Texas Commission on Environmental Quality (TCEQ)
Texas Emissions Reduction Plan (TERP)

New Technology Implementation Grant (NTIG) Program

Jaguar Electrification

Final Implementation Report for:

New Technology Implementation Grant (NTIG) Program

Solicitation No. 582-23- 41402-NG

OXY USA Inc.

Project Representative:

Ryan Prater

January 28, 2025

The preparation of this report is based on work funded in part by the State of Texas through a Grant from the Texas Commission on Environmental Quality

Introduction/Background

Jaguar, a gas lift compression facility which is owned by Oxy USA Inc (Oxy), was originally installed with 7 rental engine driven compressor skids. This project goal was to ***replace 7 gas engine driven reciprocating compressors with 6 1500HP electric motor driven reciprocating compressors***. Power for the project is supplied from an ***upgraded PME*** with high voltage power lines running to the site where reclosures and step-down transformers will be installed. In addition, the project planned to install a ***new relief header from the compressor skid area*** which will tie-in to the existing flare system. Finally, the project will also ***supplement an existing gas fired line heater with a shell and tube heat exchanger***. The heat exchanger will ***capture uncooled 3rd stage compressor discharge gas*** to heat the oil at Iguana to meet product RVP specifications.

Project Objectives/Technical Approach

The key goals and objectives of this project were to ***reduce hydrocarbon, hazardous air pollutants and CO2 emissions*** by:

- Removing the gas engine driven compressors
- Reducing the use of the gas burning line heater
- Tying the compressor blowdown valves back to the compressor suction header
- Tying the existing atmospheric relief discharges into the flare system.

Task Overview

Task 1: Secured Rights to Location (Completed November 2022)

We successfully identified and secured the South Curtis Ranch Jaguar site for electrification. This process included:

- Conducted comprehensive site screening from June 2022 to November 2022
- Verified power availability at field distribution voltage, eliminating need for substation transformer
- Completed process feasibility study for electric compressor replacement
- Developed detailed power system model using WindMil

- Created process model for the site using Hysis
- Confirmed Oxy's property ownership, streamlining the location rights process
- Identified and documented all long-lead equipment requirements
- Initiated contract compression process
- Placed orders for site transformers
- Began formal engineering phase

Task 2: Secured Permits (Completed July 2023)

We successfully updated the TCEQ Non-Rule Standard Permit Registration No. 166119 through:

- Revised equipment tables to reflect emissions reductions from electric motors
- Prepared and submitted permit documentation
- Submitted revised permit in May 2023
- Received permit approval in July 2023

Task 3: Site Preparation (Completed May 2023)

Site preparation activities were completed including:

- Installed new electrical backbone line:
    - Completed 2.6 miles of power line installation utilizing 795 arial conductors
    - Construction completed February 2023 to July 2023
    - The project was competitively bid and awarded to a qualified contractor with a solid performance and safety record. OXY Procured the materials through a supply house and provided them to the contractor. The process was managed by OXY’s electrical construction team and it was delivered on budget with the circuit energized in July of 2023.
- Civil work completed:

- Civil work was awarded to NTACT construction and they managed procurement of materials and installation. They were overseen by OXY Construction department and OXY Safety representatives.
- Installed compressor foundations
- Completed transformer foundations
- Installed drilled helical piles for the motor starting building
- Completed May 2023

Figure 1 - Photo of Installed electrical equipment and powerline construction - May 12,2023

Task 4: Equipment Procurement (Completed July 2023)

We successfully executed the following procurement activities:

- Completed vendor identification and RFQ process (November 2022)
- Reviewed and verified vendor proposals
- Issued purchase orders and contracts (November 2022 through April 2023)

- Selected vendors based on:
    - Cost effectiveness
    - Schedule alignment
    - Technical capability
    - Past experience and performance
- completed July 2023

Task 5: Installation and Commissioning (Completed July 2023)

Successfully implemented our installation plan with sequential completion:

- Installed first electric compressor (April 2023)
- Completed commissioning of all units:
- Implemented management of change (MOC) program documentation
- However, due to operational challenges discussed in another section, operations did not commence until 2024 on the heat exchanger

Task 6: Performance Testing (Completed November 2023-June 2024)

Successfully completed comprehensive testing:

- All of the process conditions and amperage have been recorded in OXY's Scada system.
- Documented emissions reductions from reduced line heater duty via the process conditions gathered in OXY's Scada system

Task 7: Implementation Period Reporting

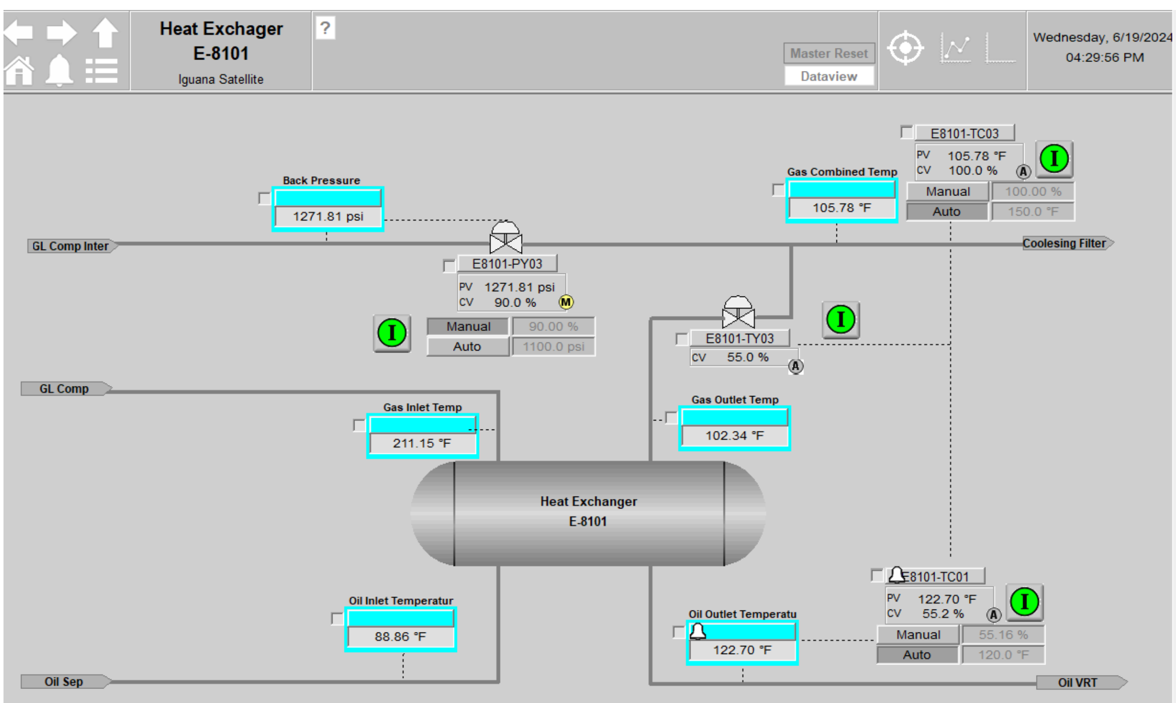
- Will submit operational reports going forward.

Discussion/Observations

In this project all the key objectives have been accomplished. The equipment was commissioned in the order shown below. It is important to note that due to some additional process risks and troubleshooting, the heat exchanger was not fully operational until late June 2024. More details on this are shared in the section "critical issues."

Equipment	Startup Date
Compressor 4	5/16/23
Compressor 1	5/26/23
Compressor 2	06/08/23
Compressor 3	06/22/23
Compressor 5	06/22/23
Compressor 6	07/05/23
Heat Exchanger & Related Piping/Control Valves	11/02/23

The heat integration was successful with the process heat from the compressed gas being used to heat the oil, reducing the need for a gas fired heater. In a normal process, this heat would be dissipated to the atmosphere with a traditional fin fan cooler. The image bellow is a snapshot of the exchanger operating shortly after commissioning. The process model has shown an approximately 2.4 MTPY of of CO2E reduced.



The Compressors have been operating more reliability than the prior gas engine driven versions. Data indicates that reliability improved from ~ 95% to ~97%. This results in fewer shutdowns and maintenance activities.

The flare header modifications were also complete so that the relief devices now tie to the flare header instead of the atmosphere, greatly reducing the amount of methane vented to the atmosphere. In addition, blowdowns have been reduced as the gas from the compressor is now blowndown to the suction header to avoid blowing down to atmosphere.

Critical issues/Technical goals and barriers

Control System Complications

During the initial startup of the new heat exchanger system, two significant challenges emerged that required engineering intervention. The first challenge manifested in the control system's operation. The initial control valve configuration resulted in unexpected high pressure at the compressor inlet, leading to multiple system shutdowns.

The resolution involved a straightforward but effective modification to the control logic. The team implemented a combined opening limit on two critical control valves, ensuring their combined opening percentage could not exceed 100%. This adjustment effectively resolved the pressure management issues, and subsequent operation proceeded without further shutdowns.

Safety System Response to Gas Release

The second challenge emerged during normal operations when an upstream equipment malfunction occurred in the production separator. A stuck dump valve in the open position resulted in uncontrolled gas flow, triggering the system's pressure safety valves (PSVs).The PSVs, initially configured to activate at 95 pounds per square inch gauge (psig), performed as designed to prevent catastrophic equipment failure. This setpoint had been established through comprehensive equipment rupture scenario analysis. Following the incident, the team conducted a detailed investigation in consultation with the equipment manufacturer. Analysis revealed that the system could safely operate at higher pressures, leading to a reconfiguration of the PSV activation point to 185 psig. This adjustment provided enhanced operational flexibility while maintaining required safety margins. The system resumed operation in June

2024, incorporating all implemented modifications and lessons learned from these incidents.

Scope for future work

There are currently no plans for the site included in the grant other than continued operations. OXY has expanded it's use of electric compression for new sites in Texas where power is available and continues to evaluate the use of heat integration to reduce emissions from fired heaters.

Summary/Conclusions

The conversion of gas engine-driven compressors to electric power represents a significant milestone in our sustainability and operational efficiency efforts. By transitioning from traditional gas-powered compression systems to electric alternatives, we have achieved multiple strategic objectives that demonstrate our commitment to reducing environmental impact and improving operational performance.

The primary technical achievement of this project was the successful electrification of compression equipment, which yielded immediate and measurable benefits. Most notably, the shift to electric compressors resulted in a substantial reduction in on-site emissions, directly contributing to our carbon reduction targets. The electric compression technology not only minimized our carbon footprint but also enhanced the overall reliability of our compression infrastructure.

One of the most challenging aspects of the implementation was the complex heat integration process. Despite initial technical hurdles, our engineering team successfully navigated these obstacles, ultimately developing an innovative approach that significantly reduced the heat requirements on-site. This optimization not only improved energy efficiency but also demonstrated our team's technical expertise in managing intricate industrial conversion projects.

The success of this pilot project has been so compelling that it has become a model for similar conversions across OXY's domestic operations. By providing a proven framework for electric compression implementation, we have created a scalable solution that can be replicated at multiple facilities. This approach accelerates our progress toward lower carbon intensity goals while potentially generating substantial operational and environmental benefits across our asset portfolio.

The broader implications of this project extend beyond immediate emissions reduction. It represents a strategic approach to technological innovation, showcasing our ability to adapt existing infrastructure to meet evolving environmental standards and operational requirements. By investing in electric compression technology, we are positioning ourselves at the forefront of sustainable industrial practices.

Key outcomes of the project include:

- Significant reduction in site-level greenhouse gas emissions
- Improved equipment reliability and performance
- Reduced on-site heat requirements
- Development of a replicable model for electric compression conversion
- Tangible progress toward OXY's carbon intensity reduction objectives

As we continue to implement this approach across our operations, we are demonstrating our commitment to technological innovation, environmental stewardship, and operational excellence.

Acknowledgments

Thanks to our contractors that participated in this project: Monarch Resource Partners and Saulsbury Industries for their work on this project. OXY received no outside funding on this project.

Appendices

Appendix A: Construction and Execution Photos

Figure 2- Unloading Electric Compressors

Figure 3- Heat Exchanger Installation

Figure 4- Heat Exchanger installation completed

Figure 5- View of all Compressors installed

Figure 6- Completed Installation of Electric Compression