

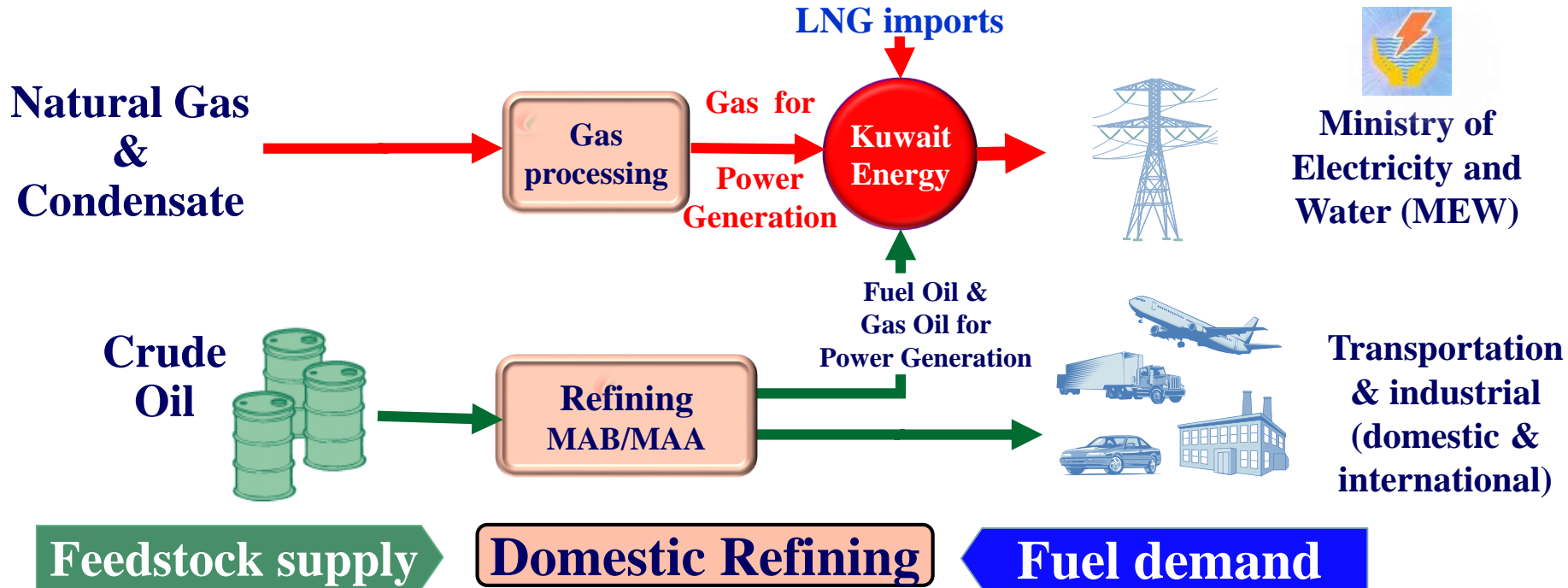
INNOVATIVE TECHNOLOGIES INCORPORATED IN CLEAN FUEL PROJECT (CFP) OF KUWAIT NATIONAL PETROLEUM COMPANY (KNPC)

AGENDA

- **Introduction**
- **Objectives**
- **CFP Salient Features**
 - **Key units**
 - **Energy Management**
 - **Environment Control**
- **Conclusion**

INTRODUCTION

KNPC is responsible for domestic refining & gas processing



MAB: Mina Abdulla Refinery
MAA: Mina Ahmadi Refinery

CFP OBJECTIVES

MODERNIZE

- KNPC refineries

BUILD

- World class Integrated refining complex

INNOVATION

- State of art technology selected

ENVIRONMENT

- Minimize emissions & produce low Sulphur products

OPTIMIZE

- Refinery assets

PRODUCE

- High value products

ENHANCE

- Profitability

RELIABILITY

- Minimize downtime

CFP Salient features

➤ Key Units

CDU

ARDS

HCR

DHT

HPU

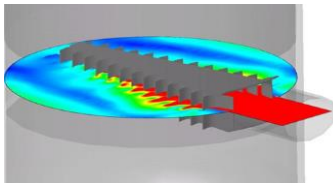
➤ Energy Management

➤ Environment

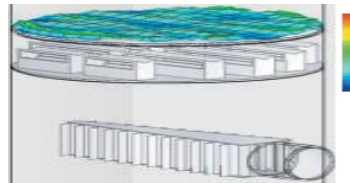
CFP Salient features : CDU

➤ Fractionator

- Top trays Metallurgy - Hastelloy C for improved corrosion resistance to enhance reliability
- Horizontal feed inlet device - Scheopentoeter type inlet which reduces entrainment of liquid with vapour
- Overhead exchanger - Vertical exchanger for effective water wash , corrosion mitigation & reliability



Scheopentoeter type feed inlet



Vertical exchanger

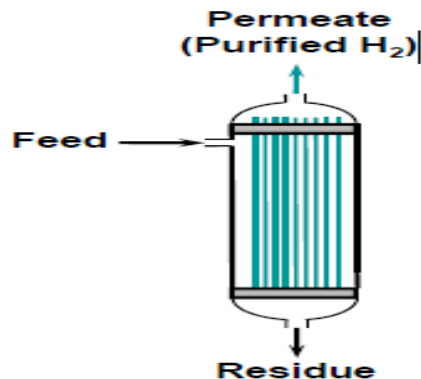


➤ Heaters

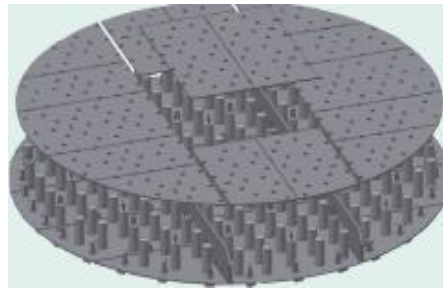
- Heaters with low NO_x burners - NO_x level 64 PPM with FG firing
- Heaters Decoking - Mechanical
- Continuous emission monitoring system provided

CFP Salient features : ARDS

- State of Art reactor internals
- Up flow reactor technology - Low differential pressure across system for better feed preparation of downstream fixed bed reactor
- Unit designed to produce 0.5 % 'S' ARDR & can meet IMO fuel oil regulations if required
- Stripper followed by fractionator configuration
- Hydrogen recovery system - Membrane based Integrated hydrogen recovery of 92 ~ 99% purity



Membrane Separation



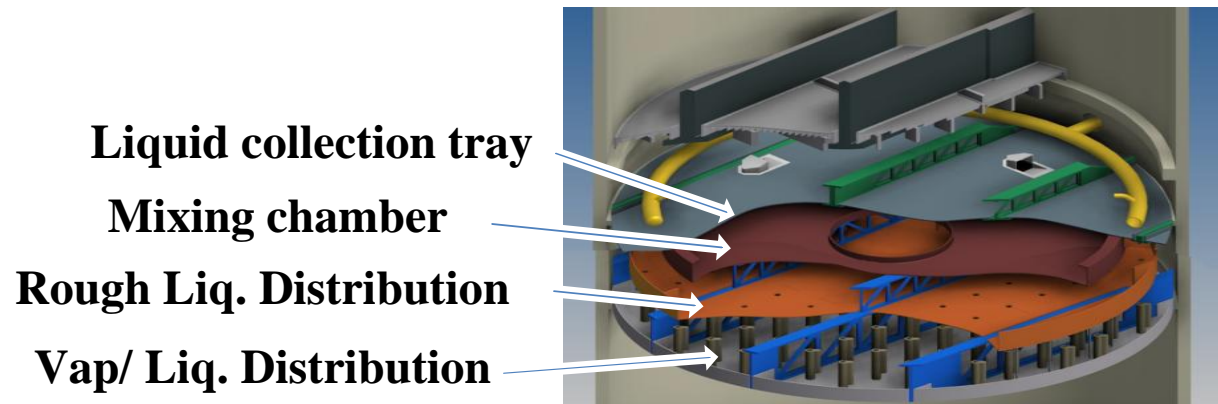
Perforated /Distributor Tray



Outlet collector

CFP Salient features : HCR

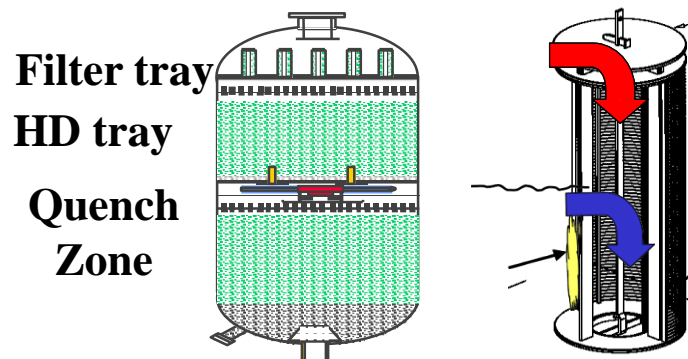
- **State of Art reactor internals - for better distribution & catalyst utilization**
- **Operation Mode - JET/JP5/PMD/LOBS**
- **Separate pre-treatment reactor before of 1st stage**
- **Naphtha product - Sulphur guard reactors for final mercaptan removal**
- **Diesel Product - Integrated vacuum drier system for moisture removal**



CFP Salient features : DHT

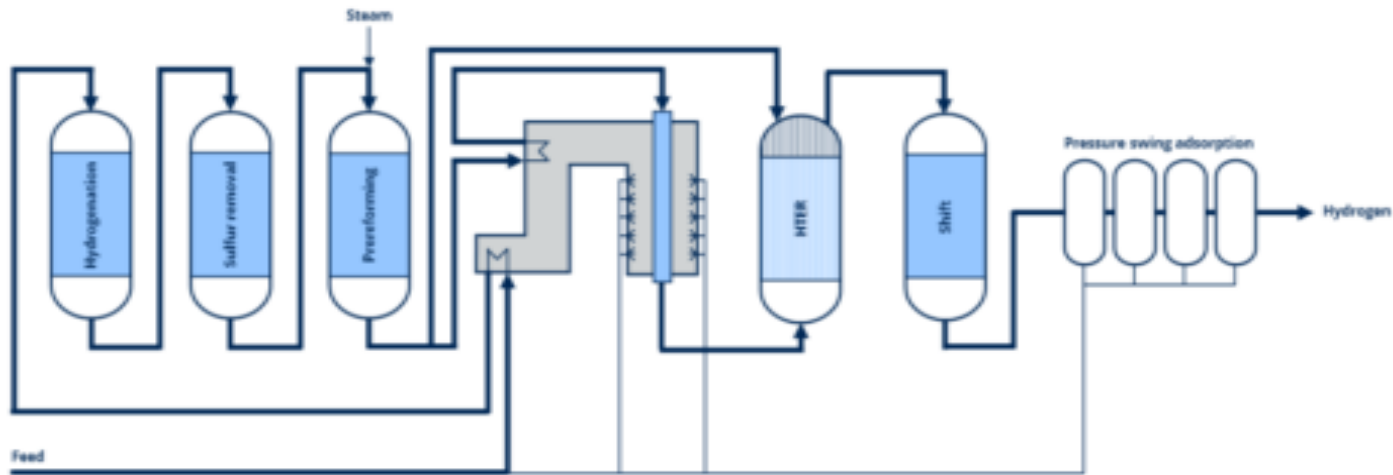
- **State of Art reactor internals - for better distribution & catalyst utilization**
- **Single reactor with multiple beds**
- **Integrated dewaxing system**
- **Diesel Product - Integrated vacuum drier system for moisture removal**
- **Diesel product will meet stringent diesel winter specifications**

State of the art internals



CFP Salient features : HPU

- Configuration includes Pre-Reformer, Reformer, HTER, MTS and PSA with multiple beds
- HTER / Pre-reformer technology with reduced equipment (reformer) size and minimal steam production by effective use of waste heat for improved Hydrogen production



CFP Salient features - Energy Management

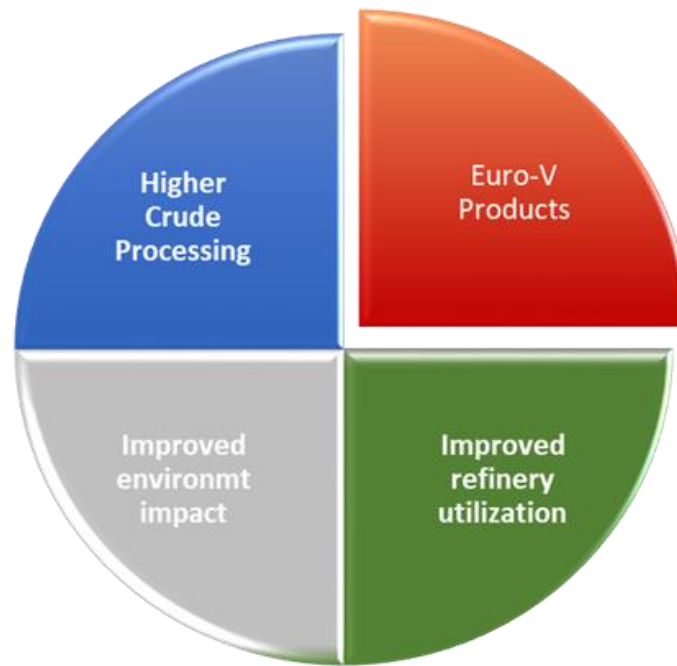
- **HTER system configuration for large scale Hydrogen production with improved Energy Efficiency (effective use of waste heat mainly for H₂ production and minimum Steam production)**
- **Integrated PSA off gas for Reformer as primary fuel**
- **Contra Trace Technology as compared to conventional Jacketed Steam heating for Liquid Sulphur lines**
- **Use of MDEA (Methyl Di-Ethanol Amine) as Amine selection for lower Amine circulation rate and lower regeneration energy**

CFP Salient features - Environment

- **Vacuum off gas - Sweet gas to vacuum heater**
- **Low NO_x burners**
- **Decoking of heaters - Mechanical**
- **Reduced SO_x emissions from SRUs - 50 PPM SO_x emissions achieved by recycling of H₂S from liquid Sulphur to Claus section of Unit**
- **Reduced H₂S in molten Sulphur - Air sparging for Sulphur degassing to achieve 10 PPM H₂S**

Overall CFP Impact to KNPC

- **Twice the rated EDC (Equivalent Distillation Capacity)**
- **Quantum shift in Complexity factor**



Conclusion

CFP salient design features/ technologies enable KNPC to achieve its strategic objectives:

- **To upgrade , modernize & expand the Refining capacity**
- **To meet stringent product specifications**
- **To meet product demand in domestic and international markets**
- **Complete Bottom of Barrel Conversion**
- **Cleaner environment**

Thank You



Presentation for JCCP
January 2019

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