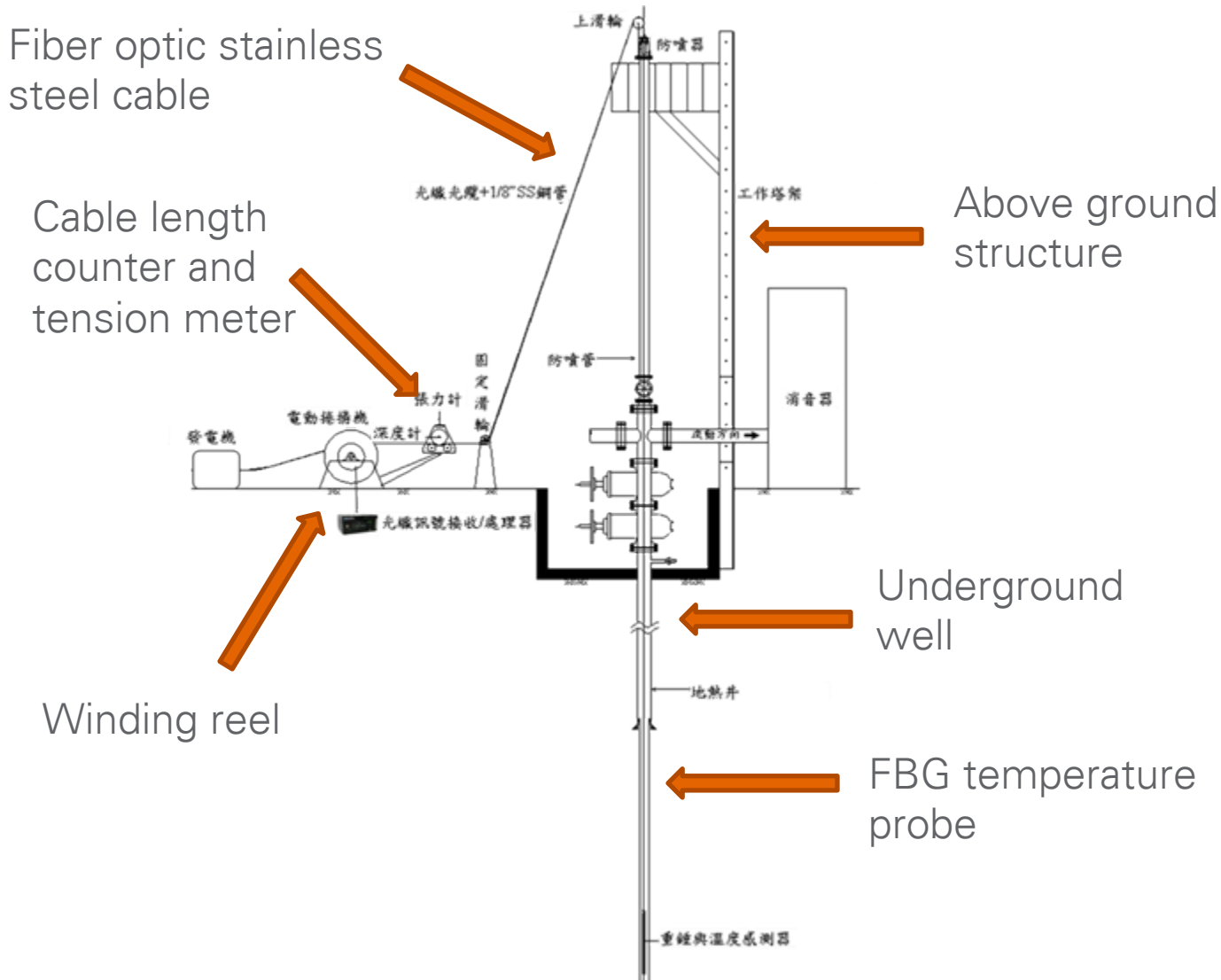


Photo from 2013 Conference on Civil Engineering



Fiber optic cable guide and tension meter

Geothermal well with cap





Above – Winding and spooling of stainless steel fiber optic cable



Right – Insertion of FBG temperature probe and fiber optic cable into the thermal well



The 60 kW geothermal pilot plant is commissioned in December 2011 by

- Taiwan Bureau of Energy
- Taiwan Ministry of Economic Affairs
- Industrial Technology Research Institute



Aim	To determine the temperature profile of a 1000-meter deep drilled geothermal well, with temperatures up to 230 C
Location	Chin-Shui, Yi-Lan County, Taiwan
System Integrator	Industrial Technology Research Institute (ITRI), Taiwan 3L Technologies, Inc., Jhu-Nan, MiaoLi, Taiwan
Customer	Taiwan Ministry of Economic Affairs and ITIR
Date	Ongoing starting December 2011
Instrumentation	Micron Optics sm125-200 Optical Sensing Interrogator
Sensors	Custom-made FBG sensing probe with 500-meter stainless steel fiber optic cable, 3L Technologies Inc.
Software	Micron Optics ENLIGHT™ Software



3L Technologies Inc.

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Special acknowledgement to ITRI for providing geothermal well #IC-21 for the this project.