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Development of MEMS Bohr-hole Seismometer for Microseismic Monitoring Purpose in Geothermal Fields

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Indonesia is blessed with about 40% of world's geothermal potency, with a total potential power of about 27,000 MWe. Beside explorating prospective areas, the producing fields are intended to be developed and monitored. Microseismic method is one of geophysical method used for characterizing subsurface fractures caused by injected fluid or by earthquakes. Geothermal energy produces heated fluid from reservoir and injects cooled fluid back to the earth in order to replace the produced fluid, so the fluid can be heated again and be used again. This is the reason why geothermal energy could be classified as one of renewable energies due to its sustainability.

As the injected fluid goes downearth, it creates microearthquakes along weak zones in subsurface. The relocation of microearthquake events can define the precise location of occurred fractures. This zone will have better permeability, so that the injected fluid will flow through these patterns. Microseismic events lie normally below 5 Hz frequency. Common geophone can hardly reacts to such range of frequencies. More over, this type of geophone are normally based on coil as their primary sensor, which produce harmonical frequencies as their vibrate to ground motion. These features will effect the data quality and furthermore influence also the modelling and interpretation processes.

In order to overcome those problems, we conduct a research project in order to develop a borehole geophone based on Micro Electromechanical System (MEMS). This project is funded by incentive research granted by the Ministry of Research and Technology of Republic Indonesia, which has been started since the beginning of 2010. MEMS is not similar to coil, in which it does not vibrate. Moreover, MEMS has wider frequency range, which could detect microseismic events more accurate than common geophones. Although the price of each MEMS is more expensive than a coil, but the advantage of using MEMS based geophones is very significant, so that at the end the use of MEMS geophone is very economically and efficient. Considering huge geothermal potency of Indonesia, which is an environmental friendly-renewable and promising energy source, we believe that the use of microseismic survey by using MEMS seismometer will be a must in the future. Based on a very good research progress, it is expected that the complete MEMS based three component borehole geophone prototype could be produced by the end of 2011.