

SPE Gulf Coast Section - Electric Submersible Pumps Symposium 2023

The Woodlands, Texas, USA
2 - 6 October 2023

ISBN: 978-1-7138-8718-8

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2023) by Society of Petroleum Engineers
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact Society of Petroleum Engineers
at the address below.

Society of Petroleum Engineers
P. O. Box 833836
Richardson, Texas 75083-3836

Phone: (800) 456-6863
Fax: (972) 952-9435

books@spe.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

ESP SURVEILLANCE AND OPTIMIZATION I

Collaborative Development of a Shared ESP Troubleshooting Guidelines Document	1
<i>S. Kennedy, T. Babatunde, F. Gaviria, R. Delaloye, L. Waldner, C. Radke</i>	
Field Validation: ESP Reliability Monitoring and Production Optimization by Trending Condition and Performance Data Extracted from ESP Surface Electrical Signals.....	10
<i>A. Badkoubeh, L. B. Waldner, M. Imanfarid</i>	

ESP PERMANENT MAGNET MOTORS I

ESP Continuous Deployment Monitoring System	23
<i>Barry Nicholson, Carlos Yicon, Fernando Carreno, Robert Navo, Christian Bodington, Gibson Gutierrez</i>	

NEW ESP TECHNOLOGIES I AND ESP THERMAL

ESP Install in Multilayer Wells with Reduced Diameters and High Production Flow - Intake Bypass Project.....	35
<i>S. I. Ghilardi, J. M. Larrocca, A. Essayag, R. H. Teves, R. A. Oyarzín, D. M. Dominguez, V. D. Devincenti, M. C. Orozco</i>	
Fighting, Mitigating, and Surviving Againstasphaltenes with a Special Electrical Submersible Pump Design	60
<i>C. H. Leon, C. H. Escobar Ardila, L. M. Perez</i>	

ESP UNCONVENTIONAL APPLICATIONS AND GASSY WELL APPLICATIONS & OPERATIONS

Lesson Learned from Digital Oil Field Implementation in ESP UCR Wells.....	83
<i>J. Gamboa, L. Grohman, M. Colter, A. Zejli</i>	
Ultra-High-Speed High-Gas-Volume-Fraction Pump Development	101
<i>C. E. Ejim, J. Xiao, A. Shakirov, Y. Alexeev, A. Shkolnyi</i>	
Gas Flow Management Technology Designed to Decrease Downtime and Improve ESP Efficiency.....	107
<i>S. Fulwider, M. Harding, A. Davis, L. Guanacas, G. Gonzalez, M. Campos, C. Portilla</i>	

KNOWLEDGE SHARING EPOSTERS I

Electric Submersible Pump Reliability Improvement Lean Six Sigma (LSS) Study	120
<i>Mohammed A. AlKhalifa, Rui F. Pessoa, Ramasubramanian Chandramouli, Rachid Elaimani</i>	
Case Study: Customized Solution Used to Successfully Set ESPs in Unconventional Wells with Complex Mechanical Geometries Where Other Artificial Lift Methods are Unsuitable.....	129
<i>Paola Elizabeth Martinez Villarreal, Diego Armando Marquez Morales, Argenis Alberto Garces Briceno</i>	

KNOWLEDGE SHARING EPOSTERS II

Field Trial Result of a New Concept of Downhole Gas Slug Mitigation in Unconventional Well.....	143
<i>D. J. Brown, K. K. Sheth, J. Munoz</i>	
Study on Flow Characteristics of a Rotating Centrifugal Impeller Under Gassy Flow Based on Dynamic Mode Decomposition (DMD).....	148
<i>Jianjun Zhu, Haoyu Wang, Nan Li, Guangqiao Cao, Yongxue Zhang, Yuanyuan Li, Haiwen Zhu</i>	

KNOWLEDGE SHARING EPOSTERS III

Thermal and Hydraulic Performance Testing of a Novel High Temperature ESP System for SAGD under Real Conditions	164
<i>W. Klaczek, J. Robles, J. Stewart, T. Kopecky, J. Frey, J. Webster</i>	
Exploratory Analysis of Electrical Submersible Pumps in Permian Unconventional Wells.....	178
<i>Lonnie Grohman, Colter Morgan, Jose Gamboa</i>	

ESP PERMANENT MAGNET MOTORS II

Permanent Magnet Motor Safety – The Big Short Question	194
<i>Charles Collins, Austin Cookson, Brandon Cloud, Dennis Harris</i>	
Methods of Preparing Safe Procedures to Handle Permanent Magnet Motors (PMM).....	212
<i>W. Dinkins, M. Lambert, H. Zakhary, D. Harris</i>	
A Failsafe Method of Preventing Voltage Generation During Installation and Pulling of ESPs with Permanent Magnet Motors	219
<i>Saveth Ken, Booth Charles, Oviedo Mauricio, Harris Dennis</i>	

ESP SURVEILLANCE AND OPTIMIZATION II

Trials of VSD Electrical Signature Analysis Technology for ESP Vibration in High Dog Leg Severity Wells at Surmont	228
<i>R. Walters, K. Ehman, K. Olson, A. O'Reilly, J. Chacin, K. Nespor, A. Badkoubeh, M. Imanfarid</i>	
AI-Based Approach for ESP Optimization.....	243
<i>T. Hnot, B. Vasylyshyn, A. Struk, D. Benham, J. Meek, N. Ferrara</i>	
The Value of Pump Discharge Pressure Measurements and their Application for Improving Performance and Operation of ESPs	259
<i>D. Narvaez, D. Aylett, K. Botros</i>	

NEW ESP TECHNOLOGIES II AND ALTERNATIVE DEPLOYMENT

New High Performance ESP Gas Separator	279
<i>Barry Nicholson, Scott R. Harryman, Donn J. Brown, Ketan K. Sheth</i>	

Top Efficiency Technologies Working in Synergy Enable a 30% Production Increase by Unlocking High-Flow Hybrid ESP Applications	286
<i>S. A. Parra, R. Herrera, D. Donado, J. Cuesta, L. M. Sanchez, F. Leon, S. Suarez, D. Munoz, P. Garcia</i>	

ESP THERMAL OPERATIONS

Enhancing Production from High-Enthalpy Geothermal Wells with New Electric Submersible Pump Technology	298
<i>M. Radov, Y. Hamitoglu, E. Sentürk, M. K. Tüzen, J. L. Holzmüller, W. K. Goertzen, V. Nyayadhish, O. S. Kulkarni, V. Amutha Nilavazhagan, J. Wu, P. Tan, A. R. Rao, A. T. Usta</i>	
Reliability Performance of 400 Series ESPs in SAGD Wells at Surmont	311
<i>K. Olson, K. Ehman, J. E. Chacin, K. Nespor</i>	

ESP THERMAL OPERATIONS AND RELIABILITY ANALYSIS

ESP Conveyance Modelling in Higher DLS Wells.....	321
<i>William C. Gorden, Wilfried Manfoumbi, Gregory S. Payette</i>	

KNOWLEDGE SHARING EPOSTERS IV

ESPs in High Productivity Wells and Use of Pressure Derivatives to Understand Behavior	338
<i>M. Dowling, A. Lemus</i>	

DATA ANALYTICS AND OPERATIONAL AUTOMATION

Assessment of Real-Time ESP Failure Prediction Using Digital Twin, Machine Learning and Damage Modelling	351
<i>R. A. Lastra Melo, D. J. Worth, S. Swaffield</i>	
ESP System Monitoring and Diagnosis from Surface Power Acquisition.....	368
<i>A. Hoefel, D. Kelly, R. Jin, D. Meier, T. Chu, J. Anderson, J. Chong</i>	

ESP SUBSEA AND NEW TECHNOLOGY

Stones Gulf of Mexico Single-Phase Subsea Pump Operation Under Gas Conditions to Enhance Production	381
<i>L. Barrios, A. Merlino, J. Brutz, K. Whitaker, J. Overstreet, K. Arkhipova, M. Rojas, B. Dowdy, G. Pisarev, F. Solvoll</i>	

ESP POWER SUPPLY, QUALITY & VISCOUS APPLICATIONS AND OPERATIONS

A Tool for Power Quality Assessment in Electric Submersible Pump Systems with Variable Frequency Drives	396
<i>S. P. Betoka-Onyama, P. M. Lingom, H. Hamza, J. Song-Manguelle, M. L. Doumbia, S. Kennedy, C. Radke, W. Manfoumbi, K. Ehman, K. Olson</i>	

A Step-By-Step Holistic Methodology Quantifies and Reduces Harmonics on ESPs, Increasing Revenue by USD 500,000 Per Year: A Case Study from a field in Ecuador	410
<i>Kevin Ismael Andagoya Carrillo, Jorge Luis Villalobos Leon, Andrés Orozco, Estefí Batallas, Luis Toledo, Luis Enriquez, Carlos Reyes</i>	
Sweating the Asset by Extending Well Run Life Through Bp to ESP Conversion in High Viscous Oil Field.....	424
<i>Ghosin AL Shukaili, Fahad AL Aufi, Adnan AL Ghadani, Said Al Kindi, Hawra Abdul Abbas, Mohammed Al Kaabi, AL Julanda Al Habsi, Gerardo Urdaneta, Ibrahim Al Abri, Ahmed Al Ajmi</i>	

KNOWLEDGE SHARING EPOSTERS V

Gas Mitigation Technology Review and Impact on Production Optimization for CO2 Applications	436
<i>J. S. Cox, R. M. El Mahbes, M. A. Sikes</i>	
Case Study: Predicting Electrical Submersible Pump Failures Using Artificial Intelligence and Physics-Based Hybrid Models.....	440
<i>Shejuti Silvia, Ted Furlong</i>	

KNOWLEDGE SHARING EPOSTERS VI

Improving ESP Survivability in the SAGD Environment: An Integrated Approach to Managing ESP Performance in Challenging Conditions	449
<i>Rejish Joseph, TK Babatunde, Lisett Briceno, Fernando Gaviria, Bill Plaxton</i>	

Author Index