NGS Conclave on Construction Management 2026

GAIL (India) Limited

The Journey of GAIL's First Electrification..

HVJ Compressor Station, Vijaipur

PRESENTERS

Mr. Yogesh Bhola
Manager (Mech)

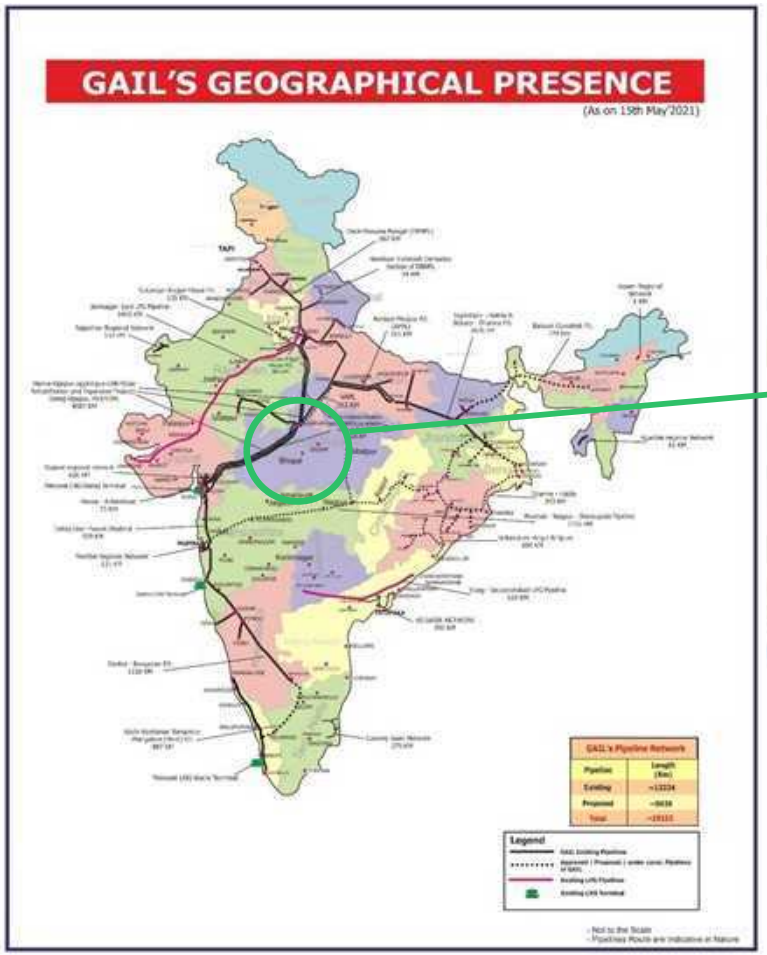
Ms. Babita Beniwal
SE (Elec)

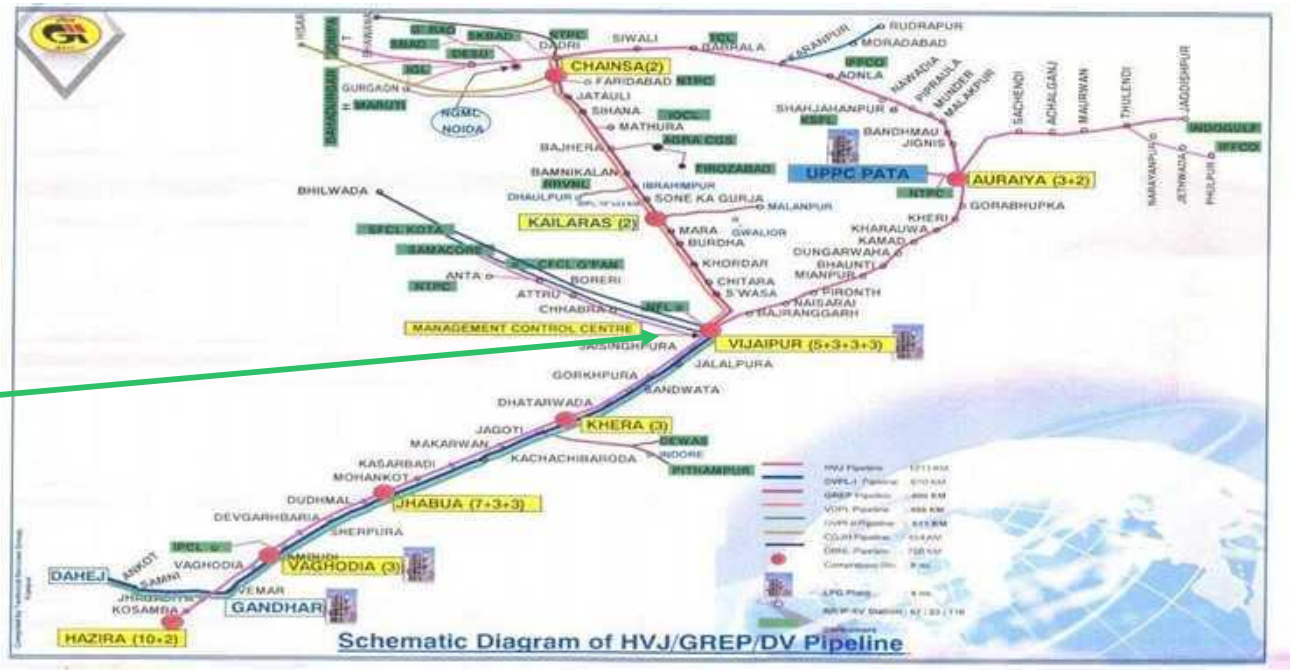
Replacement of Gas Turbine Drive with Electric Motor Drive

FIRST ELECTRIFICATION...

GAIL's Envisioned Net-Zero Action Plan

GAIL (India) Limited





- **Total NG Network of GAIL- @ 18000 KM with capacity:208 MMMSCMD**
- **Central region Network -@ 7200 KM including Gujarat Regional**
- **09 Major compressor stations** installed along HVJ Integrated Network
- **55 Gas-Turbine-Driven Compressors** operating across the network.

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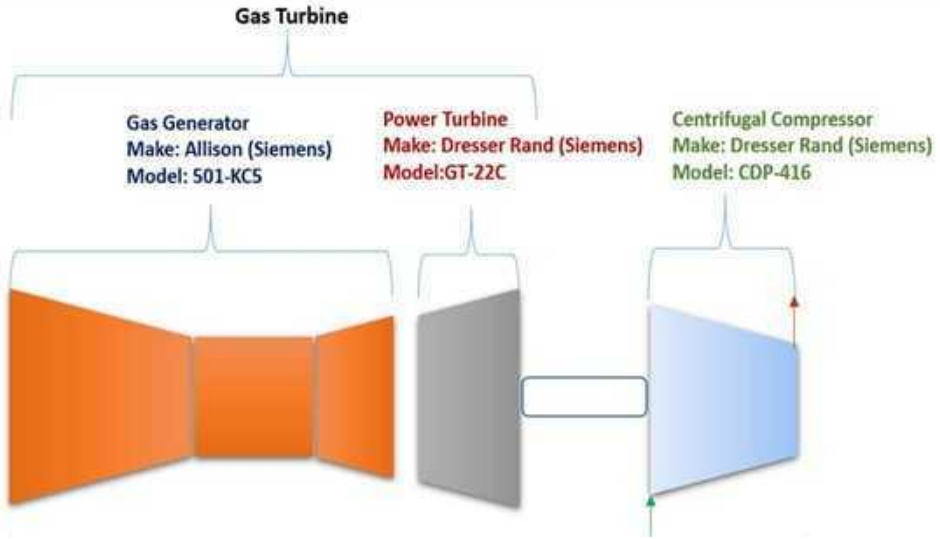
About HVJ Pipeline

- Commissioned In : 1987
- Length : @ 1800 KM
- Capacity: 18.2 MMSCMD
- Serves As Backbone for NG Transmission Network

Sr. No	Compressor Station	No. GTC skids installed
1.	Hazira	10
2.	Jhabua	07
3.	Vijaipur	05+03
4.	Auraiya	03

Typical Gas Turbine Compressor Unit



Why Gas Turbine-Driven Compressor (GTC) were selected for the HVJ Pipeline System during design stage ?

- Non-Availability of Electric Power in Remote Area
- Fuel Availability
- Independent Power Generation

Trigger Point to conceive:

01

Long Lead Time for Overhaul

Turnaround time for overhauling is about 18-24 Months

02

Rising Overhaul Costs

Overhauling cost of Gas Turbines is increasing abnormally, Current OH cost: ~16-18 Crores, Every 6th Year.

03

Volatile Fuel Gas Prices

Natural gas prices are exceptionally volatile and are driven by dynamics in the European markets.

04

Obsolescence of Turbines

Allision Turbines are very old and in the verge of obsolescence

05

Net Zero Initiative

GAIL is committed towards developing decarbonization capabilities in line with Government of India's vision

06

Efficiency

Efficiency is only 16-18 % approximately

WHY ONLY Turbine-A MACHINE for Conversion ?

01

Pipeline Hydraulics

- Operating hours of units
- Units having max. operating hours are more rewarding to convert

02

Electrical infrastructure availability

- Reliability of Grid Power
- Availability of nearest source

03

Existing Asset

- Book value of existing assets
- Assets as spare for remaining drives

04

Other Aspects

- No Combined cycle, HRSG
- Ease of Execution & Space constraints

First Pilot Project methodology

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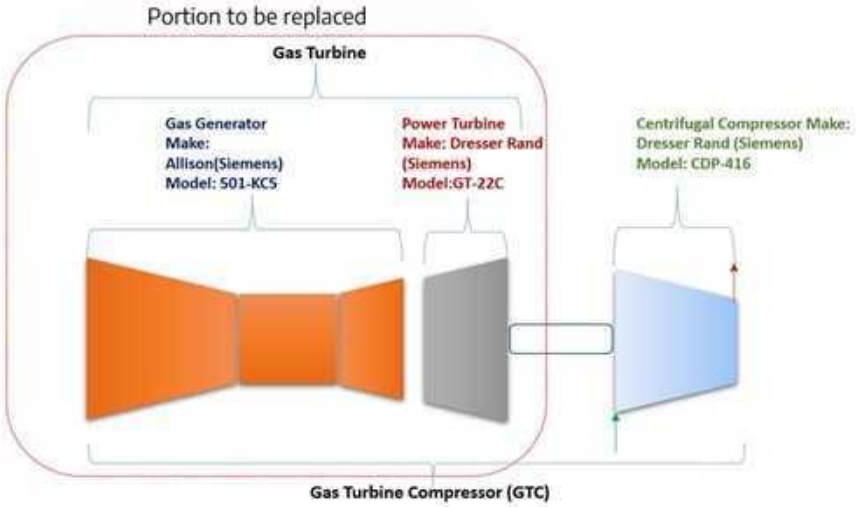
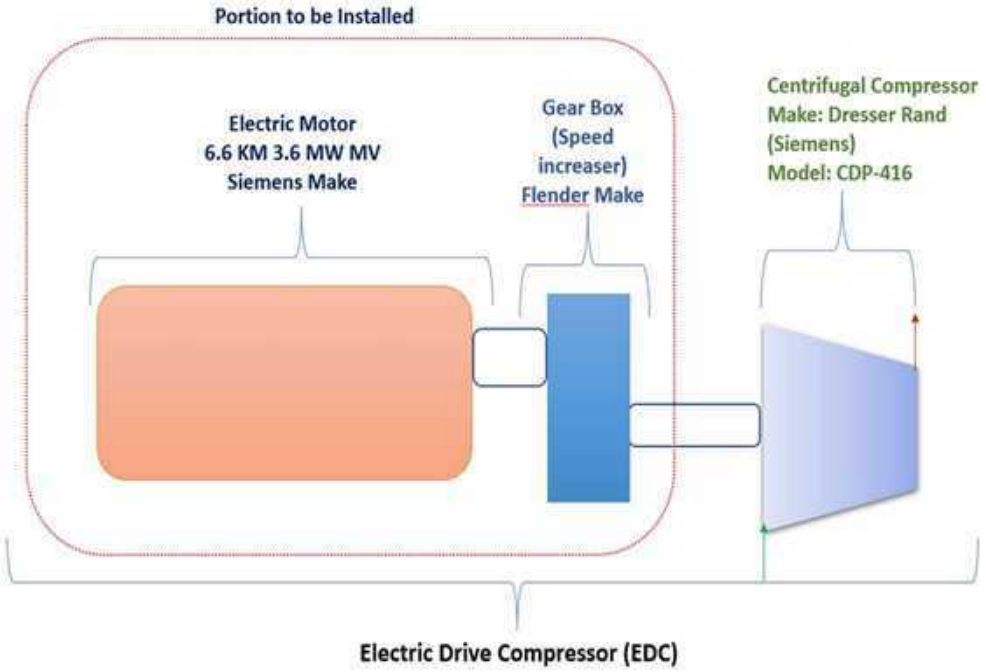


Old Schematic



New Schematic

Major Milestones

1

May 2023

Feasibility Study

2

July 2023

Tendering & Order Placement

3

Feb 2024

Drawings Submission & Approval.

4

July 2024

Manufacturing & Supply

5

Sep 2024

Site Removal & Erection

6

Dec 2024

Installation & Commissioning

Details of Major Equipment

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Scope of supplies by M/s Siemens

1 MOTOR

- ✓ 6.6kV 3.6 MW Motor
- ✓ Supplied by : M/s Siemens, Czech Republic
- ✓ Model: SIMOTICS HV M

2 GEARBOX

- ✓ Ratio: 1 : 8379
- ✓ Supplied by: M/s Flender, France
- ✓ Model: TX63/8C

3 VFD

- ✓ 6.6kV 3.6 MW MV Drive
- ✓ Supplied by: M/s Siemens, India
- ✓ Model: SINAMICS GH180

4 SWITCHBOARD

- ✓ 6.6kV MV Switchboard
- ✓ Supplied by: M/s Siemens, India

5 Automation

Control Logic, Alarm Trip/Matrix, Cards, Hard Wires, HMI etc.

Site Execution Steps

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Scope of GAIL by In-house Team

A Removal

Removal of Gas Turbine Drive Skid

- Gas & Power turbine
- Associated Auxiliaries
- Skid- Stacks, Enclosures etc.
- Filtration, Fuel, Lube Oil etc.
- Controls, F&S, Electricals etc.
- All removals are use as spares

B Foundation

Erection of Mechanical & Civil Foundation

- Used UC beams-9 TON
- Approx. 54 M3 civil concreating
- 20 + Base plates, Pockets, Shed
- 56 Nos- stiffeners, 1000+ Welding
- Designed for Dynamic and Static load
- VFD/HT Panels

C Installations

Installation of major Equipment

- Cable Laying of 1.8 KM
- Installation of Motor, GB, HT & VFD
- Partition & HVAC for VFD panel
- Lube & Seal Oil system modification
- Anchor bolts, Jacking plates etc.
- Pumps, Controls, Cables etc.

D Alignment & Commissioning

Compressor+ Gearbox + Motor alignment

- Comp + GB Alignment
- GB + Motor Alignment
- Shim, Jacking Bolts
- HS & LS coupling
- Irreversible Side & Elevation
- Axial Play adjustment
- Commissioning

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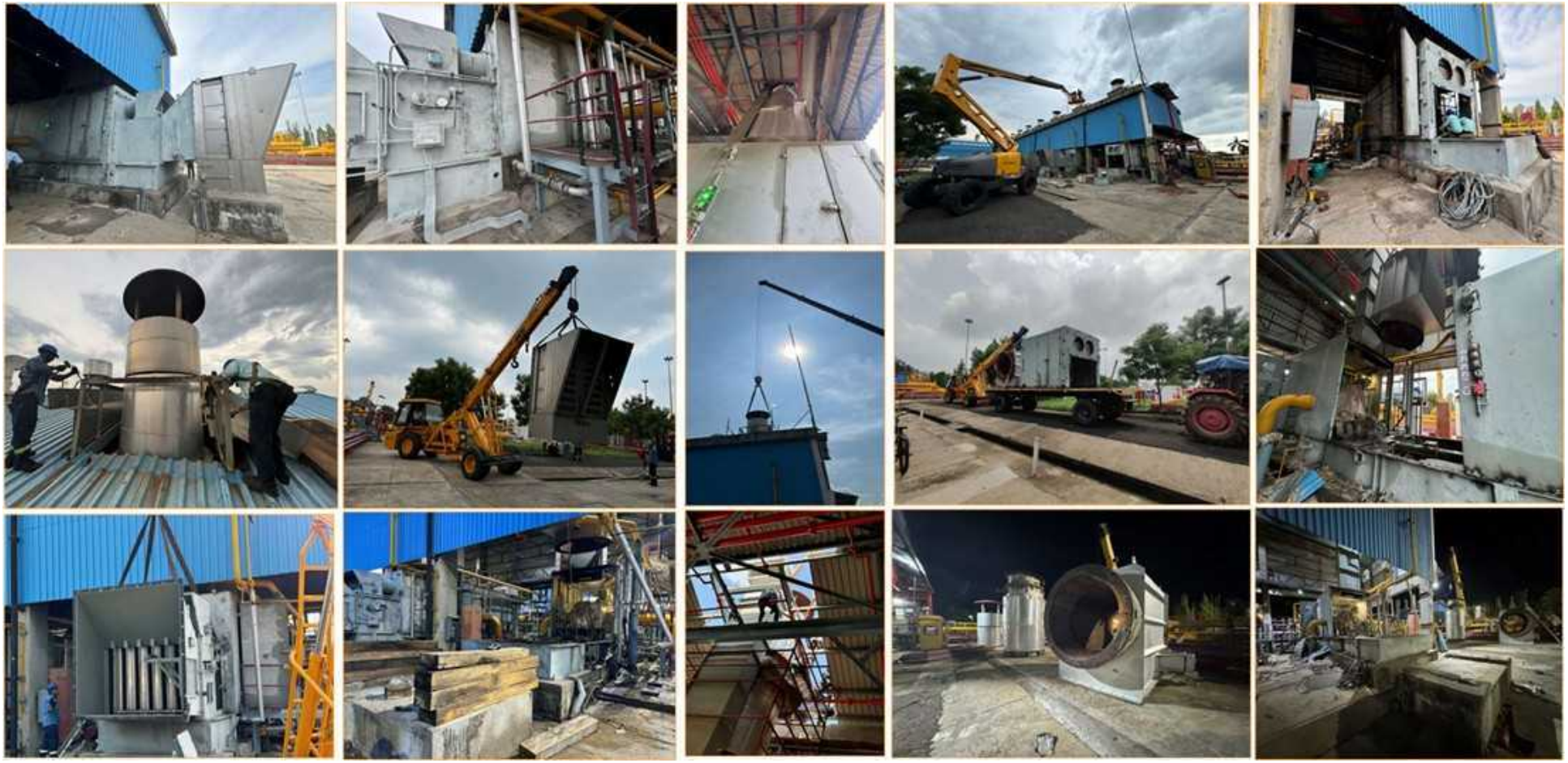
Removal- Site Snaps



Erection of Foundation - Site Snaps

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Installation of Major Equipment - Site Snaps

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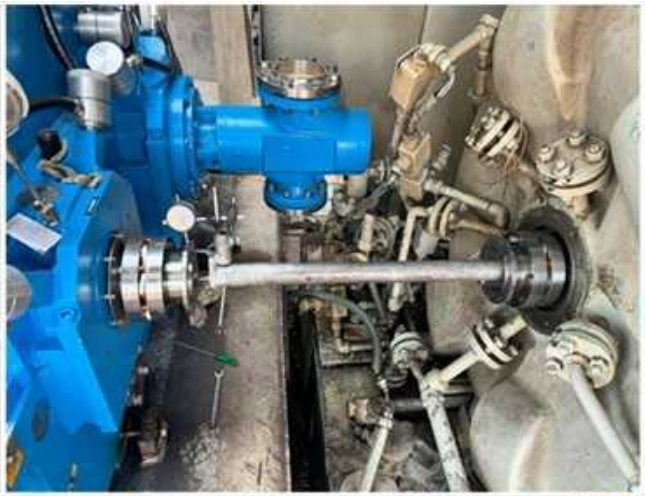

6.6 KV Power Flow of Branch Line Electrical Drive

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LPG SS-1 Substation

Make- JYOTI

6.6KV, 800A

HVJ Branch Line Main HT Motor

Make-SIEMENS

3.6MW, 6.6KV,
360A
1491RPM

3CX300 sq. mm, 4R Cable->
1.5km

3CX300 sq. mm, 2R Cable->
200m

VDPL Substation

Make-SIEMENS

6.6KV, 800A
40kA for 1s

3CX300 sq. mm, 2R
Cable

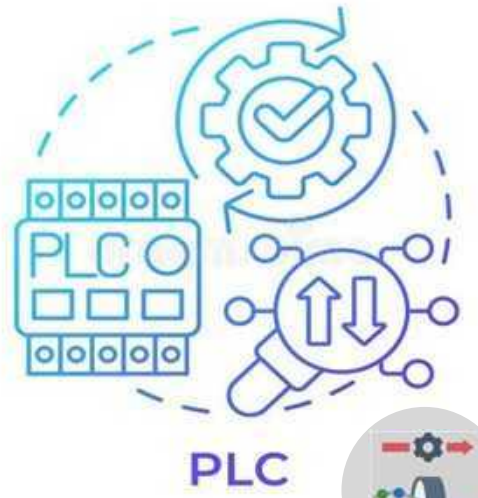
Electrical Infrastructure - Site Execution Snaps

INSTALLATION OF 6.6KV MV DRIVE:

INSTALLATION OF HT PANEL:

CABLE LAYING AND ROAD CROSSINGS

Controls & Logic



HMI
New Graphics, HMI & Structures prepared for new drive.

Hard + Soft Cables
VFD-PLC, MOTOR-PLC, MOTOR-VFD etc. hard/soft singles communication made

Logic Flow
Logic Flow, Control Narratives, Alarm/Trip Matrix prepared

IOs Identifications
190 + IO changes/prepared/modified

Logic & Interlocks
Complete logic prepared for Electric Motor Drive in-place of Gas turbine Drive.

HMI Snaps

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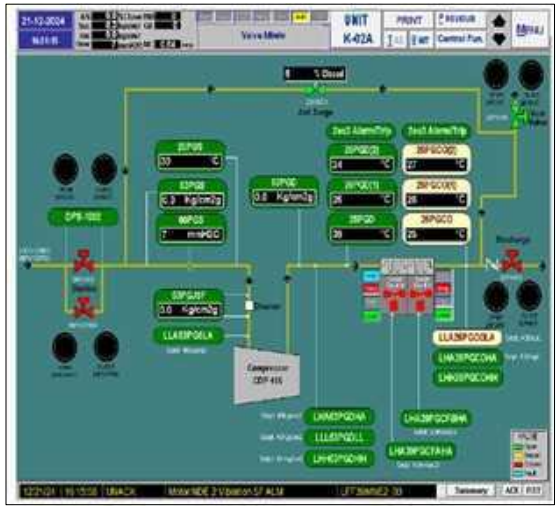
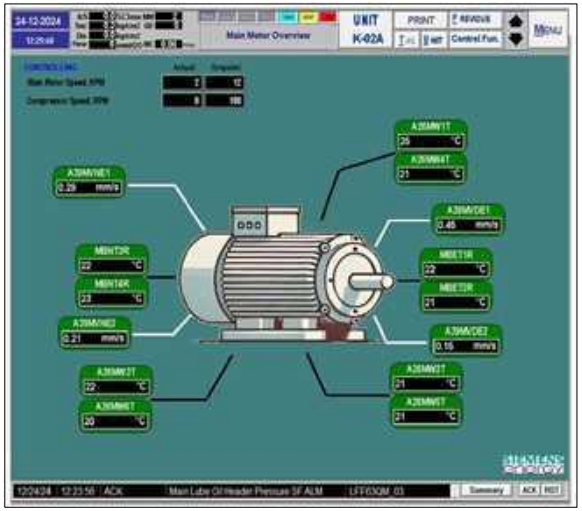
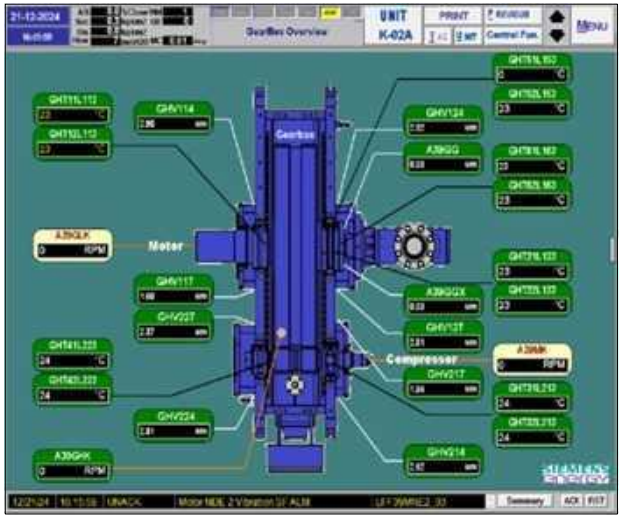


01 Compressor & Valves Mimics



02 Main Motor Overview



03 Gearbox and Compressor Overview

GAIL'S First Electric Drive Looking Like

GAIL (India) Limited

Merits of Electrical Drive as a Prime Mover

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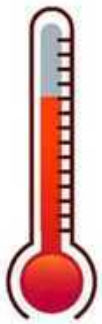

Heat Dispersion

Reduction of hot exhaust gases

@571 °C @55.8 TPH

GHG Emission

Reduction of CO2 Emission to the tune of ~12000 Tons/Annum

Project Features

Efficiency Aftermath

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- **Modern Gas Turbine Driven Train : 33%**
  (Gas Turbine to Compressor)
- **Electrical Drive Train: 80%**
  (Transformer to Compressor)
- **Electrical Drive Train: 50%**
  (Power Generation to Compressor)

$$\eta_{gas\ turb\ (aero-d)} * \eta_{comp} = \eta_{gas\ turb-drive}$$
$$0{,}40 * 0{,}83 = 0{,}33$$
$$\eta_{trans} * \eta_{VSD} * \eta_{motor} * \eta_{comp} = \eta_{e-drive}$$
$$0{,}99 * 0{,}99 * 0{,}98 * 0{,}83 = 0{,}80$$
$$\eta_{gen} * \eta_{dis} * \eta_{trans} * \eta_{VSD} * \eta_{motor} * \eta_{comp} = \eta_{e-drive}$$
$$0{,}65 * 0{,}95 * 0{,}99 * 0{,}99 * 0{,}98 * 0{,}83 = 0{,}50$$

- **Turbine, we have Replaced - Allison Gas Turbine : 24% (Actual measured: 19.5%)**
  (Gas Turbine to Compressor)

New Drive Complete Train Efficiency

η VFD x η Motor x η Gearbox x η Compressor = η e-Drive

0.99 x 0.98 x 0.95 x 0.83 x = **76.50 %**

Source: M/s Siemens Energy Technical Paper on Turbine replacement by electric drive train dated. 07 December 2017

OPEX Cost Saving

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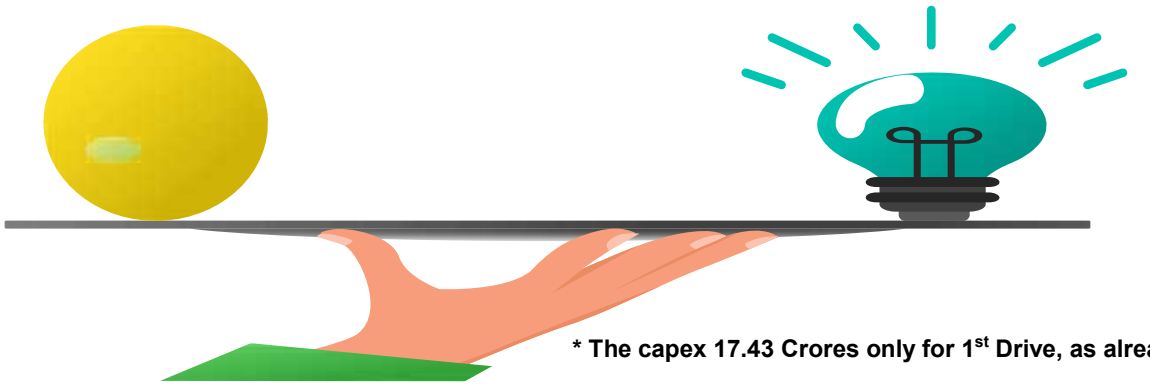
Sr No	Comparison Parameters	Gas Turbine Drive	Electric Motor	Cost Saving
1	Fuel/Energy Cost per Annum (300 Day Working)	20.49 Crores	11.78 Crores	**8.71 Crores**
2	OH & Maintenance Cost per Annum in INR	4.87 Crores	0.1 Crores	**4.77 Crores**
			Total Cost Saving per Annum	**13.48 Crores**

Total Capex involved : 17.43 Crores

Fuel/Energy Cost Saving per Day : 2.90 Lakhs



*** The capex 17.43 Crores only for 1st Drive, as already substation and grid were available.**

Challenges faced During Conversion of Gas Turbine to Electric Motor Drive

1. Elevation and Alignment

Keeping existing Compressor Shaft as reference

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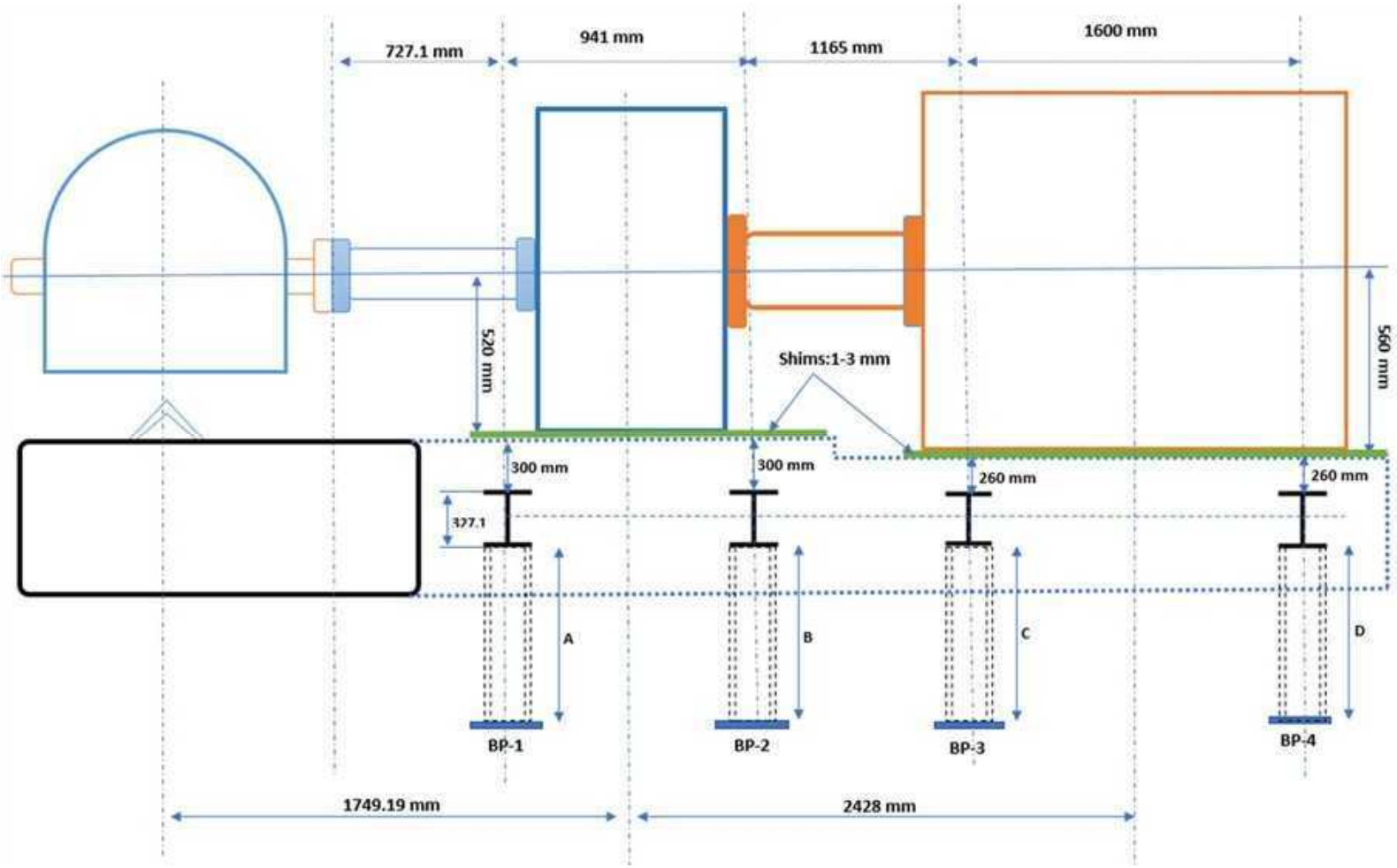

- ✓ **Existing Foundation failed due to offset of motor and load bearing capacity.**
- ✓ **Used 15+ Measuring & Directional tools.**
- ✓ **Used UC beams for static & dynamic load**
- ✓ **Cable trench, excavation near shed column & plinth beam, monsoon.**
- ✓ **Existing compressor's old and missing drawings**

2. Lube & Seal Oil Circuit Modification

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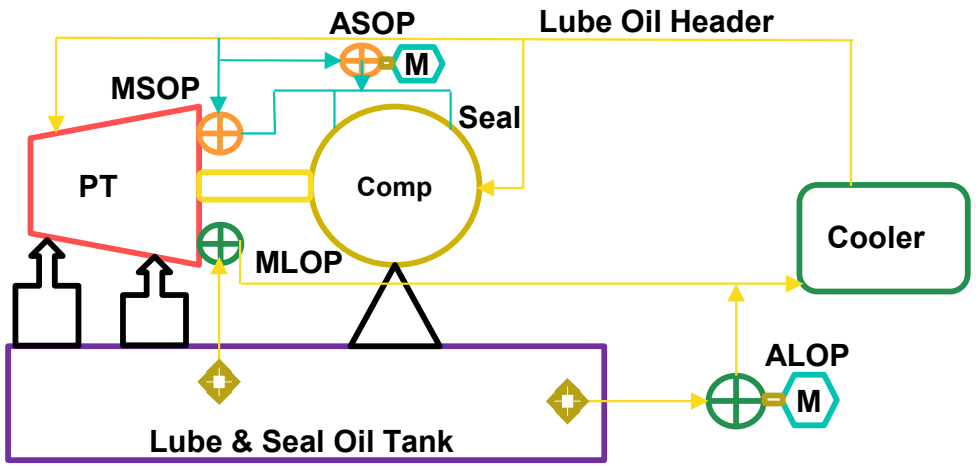
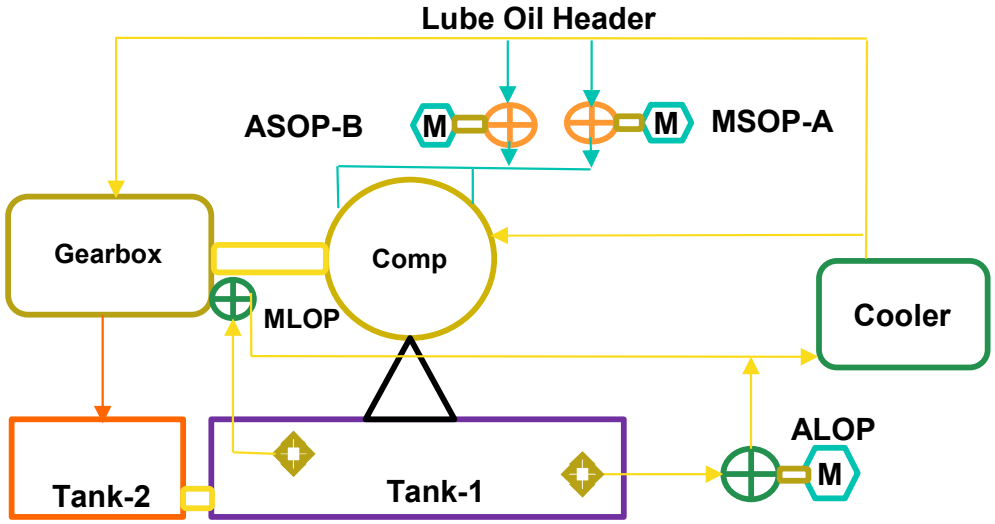
Old Lube Oil Circuit Scheme



New Lube Oil Circuit Scheme



Lube & Seal Oil Circuit Modification

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Old Lube Oil Circuit Scheme

- Old mineral oil common tank was for PT + Compressor,
- Main Lube & Seal Oil Pumps were driven by Power Turbine in GTC.
- Some part of oil tank was under PT.

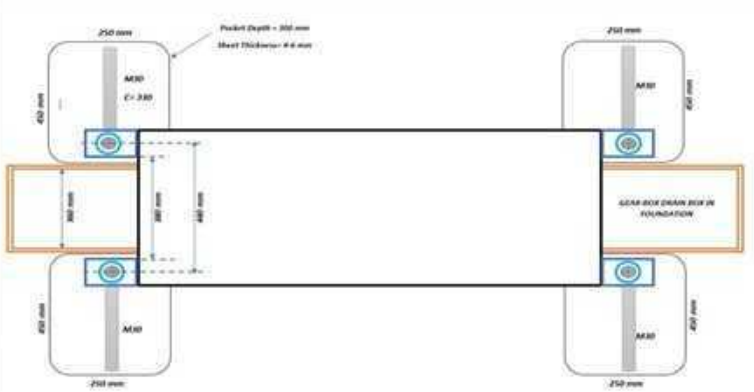
New Lube Oil Circuit Scheme

- New modified tanks are for Gearbox + Compressor.
- In new system MSOP - motor driven (Not mounted on Gearbox)
- One additional tank installed to retain oil capacity & vapor space

3.Specific Anchoring for Gearbox and Motor

GAIL (India) Limited

- Motor & Gearbox support footprint are with specific pocket design
- Gearbox drain required pockets in base frame, 1-2mm margin for side & elevation.
- Use of L-Type 8.8 Grade anchor bolts for tensile and compressive load.
- Anchor Bolts welds UC beams directly for cyclic load.



4. VFD Heat Load and Partition

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SUBSTATION PARTITION AND HVAC SYSTEM

- VFD having Heat load at maximum load = ~ 45 TON of Refrigeration
- Existing VDPL Substation HVAC system was not sufficient, so new 03 Nos Duct able AC installed.
- In-house Barrier Partition work erected for VFD Heat Load. Space availability.
- The total procurement, Installation and Commissioning done within VFD manufacturing time period.

6. Controls & Logic Modification

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- Original Logic & Interlocks were for Gas Turbine + Power Turbine + Compressor Train.
- The logic was blocked and not detailed for compressor Surging, Vented & Non-Vented shutdowns etc.
- The complete logic prepared as per new Interlocks, IOs & New equipment parameters.
- Complete New HMI preparation for Motor + Gearbox + Compressor Train: No reference available
- Hardwires, Cards, Convertors, Barriers, Speed reference for Anti-Surge Valve, Accelerometer configuration.

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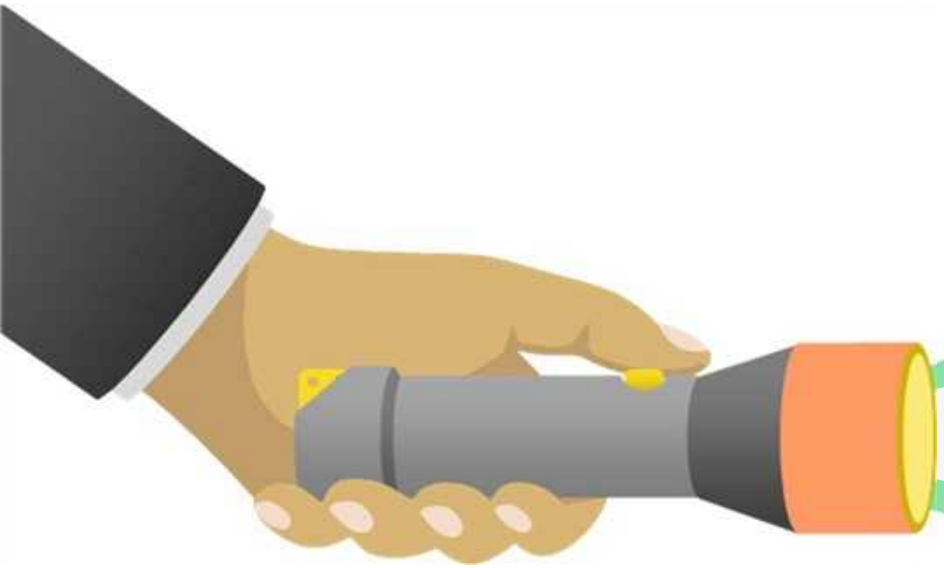

Electric Drive

Successfully Runs for ~11000

Hours in just 1.5 Years

TEAM INVOLVED IN ELECTRIC DRIVE

The project's success was driven by Continuous Support and guidance from GAIL's higher management.

Sh. Amol R Pachghare
(HOD)

Sh. Nitin Nimje
Overall Project In-charge

Sh. Mahender Singh
Mech In-charge & EIC

Sh. Sudhir Kamal
Elect In-charge

Sh. Chandresh Parsedia
Inst In-charge

Sh. Ram Kumar
Ops In-charge

Sh. Yogesh Bhola
Overall Site Coordinator

- Dushmanta Naik
- P G Bhalerao
- Rishabh Nihalani

- M.K.Aman
- Saurabh Tibrewala
- Narendra Soni
- Babita Beniwal

- Sanjeev Singh
- Shubham Shankar
- Misha
- Chinmay Sharma

- Vinay Rahar
- Himanshu Kumar
- Nayan Hari Krishna

- **Civil Team :** Abhishek Chauhan, Akshat Jain, Ashutosh Kirar

Proud Moments.....

GAIL (India) Limited

FLASH !

CENTRAL REGION

GAIL's

1st ELECTRIC MOTOR DRIVE RETROFITTED IN PLACE OF GAS TURBINE DRIVE

Inaugurated by

Sh. Sandeep Kumar Gupta

Chairman & Managing Director

on 31.03.2025

in august presence of

Sh. Deepak Gupta

Director (Projects)

WORDS OF APPRECIATION BY TOP MANAGEMENT...

MECHANICAL DEPARTME

Sh. Deepak Gupta
Director (Projects)

LinkedIn

While executing this crucial assignment the team has gained invaluable experience & this will prove useful when GAIL replaces other gas turbine drives in a phased manner.

Several other net-zero projects are on the anvil in GAIL's relentless push for energy transition for an

*GAIL's Net-Zero Initi

NET-ZERO, today, is a
have announced Net
part of its decarboni
Net-Zero target year!

Besides undertaking
innovations, the grad
Electric Drives' is one of the crucial agendas in GAIL's pursuit towards sustainable future - this will not only minimise internal fuel consumption but also bring operational efficiency!

Various GAIL work-centres are making meaningful contributions in GAIL's Net-Zero program. GAIL Vijaipur leads the energy transition push by recently commissioning the first MW scale PEM Electrolyser based Green Hydrogen Project and now, has successfully completed the 1st pilot project of replacing "Gas Turbine to Electric Motor". A Siemens make 3.6 MW Motor has replaced the Allison (now Siemens) make 4.1 MW (ISO) Gas Turbine. This will lead to reduction of CO2 emission ~ 6500 TPA. Importantly, Compressor train efficiency will get a significant boost.

775 79 comments • 6 reposts

Gail Prabudha Mujumdar
You
Vijaipur team is happy to convey that as part of GAIL's Net Zero Initiative and decarbonization journey, the 1st pilot project of Drive conversion fr...
Congrats to Team Vijaipur 19:24

Gail Avinash Bauskar
Congrats team Vijaipur 19:39

You
Vijaipur team is happy to convey that as part of GAIL's Net Zero Initiative and decarbonization journey, the 1st pilot project of Drive conversion fr...
Great achievement. Congratulations. 19:24

Gail R K Singh GM
Congratulations to the entire team on completion of successful Drive conversion having multiple benefit 19:25

Sh. Praveer Kumar Srivastava
Executive Director (O&M) & OIC- CR

Vijaipur team is happy to convey that as part of GAIL's Net Zero Initiative and decarbonization journey, the 1st pilot project of Drive conversion fr...
Congratulations, Team... I believe this was one of the most challenging projects considering such modification being done for the first time in India, where OEM itself had very limited exposure and many of the innovative ideas and activities were carried out by in house team at Viajipur...This unique experience of the team will go a long way and I am sure going forward this team can make these modifications with much ease...Kudos to the team once again. Well done. 22:39

Sh. Dinesh S. Divekar
Chief General Manager(O&M)

Vijaipur team is happy to convey that as part of GAIL's Net Zero Initiative and decarbonization journey, the 1st pilot project of Drive conversion fr...
Congratulations to team...Great job done , as a result of great team work with well coordinated efforts and display of great confidence in executing the job due to vast experience in dealing with KC5 machines. Kudos to entire team for showing way forward towards achieving our Net zero targets.. Hope to continue the same enthu in 2025 also..

IEW INDIA ENERGY WEEK
27 - 30 JANUARY 2026 | GOA, INDIA

UNDER THE PATRONAGE OF
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
MINISTRY OF PETROLEUM AND NATURAL GAS
सत्यमेव जयते

ENERGISING GROWTH.
SECURING ECONOMIES.
ENRICHING LIVES.

PRESENTED IN INDIA ENERGY WEEK (IEW)-2026

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What is Next ?

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Sr No	Location	Machine Type	Installed Qty	How Many conversion can be done	ISO Rating (KW)	Power Required for possible options model wise	Station Wise Total Power Required for possible options	Tag Number for conversion	Priority for conversion
1	Hazira	KC5	10	2	4103	8206.00	37736.00	11-K-101A/B	5
2		RB211-24G N-DLE	2	1	29530	29530.00		51-KA-01A	6
3	Vaghodia	RB211-24G N-DLE	3	0	29530	0.00	0.00	NOT PROPOSED	0
4	Jhabua	KC5	7	0	4103	0.00	32885.00	NOT PROPOSED	0
5		PGT10	3	0	10680	0.00		NOT PROPOSED	0
6		RB211-24G DLE	3	1	32885	32885.00		052-KA-CF-102A	11
7	Khera	RB211 24 G N-DLE	3	1	29530	29530.00	29530.00	56-KA-101 A	7
8	Vijaipur	KC5 -Branch Line	3	1	4103	4103.00	64587.00	13-K-02A	1
9		KC5 -Main Line	5	3	4103	12309.00		13-K-01C/D/E	2
10		Solar Titan 130S	3	1	15290	15290.00		57-KA-01B	12
11		RB211-24G DLE	3	1	32885	32885.00		057-KA-01A	10
12	Auraiya	KC5	3	1	4103	4103.00	10744.00	14-K-01C	3
13		SGT-200-2S	2	1	6641	6641.00		54-KA- 101 A	4
14	Kailaras	RB211-24G DLE	2	1	32885	32885.00	32885.00	GTC-A	8
15	Chhainsa	RB211-24G DLE	2	1	32885	32885.00	32885.00	GTC-A	9

Thanks !!!

“अंतः अ ित रंभः”

The End is the Beginning...