Two new sensor technologies have been developed that provide real-time measurement of fluids inside steam field or other field piping. The sensors can provide information on water content , dryness fraction and flow velocity on a real time basis in two-phase and other geothermal fluids, thereby providing the necessary information to calculate total mass flow and Enthalp y in a considerably more timely manner than techniques currently in use. The sensor techniques do not require pressure drops or similar disruption to the flow and allow for cost effective full deployment throughout a steam field to provide information on well performance from multiple wells simultaneously.

The two sensor techniques are the load cell version and the RF (radio frequency) version. The load cell version has been tested in field trials, showing that the sensor can accurately track changes in the contents of the pipe and flow rate of the water. The RF sensor version has also been tested with promising results, but in a non-flowing laboratory environment, without the use of pressurized high temperature fluids.

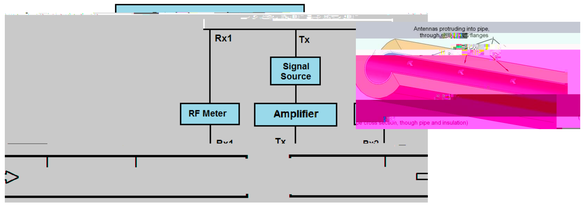
The load cell field trials showed that the sensor could provide data to calculate changes to dryness fraction, total mass flow, and overall Enthalpy. The results show that the same sensor can provide information on flow regime, minute-by-minute changes to well output, and onset of events worth tracking such-as development of slug flow or other dangerous conditions. These capabilities are all possible from the same sensor, allowing much more information to be available for steam field operation.

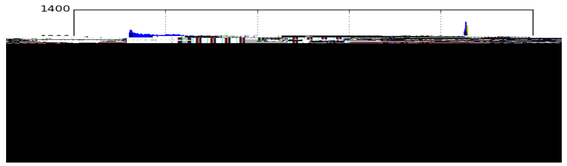
The RF version laboratory testing allowed for development and modification of antenna designs, resulting in effective antenna plans that are more robust while also showing an increase in performance. The RF version is potentially more useful than the load cell version as it is able to provide the same wide range of capabilities while allowing for deployment in more complex piping structures.

Producers could deploy either or both of these sensor technologies at individual wells, or multiple wells simultaneously, allowing for continuous sensor results from the entire resource. This is information not currently available to production operations, and may lead to production strategies that improve the efficiency of electrical generation immediately, while also allowing for better understanding of how the resource could be managed for the long term.

For the load

cells as discussed above.





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