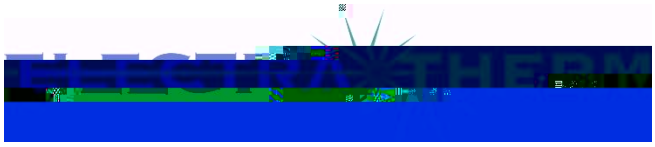
Mississippi Oilfield Generates Low-Temperature, Emission Free Geothermal Energy at the Wellhead

Summary

In the summer of 2011, the Green Machine completed a six-month demonstration at a Mississippi oil field generating renewable energy from the hot produced water that oil and gas producers consider a waste. This is the first small-scale (<200kWe) application to generate fuel-free, emission free power at an oil well. According to reports by Massachusetts Institute of Technology and the National Renewable Energy Laboratory, there are 823,000 oil and gas wells in the U.S. that co-produce hot water concurrent to the oil and gas production. This equates to approximately 25 billion barrels annually of water which could be used as fuel to produce up to 3 GW of clean power. By tapping this enormous resource to generate clean energy, the power generation potential is significant and should not be ignored. This demonstration successfully proved that the Green Machine is a viable power generator for oil and gas wells.

The demonstration developed from a grant by the Department of Energy's Research Partnership to Sr8>> BD6.65 350.21 Tm[ )]TJET EMC /P <</MCID54 4MC

“This Green Machine was designed to fit on a truck bed for a simple plug-and



Challenges with Co-Produced Fluids

There are a number of variables in co-produced fluids that have limited the technology from being adapted on such a vast resource. From the beginning of the demonstration, we were able to prepare for expected challenges, as well as adapt to unexpected challenges that arose during the process. The project was a success in that it proved educational in developing improvements and minimizing troubleshooting for future opportunities.

For this report, we will provide a simple summary of the challenges anticipated with power

risk demonstration project to prove that practical operations of a Green Machine at oil and gas fields are commercially-viable, and easy to install and operate.

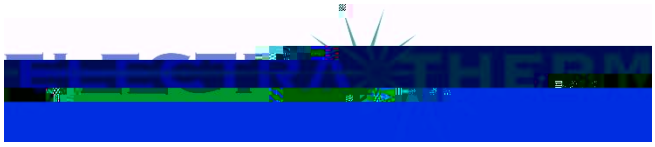
<u>The Green Machine Commissioning</u>

ElectraTherm's Green Machine was manufactured and assembled at its headquarters in Reno, Nevada. ElectraTherm mounted a Green Machine to a trailer in our manufacturing facility, with the air cooled condenser, hot water bypass and electrical controls in

problems are site specific problems that are dealt with at existing large scale geothermal and similar applications today.

Installation and Operation at Remote Locations

ElectraTherm's modularity proved extremely helpful in both installation and removal. The truck bed set-up enabled door to door transportation of an almost fully configured balance of plant. ElectraTherm believes that our 50 hour installation could be reduced to less than a day in the future with additional planning. The Laurel installation was stagnant for hours at a time as the team waited



Through further review of the Laurel site and its high ambient temperatures, ElectraTherm determined the air cooled condenser going in was undersized for this site. Concurrent testing at ElectraTherm's test cell showed an approximate 40% power derate, a clear factor in limiting optimal output at the site. Subsequent performance modeling of the Denbury site concluded that with higher flow rates (>150 GPM) and an appropriate sized air cooled condensing unit, the average annual output of the green machine would be 50kWe gross/38.5kWe net at this location. To reach maximum power output capabilities on a Green Machine (65kWe gross), heat and flow parameters would reach 240°F at 160 GPM, and require an ambient air temperature of 60°F.

Conclusion

The demonstration at Denbury's Laurel site provides insight into future applications to reduce installation time, increase efficiency, generate additional power and minimize maintenance. This kind of co-generation can be particularly effective to reduce the energy costs f-4(p)3(er-79(en))10(o)-509 the en