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

New Technology Implementation Grant (NTIG) Program

Pecos Bend Gas Processing Plant

Electric Motor Installation

Final Implementation Report for:

New Technology Implementation Grant (NTIG) Program

Solicitation No. 582-23-41402-NG

Submitted by:

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Project Representative:

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Introduction/Background

CR Permian Processing, LLC (CRPP), an entity of Kinetik Holdings, Inc (Kinetik) owns and operates the Pecos Bend Gas Processing Plant (Pecos Bend) located near Pecos, Texas, with a processing capacity of 540 MMcf/d of natural gas.

The project consisted of replacing an existing Caterpillar (CAT) G3616LE A3 4,735 horsepower (HP) lean burn natural gas fired engine, used for residue gas compression, with a Hyundai 5,000 HP electric motor. The primary goal of this project was to eliminate emissions, including nitrogen oxides (NOx), volatile organic compounds (VOC), particulate matter (PM), sulfur dioxide (SO2), carbon monoxide (CO), formaldehyde (HCHO), and greenhouse gases (GHG) associated with the operation of the natural gas fired engine, by repowering the compressor with an electric motor. The project was a success, and the new motor commenced operation September 2024.

Project Objectives/Technical Approach

The New Technology Implementation Grant (NTIG) program's main goal is to offset the incremental cost of emissions reductions from facilities and other stationary sources in Texas. CRPP demonstrated compliance with the NTIG program's eligibility requirements during the application process, ultimately securing a grant for this project.

By repowering the existing natural gas compressor with an electric motor at Pecos Bend, CRPP aligned with NTIG's objective to reduce emissions from midstream oil and gas operations.

Since electric motors produce no emissions during operation, this change resulted in elimination of NOx, VOC, PM, SO2, CO, HCHO, GHG, and other pollutants previously emitted by the natural gas engine.

Notable emissions reductions attributable to this project include:

- Over 12 tons per year (TPY) of NOx
- Over 2 TPY of CO
- Over 3 TPY of VOC
- Over 1 TPY of PM
- Less than 1 TPY each of HCHO and SO2
- More than 18,000 metric TPY (mTPY) of CO2e (GHG)

In addition to eliminating 100% of the emissions from the existing engine, electric motors offer other environmental and operational advantages. They require minimal lubrication of the rotating parts relative to natural gas engines. Additionally, natural gas engines require their own lubricating oil systems and jacket water cooling systems, and the installation of this electric motor eliminates these potential leak points.

The project objectives from the Grant Contract Scope of Work (SOW) included the following tasks:

- Task 1 Implementation Period Reporting
- Task 2 Secure Rights to Location
- Task 3 Secure All Necessary Permits and Insurance to Install and Operate Project
- Task 4 Specific Project Site Preparation
- Task 5 Execution of Contracts and Purchase of Equipment
- Task 6 Installation and Commissioning of Project
- Task 7 Testing and Final Design
- Task 8 Operation Period Reporting

Task Overview

CRPP successfully completed Tasks 1 – 7. Task 8 requires ongoing annual operational reporting and will be completed as required by the grant contract.

Task 1 Implementation Period Reporting

During the Implementation Reporting Period, CRPP successfully coordinated resources and met NTIG program requirements while providing deliverables on-schedule and on-budget. Key activities included:

- Developing a webpage on Kinetik's website describing the NTIG project, funding details, and point of contact for public inquiries. The webpage can be found at https://www.kinetik.com/sustainability/new-technology-implementation-grant/.

- Submitting Biannual Progress Reports and the Final Implementation Report in a timely manner, summarizing project tasks and documenting project milestones. CRPP submitted the following reports:
  - Biannual Progress Report #1 – Submitted December 2023
  - Biannual Progress Report #2 – Submitted June 2024
  - Biannual Progress Report #3 – Submitted December 2024
  - Final Implementation Report – Submitted December 2024

Task 2 Secure Rights to Location

CRPP demonstrated ownership of the Pecos Bend Processing Plant by submitting all required property ownership documents

Note: Task 2 was required before the NTIG Program would issue the Notice to Proceed (NTP). The NTP was issued in October 2023.

Task 3 Secure All Necessary Permits and Insurance to Install and Operate Project

CRPP submitted proof of insurance coverage in compliance with the grant requirements. Since the electric motor does not generate emissions, no new state or federal permits were required for its installation and operation.

Note: Task 3 was required before the NTIG Program would issue the NTP. The NTP was issued in October 2023.

Task 4 Specific Project Site Preparation

CRPP initiated internal project approval, set up an AFE, and executed the necessary purchase orders (POs) and contracts required to complete construction drawings and prepare the site for installation.

CRPP established a contract with Kahuna USA, LLC (Kahuna) in September 2023 to complete detailed engineering and design services and provide construction support throughout the project, as detailed further in the following tasks.

No significant earthwork was needed to prepare the site for construction since this project mostly involved modifying and replacing existing equipment. Preparatory project work involved planning for the operational outage, removing the engine from the skid, and modifying the skid for the motor installation.

For photos, refer to *Appendix A – Project Photos*

Task 5 Execution of Contracts and Purchase of Equipment

CRPP executed POs and contracts necessary for the timely completion of the project.
PO and Contracts were executed with:

- **HD Hyundai Electric America Corporation** (Hyundai) – Electric Motor Supplier
- **Kahuna** – Project Engineering, Design and Construction Support
- **Innovative Compression Equipment** (ICE) – Engine Removal/Motor Installation
- **NTACT I&E** (NTACT) – Motor Instrumentation and Electrical Installation
    - Roundhouse Electric & Equipment (Roundhouse) – Subcontracted by NTACT for Cable Testing
- **Consolidated Electrical Distributors** (CED) – Reduced Voltage Soft Start (RVSS) Supplier and RVSS Testing
    - Eaton – Subcontracted by CED for RVSS Site Acceptance Testing to validate factory extended warranty

CRPP issued a PO for the 5,000 HP electric motor from Hyundai and a PO for the RVSS from CED. Being long-lead items, the POs were issued in November and October 2023, respectively, and the motor and RVSS arrived on-site between July 11th – 12th. Installation followed the delivery schedule of these long-lead items.

Kahuna provided detailed engineering and design services to support the installation of the 5,000 HP electric motor and RVSS. Their scope included:

- Delivering Issued for Construction and revised As-Built drawings
- Electrical Engineering and Design
    - Issuance of all electrical and instrumentation drawings
    - Arc Flash Report update and relay programming
- Project Management, Procurement, and Administration
    - Project schedule updates and tracking
    - Project meetings
    - Document control
- Construction and Startup
    - On-site support from an electrical inspector
    - On-site engineering support for loop checks and commissioning

ICE performed the construction work necessary to replace the existing CAT 3616 natural gas driven engine with the new 5,000 HP electric motor. This included:

- Removal of engine upper structure and engine
- Removal of all engine-associated piping off skid
- Removal of the engine pedestal and concrete
- Installation of the new motor pedestal and concrete
- Installation of new Hyundai motor, coupling, and hub
- Modification of the compressor oil day tank
- New paint, hardware, and materials
- Completion of cold and hot alignment

NTACT provided labor, materials, equipment, tools, supervision, insurance, and overhead costs for motor instrumentation and electrical installation (I&E), which inlcuded:

- Furnishing and installing:

    - Leveling plate for the RVSS
    - Cable tray and supports
    - Cable and terminations
    - Conduit and fittings
    - Ground wire and grounding material
    - Wire labels
    - 5kv RVSS (furnished by Kinetik)
- Loop checks
- Startup and commissioning support
- DC high potential testing of 5kV cabling (subcontracted to Roundhouse Electric & Equipment Co., Inc)

CED supplied the RVSS and provided inspection and testing services (subcontracted to Eaton) to ensure the new electrical equipment installation met the manufactures's specifications and industry standards.

Kinetik also engaged Dutcher-Phipps Crane and Rigging (Dutcher-Phipps), Industrial Piping Specialists (IPS), Priority LLC, AWC Inc. (Priority), and Dearing Compressor & Pump (Dearing) to provide essential equipment, parts, and services that supported various project needs. While the contributions from these vendors were crucial to project success, their associated costs were relatively minor compared to the overall budget.

For photos, refer to *Appendix A – Project Photos*

Task 6 Installation and Commissioning of Project

CRPP successfully coordinated the contractor personnel, employees, and equipment deliveries to ensure the safe, efficient, and professional installation and commissioning of the project.

Installation followed delivery of the electric motor and RVSS which arrived on-site July 12, 2024.

CRPP hired Dutcher-Phipps to unload the 33,000 lb motor on July 12th, utilizing a 110-ton hydraulic crane.

Priority arrived on July 12, 2024 to cut in the engine's fuel gas line, which involved removing unnecessary piping and blinding it off at a safe location. CRPP coordinated this work to align with an unrelated outage, thereby avoiding a full plant outage later.

CRPP initiated the Pecos Bend's Train 4 MCC outage (1 day) on August 7th to tie in the RVSS. On August 8th, CRPP initiated the compressor outage (24.5 days).

NTACT mobilized on July 22, commencing the I&E work. Prior to the outage, they installed the tray and cable, conduit and fittings, and tray grounding and bonding. Once the outage was initiated, they completed the remainder of the I&E installation work.

ICE mobilized on August 8th and began demoing and removing piping, structural supports, and the old pedestal and engine. They began installation of the new pedestal and electric motor on August 13th and were substantially complete with installation on August 20th.

Eaton performed RVSS commissioning from August 28 – 29.

Kinetik conducted the Pre-Startup Safety Review (PSSR) on September 10, and the new electric motor was commissioned and handed over to plant operations on September 11, 2024.

Kinetik did not encounter any significant challenges during the project. Minor disruptions included delays in the shipping of the motor, RVSS, and other miscellaneous parts and equipment. Additionally, minor engineering and installation challenges arose while retrofitting the existing skid, originally designed for a natural gas driven engine, to accommodate an electric motor. These minor challenges were effectively resolved. Despite these minor delays and challenges, all installation and commissioning activities were completed safely and without incident.
For additional details, refer to:

- *Appendix A – Project Photos*
- *Appendix B: Pecos Bend Electrification Outage Schedule*, which provides further information on the installation and commissioning process.

Task 7 Testing and Final Design

The following testing was conducted to ensure proper installation and activate factory warranties:

- Factory acceptance testing of the RVSS
- DC high potential testing for cable
- Testing and commissioning of the electric motor

Note: Emissions testing is not applicable since this is an electric motor and there are no associated emissions or applicable emissions testing requirements.

FACTORY ACCEPTANCE TESTING OF THE RVSS

Eaton tested and inspected the RVSS to ensure it meets the manufacturer's specficaitions and industry standards and concluded:

"The equipment was found in good operating condition and is considered acceptable for service energization."

Specifically the following RVSS devices were inspected, tested, and found acceptable:

Device ID	Device Type	Comment
Main Contactor	MV Vacuum Contactor	Test OK, equipment OK for continued service
Bypass Contactor	MV Vacuum Contactor	Test OK, equipment OK for continued service
SEL 710	Motor Protectice Relay	Test OK, equipment OK for continued service
RVSS Trucks 1 & 2	Reduced Voltage Soft Starter Trucks	
CPT	Control Power Transformer	
PT's	Potential Transformers	
CT's	Current Transformers	

Procedures included:

Vacuum Motor Starter – Medium Voltage

Mechanical and Visual Inspection

- Examined contactor for:
  - Shipping damage and status of the tip over indicator.
  - Loose or obviously damaged components.
  - Application with the cell.

    - Compliance to drawings.
    - Customer field connections and signals.
- With contactor out of the cell, inspected:
    - Primary disconnects, insulators, and interphase barriers.
    - Primary and control fuse holders and connections.
    - Mechanical interlock linkages.
    - Contactor ground connection.
    - Control plug and wiring harness.
    - Verified coil voltage matches actual control voltage.
    - Current transformer, polarity marks, mounting, and leads.
    - Door fit and alignment.
- Inserted the contactor into the cell.
    - If necessary, lubricated contactor truck wheels.
    - If necessary, lubricated main finger clusters for draw out contactors.
- Verified the proper operation of all contactor / cell safety interlocks:
    - Closed contactor insertion/withdrawal interlock.
    - Isolation switch interlocks.
    - Contactor/cell rating code interlock.
    - Contactor grounding connections.
    - Where applicable, truck safety locking bolt is properly torqued.
    - Auxiliary switches.

Electrical Tests

- Applied temporary control power to the contactor per the instruction book:
    - Closed contactor.
    - Inspected contact wear.
    - Measured contact resistance.
    - Measured power fuse resistance.
    - Checked continuity of all instrument and control fuses.
    - Performed “CLOSED” portions of the insulation resistance and high
    - potential tests each phase to ground.
    - Opened contactor.
- With the contactor open:
    - Performed the “OPEN” portion of the insulation resistance and high potential tests line to load to ground.
        - Performed the vacuum integrity test at the recommended voltage level. **Did not exceed maximum voltage stipulated for this test**. Provided adequate barriers and protection against x-radiation during this test. Did not perform this test unless the contact displacement of each interrupter was within manufacturer's tolerance.

Functional Test without Primary Voltage

- Function Tests with Contactor in Cell without Primary Voltage.
    - Left the Isolation switch open for this check.
    - Applied temporary control power per the instruction book.
    - Verified the electrical operation of the contactor from local switches or terminal blocks.
    - Programed or set power monitoring devices.
    - Verified that each protective relay.
    - Remove temporary control power and any jumpers used during the check out.

Instrument Transformers

Mechanical and Visual Inspection

- Inspected enclosure for structural integrity.
- Inspected for loose, broken, or missing hardware or components.
- Inspected the electrical connections and performed a pull test on all customer and factory connections by giving a firm tug on all the connections.
- Checked tightness of bolted connections.
- Inspected cable for tightness, insulation fraying and clearances.
- Verified proper location and configuration of current transformers.
- Confirmed all voltage and current ratios properly corresponded to drawings and that polarity was correct.
- Removed shorting screws and bars were from current transformers and terminal blocks as required.
- Verified primary and secondary fuse ratings or circuit breakers match drawings.
- Verified current transformer secondary circuits were grounded in accordance with ANSI/IEEE C57.13.3 and corresponded to locations on engineer drawings.

Electrical Tests

- Performed the following tests on potential and voltage transformers.
  - Insulation-resistance tests. Performed measurements from winding-to-winding and each winding-to-ground.
  - Polarity.
  - Ratio.
- Performed the following tests on current transformers in accordance with the testing methods in ANSI/IEEE C57.13.1
  - Ratio.
  - Polarity.

Reduced Voltage Soft Starter

Mechanical and Visual Inspection

- Inspected for loose, broken, or missing hardware and components.
- Verify the RVSS trucks are receiving power as indicated by the LED lights along with the current, and control board.
- Inspected fiber runs for proper bend radius and termination points.
- Inspected termination points for conformance to the drawings and reported any discrepancies.
- Obtained motor name plate data and programed RVSS control with the obtained values and relay outputs per manufactures drawings.

Electrical Tests

- SCR and Gate resistance values were measured and compared against manufactures published values.

Startup

Main Power Off Inspection

- Simulated fault signals and run statuses to the PLC and verified the control room can see the values for all three pump starters.
- Verified the relays are properly programed per the customer provided coordination study and the motor RTD values are read by the relay.
- Obtained as found and as left settings for the relays.

Main Power Inspection

- With the main power on, the voltage phase angles were observed, and phase rotation programed into the RVSS to allow for the proper firing sequence of the SCR's.
- Verified a ready status was shown on the RVSS controller and the motor protection relay was not in a fault status.
- Provided a start command to the RVSS to verify the motor rotation.

DC HIGH POTENTIAL TESTING FOR CABLE

Roundhouse completed the Very Low Frequency (VLF) cable testing for the 5 kV power system on August 26. This test evaluated the condition and integrity of the cable insulation to ensure there are no electrical issues. The test was conducted in accordance with industry standards and manufacturer specifications.

During the VLF testing, all three phases of the cable were tested together. The test voltage was applied incrementally, with readings taken at five equal steps and a 30-minute hold applied at the final test voltage. The cable successfully passed the VLF test, confirming its integrity for operation.

TESTING AND COMMISSIONING THE ELECTRIC MOTOR

Prior to shipment, the electric motor underwent factory acceptance testing conducted by Hyundai to ensure it met design specifications. After installation and before commissioning, a no-load test was performed by operating the motor uncoupled from the compressor. This process verified the motor's performance and ensured proper break-in before subjecting it to full-load conditions during system start-up.

Task 8 Operation Period Reporting

CRPP will operate the project for a minimum of five years, providing the TCEQ with Annual Operation Status Reports and a Final Operations Report throughout the contract period.

Discussion/Observations

Objectives and Results

The project objectives were successfully achieved – the natural gas-driven engine was replaced by an electric motor, effectively eliminating combustion emissions from the engine. This project aligns with Kinetik's broader sustainability goals and commitment to reducing operational emissions.

Drawing from experience in similar projects, our team was well-prepared to address challenges throughout the project. The project did not encounter any notable issues or setbacks. Minor setbacks, such as shipping delays for certain equipment and parts, were mitigated through strategic planning and execution.

Our engineering team established a detailed schedule and budget early in the application process to manage uncertainties around grant approval timing. Planning a year in advance was challenging given inflation and rising costs of goods and services. Nonetheless, Kinetik's experience and proactive approach allowed us to minimize disruptions, maintain project momentum, and most importantly, deliver the safe and successful installation of the new motor.

Critical issues/Technical goals and barriers

A technical challenge involved retrofitting a skid initially designed for a natural gas-driven engine to accommodate

an electric motor. Retrofitting the existing equipment was a challenge since original design documentation was limited.

While the project's technical goals were achievable, addressing the known variables was key to overcoming barriers. These challenges were effectively managed through a combination of engineering solutions and close collaboration with contractors. The obstacles encountered during this project do not pose a limitation to using this technology in similar applications in the future. The technology proved capable of overcoming these barriers once addressed.

Scope for future work

While Kinetik has experience engineering and installing similar projects, each project presents its own unique challenges and learning opportunities. Lessons from this project, such as managing supply chain risks, planning for cost escalations, and addressing retrofitting complexities are valuable and will inform the execution of future projects.

Summary/Conclusions

Kinetik and CRPP consider this project a success, meeting all objectives on time and within budget, with zero safety incidents and only minimal disruption to site operations during the required outage.

The Designated Project Representative will not be changing for the operational phase.

Acknowledgments

CRPP gratefully acknowledges the support and contributions of the following parties in making this project a success:

- **TCEQ's TERP team** for enabling this project through the grant award.
- **Kinetik's engineering and operations teams** for their expertise in designing and managing the project to completion.
- **Contractors, consultants, and vendors** for their safe and diligent work in design, procurement, engineering, construction, and commissioning.

References

None

Appendices

Appendix A
Project Photos

	*Figure 1 Skid Modifications: Cat 3616 engine removed from skid*
	*Figure 2 Skid Modifications: CAT 3616 engine removed from skid*

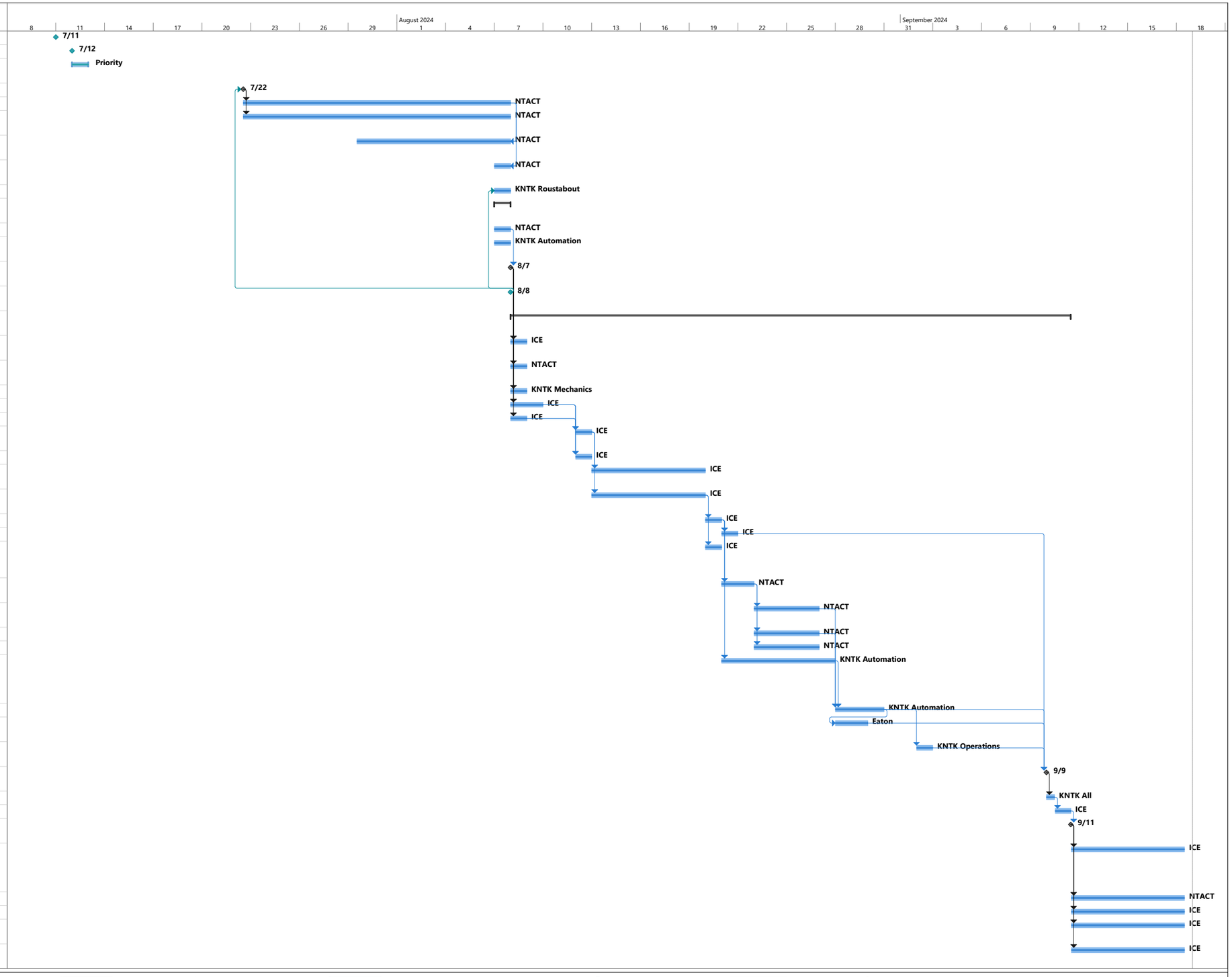
Figure 3 Electric motor set on skid

Figure 4 Completed RVSS Installation

Figure 5 Completed Motor Installation

Appendix B
Pecos Bend Electrification Outage Schedule

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		Arrival of Soft start	0 days	Thu 7/11/24	Thu 7/11/24		KNTK Engineering
2		Arrival of motor	0 days	Fri 7/12/24	Fri 7/12/24		KNTK Engineering
3		Cut in Fuel Gas Valve	1 day	Fri 7/12/24	Fri 7/12/24		Priority
4		NTACT mob in	0 days	Mon 7/22/24	Mon 7/22/24	14FS-2.5 wks	NTACT
5		Install tray and cable	2.5 wks	Mon 7/22/24	Wed 8/7/24	4	NTACT
6		Install conduit and fittings	2.5 wks	Mon 7/22/24	Wed 8/7/24	4	NTACT
7		Grounding and bonding on tray	1.5 wks	Mon 7/29/24	Wed 8/7/24	5FF	NTACT
8		Install soft start bucket	1 day	Wed 8/7/24	Wed 8/7/24	5FF-1 wk	NTACT
9		Skid cleanup	1 day	Wed 8/7/24	Wed 8/7/24	14FS-1 day	KNTK Roustabout
10		**Train 4 MCC-4000 outage**	**1 day**	**Wed 8/7/24**	**Wed 8/7/24**		
11		Tie in soft start	1 day	Wed 8/7/24	Wed 8/7/24		NTACT
12		Communications for SEL	1 day	Wed 8/7/24	Wed 8/7/24		KNTK Automation
13		Power up MCC-4000	0 days	Wed 8/7/24	Wed 8/7/24	11	KNTK Operations
14		Operations ready for outage	0 days	Thu 8/8/24	Thu 8/8/24		KNTK Operations
15		**Residue compressor C-3106 outage**	**24.5 days**	**Thu 8/8/24**	**Wed 9/11/24**		
16		Remove fuel gas dead leg	1 day	Thu 8/8/24	Thu 8/8/24	13	ICE
17		Demo tray near engine	1 day	Thu 8/8/24	Thu 8/8/24	13	NTACT
18		Drain fluids	1 day	Thu 8/8/24	Thu 8/8/24	13	KNTK Mechanics
19		Demo piping	2 days	Thu 8/8/24	Fri 8/9/24	13	ICE
20		Demo structural	1 day	Thu 8/8/24	Thu 8/8/24	13	ICE
21		Demo out existing engine	1 day	Mon 8/12/24	Mon 8/12/24	19,20	ICE
22		Demo hot start	1 day	Mon 8/12/24	Mon 8/12/24	19,20	ICE
23		Demo old pedestal	5 days	Tue 8/13/24	Mon 8/19/24	21	ICE
24		Install new pedestal	5 days	Tue 8/13/24	Mon 8/19/24	21	ICE
25		Install new motor	1 day	Tue 8/20/24	Tue 8/20/24	24	ICE
26		Align motor	1 day	Wed 8/21/24	Wed 8/21/24	25	ICE
27		Install compressor oil cooler and stand	1 day	Tue 8/20/24	Tue 8/20/24	24	ICE
28		Medium voltage cable testing	2 days	Wed 8/21/24	Thu 8/22/24	25	NTACT
29		Terminate new motor	2 days	Fri 8/23/24	Mon 8/26/24	28	NTACT
30		Terminate new IO	2 days	Fri 8/23/24	Mon 8/26/24	28	NTACT
31		Modify Coms	2 days	Fri 8/23/24	Mon 8/26/24	28	NTACT
32		Rebuild existing cabinet. HMI updates, IO termination	5 days	Wed 8/21/24	Tue 8/27/24	25	KNTK Automation
33		Loop checks	3 days	Wed 8/28/24	Fri 8/30/24	29,30,32	KNTK Automation
34		Soft start commissioning	2 days	Wed 8/28/24	Thu 8/29/24	33FS-3 days	Eaton
35		Bump check motor	1 day	Mon 9/2/24	Mon 9/2/24	33	KNTK Operations
36		Motor ready for operation	0 days	Mon 9/9/24	Mon 9/9/24	34,33,26,35FS+5 days	
37		PSSR	0.5 days	Tue 9/10/24	Tue 9/10/24	36	KNTK All
38		Hot alignment	1 day	Tue 9/10/24	Wed 9/11/24	37	ICE
39		Handoff to Operations	0 days	Wed 9/11/24	Wed 9/11/24	38	KNTK Operations
40		Move demo'd equipment to warehouse, engine cradle	1 wk	Wed 9/11/24	Wed 9/18/24	39	ICE
41		Wire labels	1 wk	Wed 9/11/24	Wed 9/18/24	39	NTACT
42		Blind off equipment	1 wk	Wed 9/11/24	Wed 9/18/24	39	ICE
43		Remove trash and pipe	1 wk	Wed 9/11/24	Wed 9/18/24	39	ICE
44		Remove upper structure	1 wk	Wed 9/11/24	Wed 9/18/24	39	ICE



Project: 2024611 Outage Pecos
Date: Thu 9/26/24

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress