

Maintenance and Operation of Dahej LNG Terminal

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Introduction

- The 10 MTPA LNG Terminal at Dahej, is state of art technological infrastructure and plays a crucial role in fulfilling the energy requirement of the country.
- 16~18% of Indian gas demand is met by PLL's Dahej terminal.
- Terminal is equipped with 2.4 Km long Jetty, which can handle upto 160 ship berthing in a year.
- The terminal is operated round the clock, maintaining required sendout to meet the customers requirement.

Introduction cont...

- **To maintain almost Zero downtime timely preventive maintenance activities are carried out on the installed equipments.**
- **The operating and safety procedure are constantly reviewed and modified as per requirement and operating experience.**
- **The highly experienced and dedicated operating and maintenance team is self sufficient to cater any operational or maintenance related problems.**

OPERATIONS

Our AIM 100 % Safe & Continuous Operation



Petronet LNG Ltd.



MAJOR JOBS Of Operating LNG Terminal

- ✓ **Unloading LNG from ship**
- ✓ **Storage of LNG in tanks**
- ✓ **Regasification of LNG**
- ✓ **Custody transfer of NG as per nomination**
- ✓ **Joint Ticket/Reconciliation**
- ✓ **Loading LNG in Road Tankers**
- ✓ **Maintaining equipment/system fit to work**
- ✓ **Monitor and control operating parameters**
- ✓ **Optimization**
- ✓ **Co-ordination with internal/external agencies**
- ✓ **Start up/Shut Down & emergency handling**

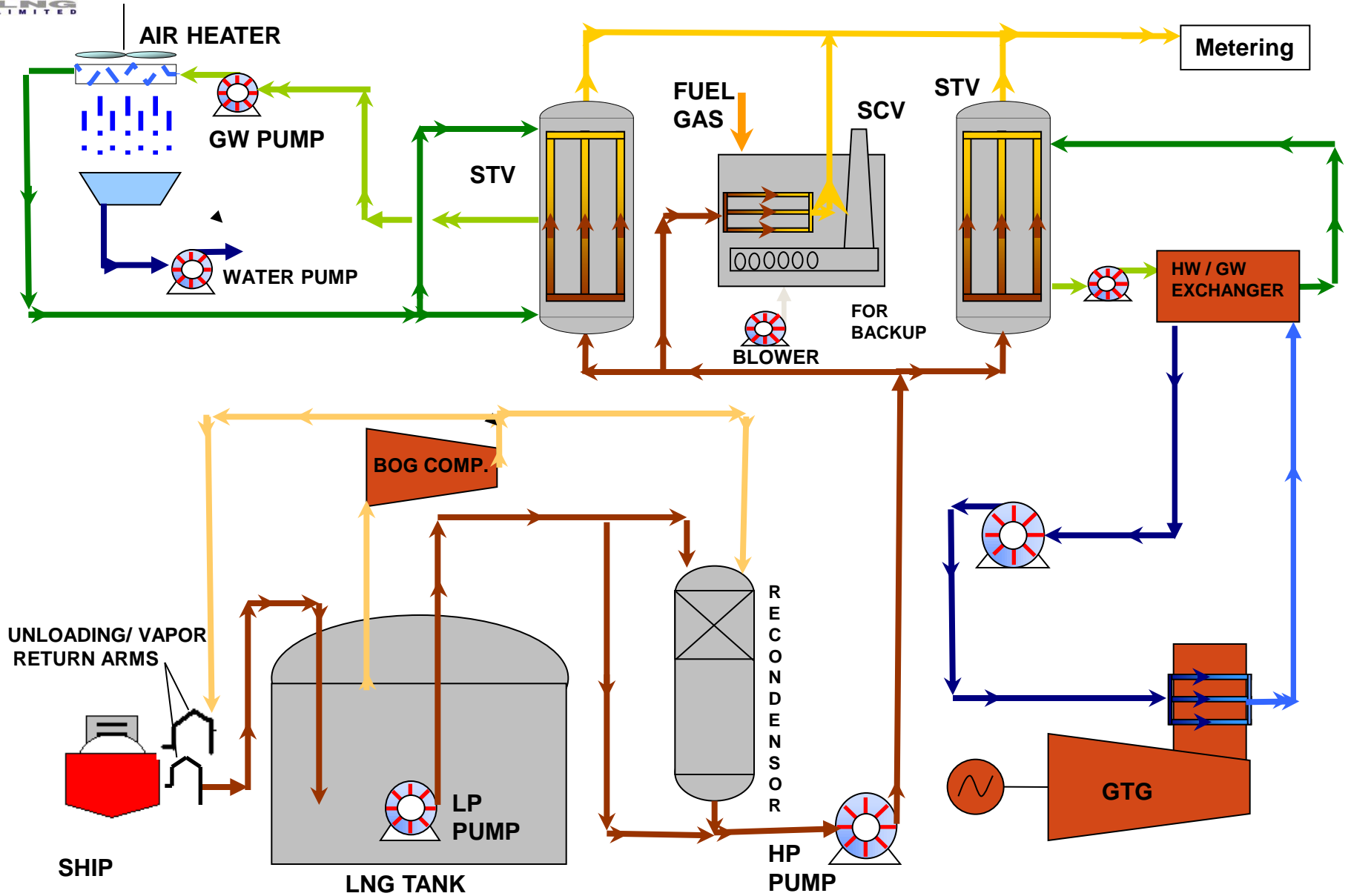


OPERATIONAL CONTROL

- ✓ **Standard Operating Procedure**
- ✓ **Training**
- ✓ **Field Round**
- ✓ **Patrolling Sheet (Engineer & Operator)**
- ✓ **Permit System**
- ✓ **Fluid Lock Out system**
- ✓ **Bypass procedure**
- ✓ **Performance Management System**
- ✓ **Abnormalities Identification and Reporting System**
- ✓ **Internal/External audits**
- ✓ **Health Monitoring**
- ✓ **Communication Procedure**
- ✓ **Incident analysis**



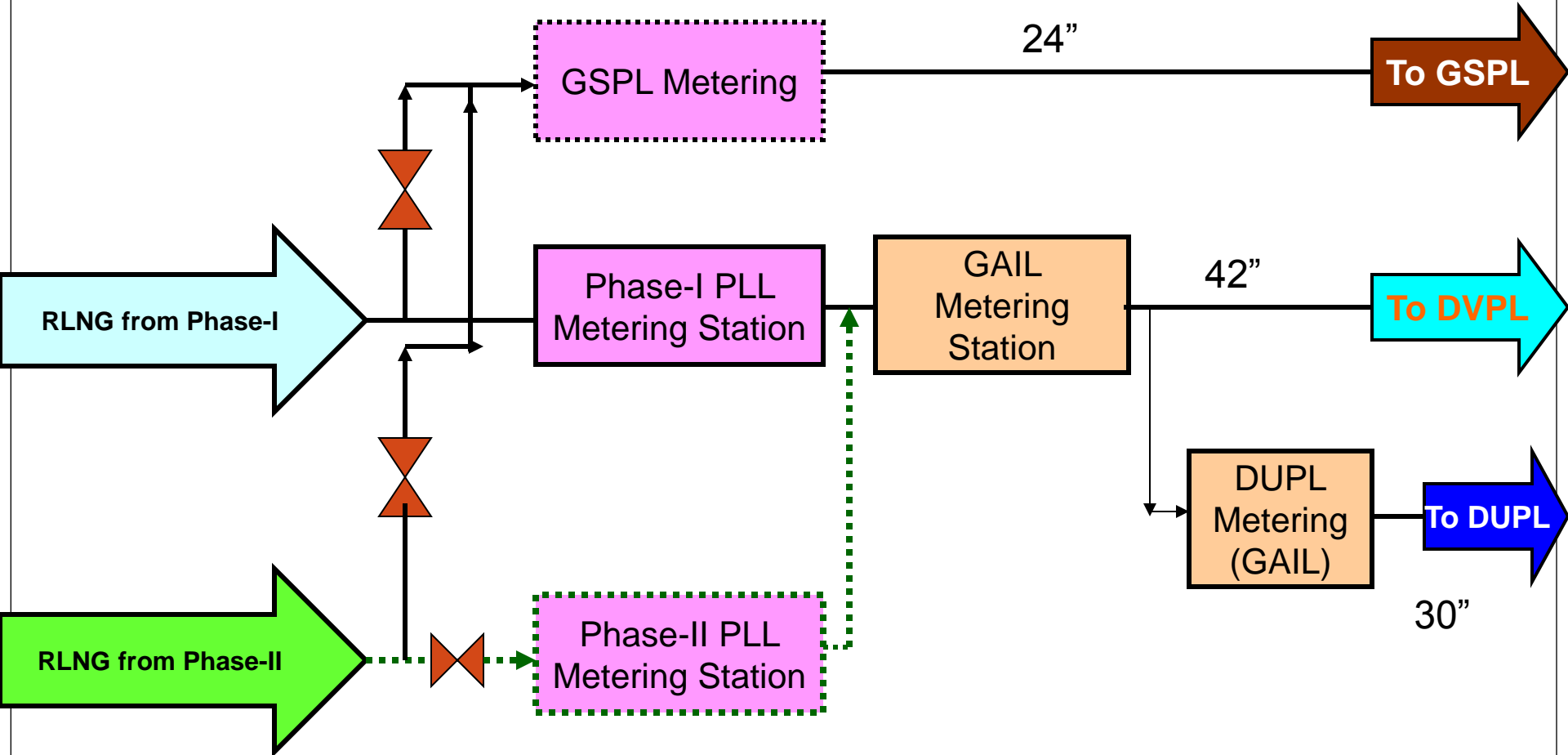
Process Flow diagram of LNG Terminal, Dahej



LNG Vaporizers



RLNG Distribution to Consumers



Jetty Trestle



Facilities for Ship Berthing

- **State of the Art Ship Berthing & Mooring system including**
 - **Ship Docking assistance Unit Including:**
 - **Sensors (Sea current sensor, Wave & tide sensor, Wind sensor)**
 - **Radars**
 - **Display Units**
 - **Portable Display Units**
 - **Tension Monitoring arrangement**
 - **Constant Tension Hydraulic winches**



Ship maneuvering



Tug
Boat

Tug
Boat

Ship at Berth





Jetty Features

► The 2.54 Km Jetty facilitates the safe unloading operation.



Description	Specification
LNG Unloading Arms FMC	3 X 16" Total Flow Rate = 10360 m3/hr
NG Loading Arm FMC	1 X 16" Flow Rate = 14000 m3/hr (at 0.13barg, -87.7 Deg C)
LNG Drain Drum	V-101 Capacity = 53 m3
Berth Aid System Weather, Tide, Current Monitoring	Marimatech
Unloading Arm Safety System	FMC
Unloading Lines	2 X 30"



LNG Storage Tanks: 4 X 148,000 m³





LNG Storage Tanks

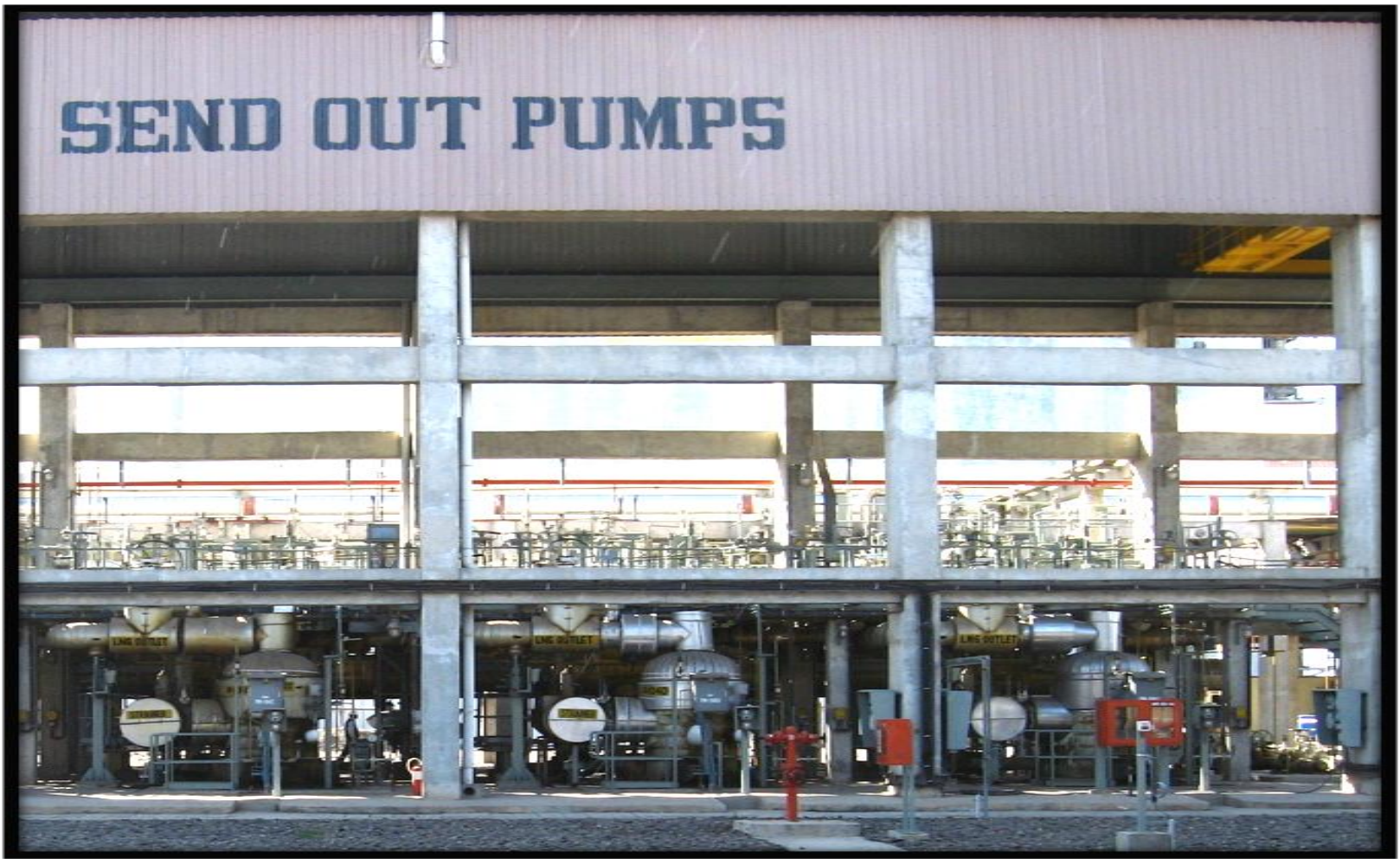
Capacity :1,48,000 m³

Outer Dia. : 81 m

Height : 55 m



LNG HP Pumps





LNG Truck Loading Facility

➤ Truck Loading facility at Dahej terminal was commissioned in August 07.

➤ Facility can handle 2500 loadings per year



VAPORISATION FACILITIES AT CUSTOMER'S END



Maintenance Activities



Petronet LNG Ltd.

Philosophy

- Preventive maintenance philosophy is followed for all critical equipments like Unloading arms, BOG compressor, Diesel engines and GTGs. Periodic overhauling is done for LNG Pumps.
- A combination of Preventive maintenance and Condition based maintenance philosophy for all other equipments in the terminal like GW Pumps, FW Pumps etc.

Critical equipments

- Jetty and Unloading arms
- In tank and HP LNG pumps
- BOG compressors
- Fire Water pumps
- Instrument air compressors
- GTG & EDG

Jetty

- 4 Breasting Dolphins and 5 Mooring Dolphins
- Can berth ships from 65000M3 to 215000M3 size
- Facility for berthing tug boats at Port craft Jetty

Un loading arms

- FMC France make
- 16" Dia 3Nos Liquid arms and one Vapor arm
- Rated capacity of 3640M³/hr liquid and 14000M³/hr BOG at -87.7 Deg C & 0.13mbarg.

LNG Pumps

- NIKKISO Japan make
- 12Nos In tank pumps, 3in each tank and 2 ware house stand by
- 10Nos HP LNG pumps and 1 ware house stand by

BOG Compressors

- Dresser rand, France Make
- 3 Compressors Installed
- 12000M³/hr at 1.013bar and 0Deg C

GTG & EDG

- 5 Nos SIEMENS GTG 7.5MW ISO rating.
- 3 Nos commissioned in phase-1 and 2 Nos commissioned in phase-2
- 1 No EDG 1875KVA capacity.

Challenges for maintenance

- Maintenance in Unloading arms and jetty equipments in view of more number of ships unloading from single jetty.
- Availability of trained manpower.



Electrical maintenance

POWER SYSTEM LAYOUT

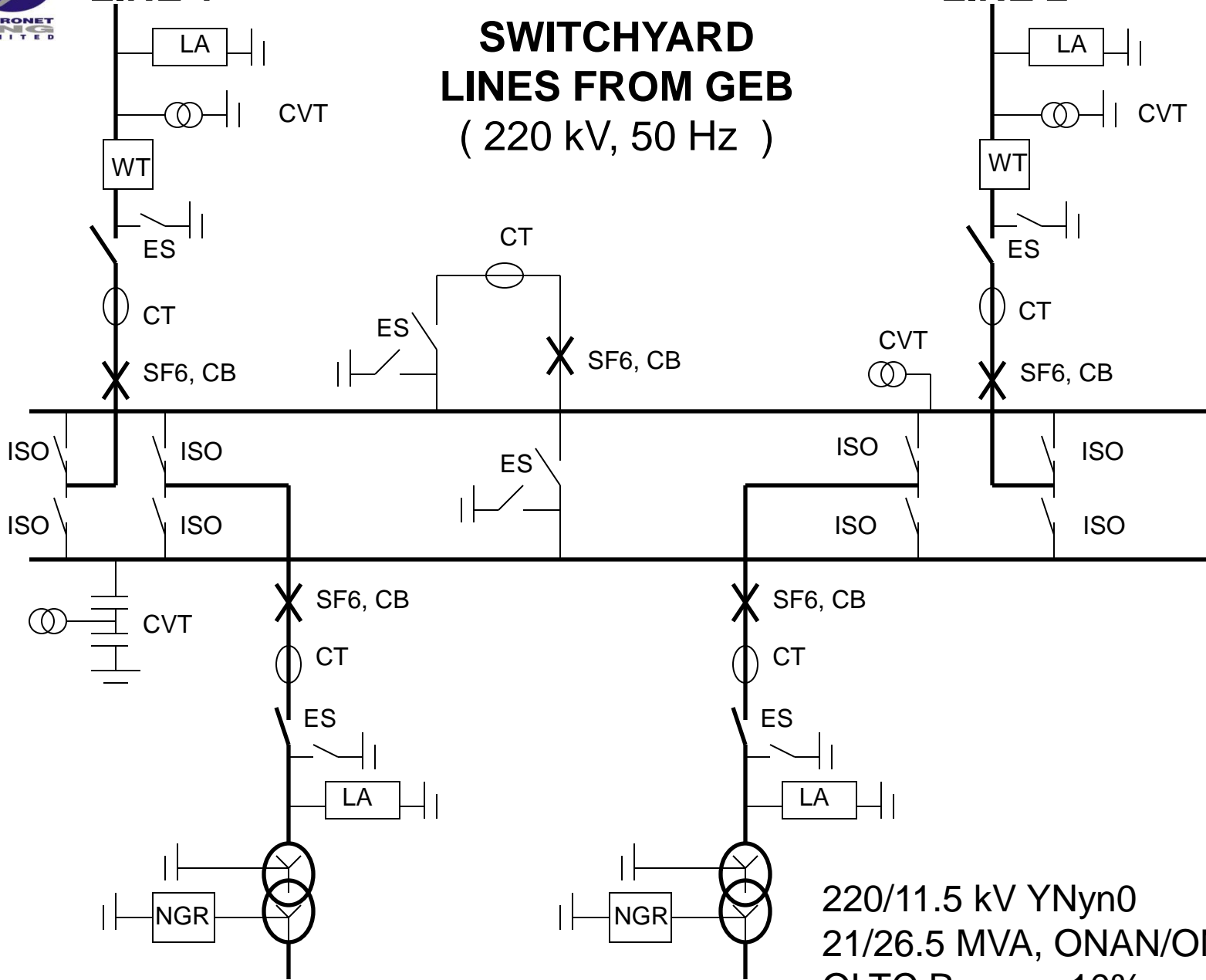
- Our main power system consists of 5 GTGs (Gas Turbine Generators) and 2 lines from GEB.
- Each GTG has a rated power generation capacity of 7.5 MW.
- Our provision for GEB is for 2.5 MVA i.e. we can draw this much power from GEB at a time.



LINE 1

SWITCHYARD LINES FROM GEB (220 kV, 50 Hz)

LINE 2



220/11.5 kV YNyn0
21/26.5 MVA, ONAN/ONAF
OLTC Range ~10%



EMERGENCY DIESEL GENERATOR SET

- Emergency diesel generator set of 1.875 MVA rating.
- Useful in case of a blackout and emergency.



Instrumentation

Instrumentation

- Field instrumentation
 - Primary measuring elements
 - Transmitters
 - Switches
 - On-Off Valves and its accessories
 - Control Valves and its accessories
 - Analyzers
 - Gas Chromatograph, etc...

Main Control system

- DCS (Distributed Control System)
- ESD (Emergency shutdown system)
- FGS (Fire, gas and spill detection system)
- ULA (Unloading Arm system)
- BAS (Berth Aid System)
- TFMS (Tank farm management system)
- Gas Metering System

ESD Philosophy

In our terminal ESD is split into 3 main groups as below:-

- ESD # 1 – Takes care of the Jetty Operations & Receipt.
- ESD # 2 – Takes care of the Send out operations
- ESD # 3 - Takes care of both the operations i.e jetty and send out i.e combination of ESD1&2 also gives permissive for complete depressurizations of STV/SCV.

FGS System

- Components of Fire, Gas, Spill Detection & Prevention System
 1. Fire , Gas , Spill detectors, Manual call points (Break glass), Deluge valves, beacons lamps and hooters etc..
 2. FGS PLC :
 - ICS Triplex for phase – I
 - Triconex for Phase - II
 1. FGS HMI # 1,2 & FGS printer.
 2. Fire Prevention Mimic Panel.
 3. Fire Detection Mimic Panel.
 4. Inergen / Clean agent gas systems.
 5. Building Fire detection system.

FGS Shutdown system

ESD#1 is activated in case of :

- Activation of any two gas detectors – 60 % LEL.(GSD +GSD)
- Activation of any two fire detectors. (FSD+FSD)
- Activation of any two spill detectors. (TSD+TSD)
- Activation of any two types of detectors. (GSD+TSD or GSD+FSD or TSD+GSD)



Berth Aid System

Berth Aid System consists of :

- Weather monitoring system
 - Consists of
 - Wind Speed & Direction sensor
 - Current speed & Direction Sensor
 - Tide/Wave Sensor
- Laser docking system

Consists of

- Telescopic Lift
- Distance sensors
- Level Sensor
- Level Switch
- Large Digital Display
- Mooring Load Monitoring System

Consists of

- Quick release mooring hook with load cell



Tank Farm Management System

System supplier and manufacture : M/s Whessoe S.A. France

Each tank Consists of :

- Redundant servo level gauges
- High/high level alarm gauge
- LTD gauge
- Product spot temperature sensing elements
- Temperature element transmitters

Redundant SCADA system :

Features :

- Data handling / control software
- LNG tank management software
- Report Manager
- Data Historisation
- Communication with DCS on Modbus



Gas Metering System (Phase-I)

System supplier : Oval, Singapore

Gas Metering system Consists of :

- Turbine meter
 - Make : Elester-Instromet
 - Model : SM-RI / X-L / 4000G

- Gas chromatograph
 - Make : ABB
 - Model : PGC 2000

- Flow computer
 - Make : OMNI
 - Model : 6000

- PLC
 - Make : Allen-Bradley
 - Model : Logix 5555 (redundant)

- SCADA Software
 - RS View 32 of Allen-Bradley



Gas Metering System (Phase-II)

System supplier : Daniel, Singapore

Gas Metering system Consists of :

- Ultrasonic meter
 - Make : Daniel
 - Model : 3400

- Gas chromatograph
 - Make : Daniel
 - Model : 570 series

- Flow computer
 - Make : Daniel
 - Model : FloBoss S600

- PLC
 - Make : Allen-Bradley
 - Model : Logix 5555 (redundant)

- SCADA Software
 - Ifix of GE-Fanuc



Gas Metering System (GSPL)

System supplier : FMC, Singapore

Gas Metering system Consists of :

- Ultrasonic Flow meter

- Make : FMC
- Model : MPU1200

- Gas chromatograph

No GC at present. Gas quality data given from phase-II GC.

- Make : Daniel (Proposed)
- Model : 570 series (Proposed)

- Flow computer

- Make : OMNI
- Model : 6000



Calibration of Instruments

Periodic calibration / Preventive maintenance of instruments are carried out.

Transmitter : Yearly

Control Valve : Yearly

Pressure switch : Half Yearly

Gas Detector : 4 Monthly

Fire Detector checking : 4 Monthly

Spill Detector : 4 Monthly

On-Off Valve : Yearly

Analyzer : 4 Monthly

Metering station instruments : Monthly

Challenges for maintenance

- Maintenance of Unloading arms and jetty equipments in view of more number of ships unloading from single jetty.
- Maintenance of Jetty equipments like Fenders, current sensors and CT winches is a big challenge in view of non availability of lifting equipment like cranes.
- Maintenance of LNG pumps requires highly skilled man power.

Challenges for maintenance

- Maintenance of Berth aid system as highly specialized equipments are there.
- Maintenance of Cathodic protection system of jetty, inspection of pile condition under water in view of high currents and muddy water in sea.
- Maintenance of LNG submerged motors.
- Maintenance of Tank level gauging and density meters.

Thank you