Hydraulic Submersible Pump Technology Assessment

A Global Energy Services Limited Technology

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About the Authors

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Matt McCulloch is co-director of the Pembina Institute's Corporate Consulting Services, and has been part of this program since 1998. Matt's main area of focus is on corporate sustainability, where he works closely with businesses integrating sustainability concepts into their strategies and operations, assessing performance and corporate culture, and developing metrics to measure their progress. His work includes bringing triple-bottom-line thinking into company decision-making and project-design processes, using a systems and life-cycle approach. Matt supports the identification and development of new technologies and alternative and renewable energy business opportunities. He also leads Pembina's Corporate Consulting climate change and GHG offset related services.

Matt adds business value to companies through helping them understand and address the perspective of environmental NGOs. He also has deep experience facilitating decision making and providing leading edge advice on environmental, social, and technical issues. Matt has worked internationally, frequently presents on sustainability issues, and is an active board member of the Society of Young Environmental Professionals in Calgary. Matt has a degree in Applied Science from Queen's Engineering, and has been a professional engineer since 2002. Prior to joining Pembina, he worked with the remediation group at Golder Associates in Mississauga, Ontario.

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As a Pembina Corporate Consulting eco-efficiency analyst, Jeremy Moorhouse provides technical analysis for life-cycle value assessments for decision-making and technology assessments, and conducts research into practices and strategies for sustainability. Jeremy also has experience and knowledge in energy systems, water management and solid-waste management. His technical background includes experimental mining equipment design and production, as well as experimental data analysis. Jeremy holds a B.Eng. in Mechanical Engineer from McGill University.

About the Pembina Institute

The Pembina Institute creates sustainable energy solutions through research, education, consulting and advocacy. It promotes environmental, social and economic sustainability in the public interest by developing practical solutions for communities, individuals, governments and businesses. The Pembina Institute provides policy research leadership and education on climate change, energy issues, green economics, energy efficiency and conservation, renewable energy, and environmental governance. More information about the Pembina Institute is available at http://www.pembina.org or by contacting: info@pembina.org. This report was prepared by the Pembina Institute’s Corporate Consulting Services. More information on Pembina’s consulting services can be found at http://www.pembina.org/corporate.

Disclaimer

The Pembina Institute has been contracted by Global Energy Services to evaluate the triple-bottom-line performance of competing pump technologies. Pembina applies a consistent, independent, and objective approach to the assessment of each technology, and in no way officially endorses any specific technology. Pembina will, however, promote the eco-efficiency and broader sustainability benefits of selected technologies that further its organizational mission of advancing innovative sustainable energy solutions. To this end, the results of this analysis and the subsequent conclusions are those of the Pembina Institute based on the information acquired through its assessment methodology.

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Executive Summary

Introduction

Global Energy Services Limited is interested in determining whether its hydraulic submersible pump (HSP) has superior environmental and social performance characteristics in comparison with other competing technology offerings. Its target market is as an artificial lift solution for low flow applications in coal bed methane, shallow gas and conventional oil. The primary competing technologies are: conventional pump jacks (CPJs), progressive cavity (PC) pumps and hydraulic pump jacks (HPJs).

The objective of this report is to compare the HSP, using environmental, social and economic performance criteria, to the primary competing technologies. The performance criteria used to effectively compare the different technologies are listed below.

- Noise
- Footprint and Visual Impact
- Efficiency
- Air Emissions
- Leaking
- Operational Performance
- Economic Performance

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Key results

- **Noise:** While sound attenuation is an option for most technologies, it is not necessarily implemented as demonstrated by the sites visited. For this reason, the fact that HSP includes sound attenuated enclosure carries the advantage of ensuring noise levels will be reduced.
- **Footprint and Visual Impact:** The HSP's surface unit is significantly smaller than a CPJ and has an overall reduced visual impact in comparison with a CPJs or HPJ. The HSP is essentially equivalent with a PC pump in terms of footprint and visual impact.
- **Efficiency:** The theoretical data indicates that the HSP is similar in efficiency to the CPJ and the PC pump and superior to the HPJ. Operator feedback indicates the HSP performs better than its theoretical efficiency, and others perform worse than their theoretical efficiency. Efficiency calculations in this report are for the power stroke only, and not for an entire cycle.

As the different technology suppliers are inconsistent in their approach to efficiency calculations, further research is required to better compare the different technologies.

- **Air Emissions:** Based on current data the use of the HSP would result in slightly more emissions in comparison with a CPJ and less emissions in comparison with an HPJ if all technology options were given similar considerations in terms of engine optimization, emission reduction technology, and fuel type. Given the HSP comes with an engine of specific size; there is also no risk that the engine will be unnecessarily oversized compared with other technologies. As this assessment is based on the theoretical efficiencies and carries the same limitations expressed above, further research should be performed to validate results.
- **Leaking:** The HSP's design is inherently less prone to leaking due to fewer moving parts, relative to its competitors.
- **Operational Performance:** The majority of users of the HSP characterized its performance as equivalent to, or better than, current technology offerings. Operators noted either equivalent or a 'significant decrease' in set up time with HSP compared to the other technologies. When asked whether they were satisfied overall with the performance of the HSP pump some respondents were very supportive of the pump with responses such as "yes it's the best pump I've ever used" and "overall positive, [I] would recommend [the HSP] to others." Others were more cautious and felt that the technology required more development.
- **Economic Performance:** The HSP's competitiveness, in terms of capital cost, is strongly dependent on depth. It is less expensive then other options for shallower wells while it is more expensive for deeper wells. Life-cycle costing was not performed in this analysis.

Conclusion

Based on the available quantitative and qualitative data, including landowner and operator feedback, and for the given application scenario, Pembina believes this pump can be considered a best practice for industry at this point in time. This conclusion should be validated for the HSP based on other applications.

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