عاماً على تأسيس
75 Anniversary
شركة نفط الكويت
1934 - 2009
Kuwait Oil Company
subsidiary of KPC
احدى شركات مؤسسة البترول الكويتية

Energy Optimization in the Gas Processing Industry: Energy Savings Lessons Learned

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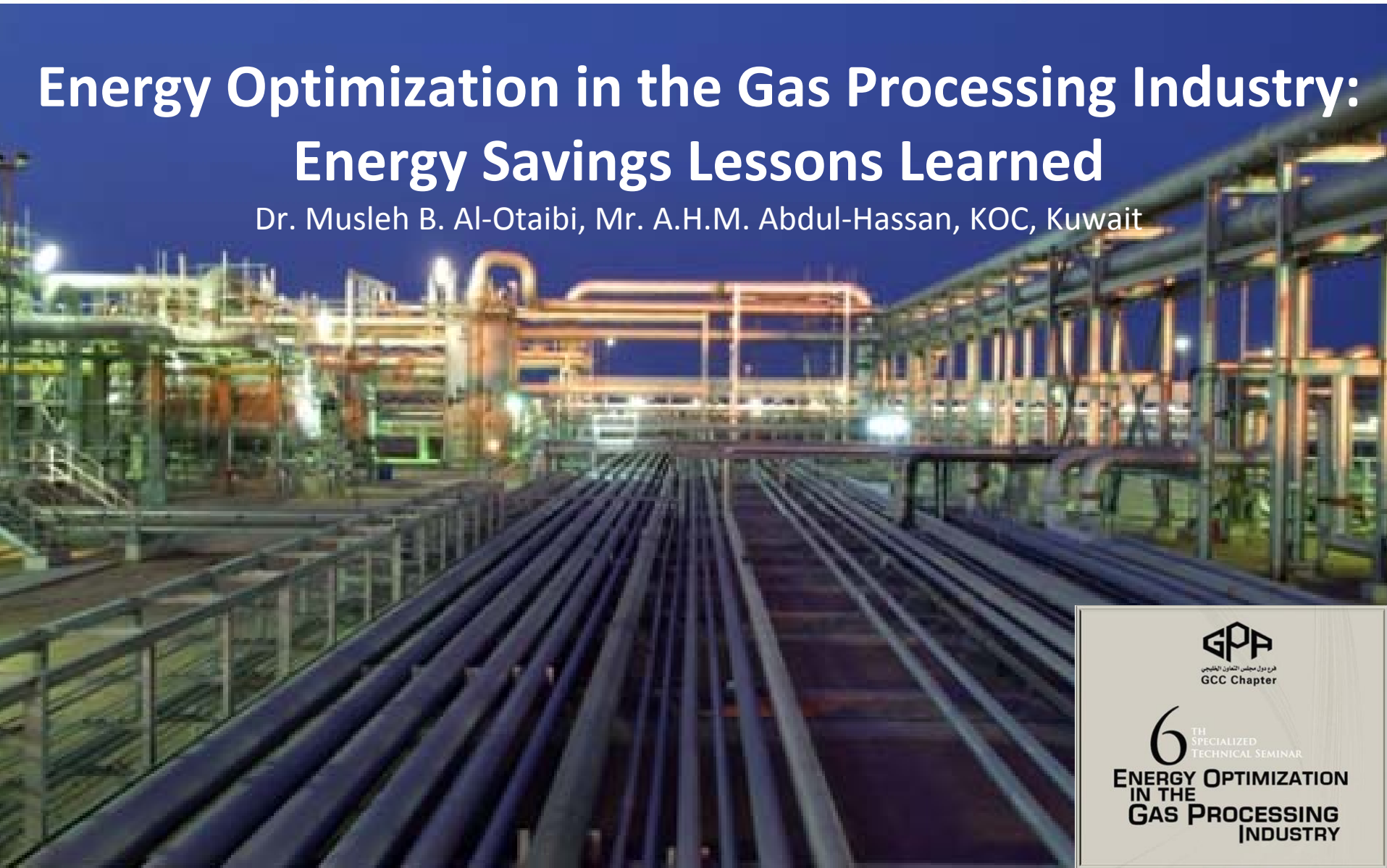


Outline

- Introduction
- Strategic Goals
- Field and Facilities overview
- Statement of the problem
- Achievements
- Facts & Challenges
- 5 Lessons Learned
- Additional Recommendations
- Conclusion

INTRODUCTION

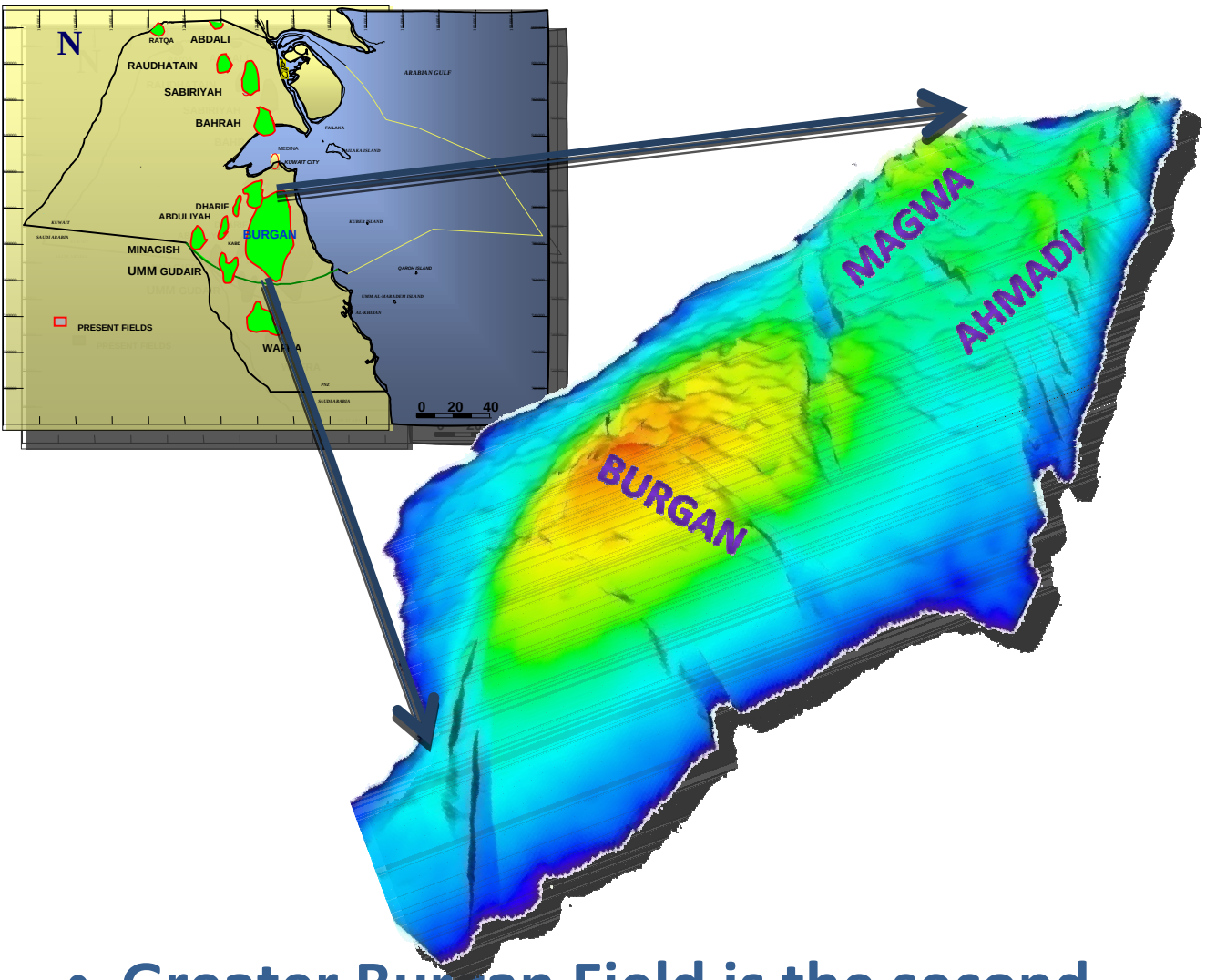
- COMPANY PROFILE:
  - KOC was established in 1934
  - First Oil Shipment in 1946
  - Subsidiary of Kuwait Petroleum Corporation (KPC)
  - Activities include:
    - **Crude & Natural Gas Exploration and Operations**
    - **Development of Producing Fields**
    - **Production Operations**
    - **Crude Oil Export**

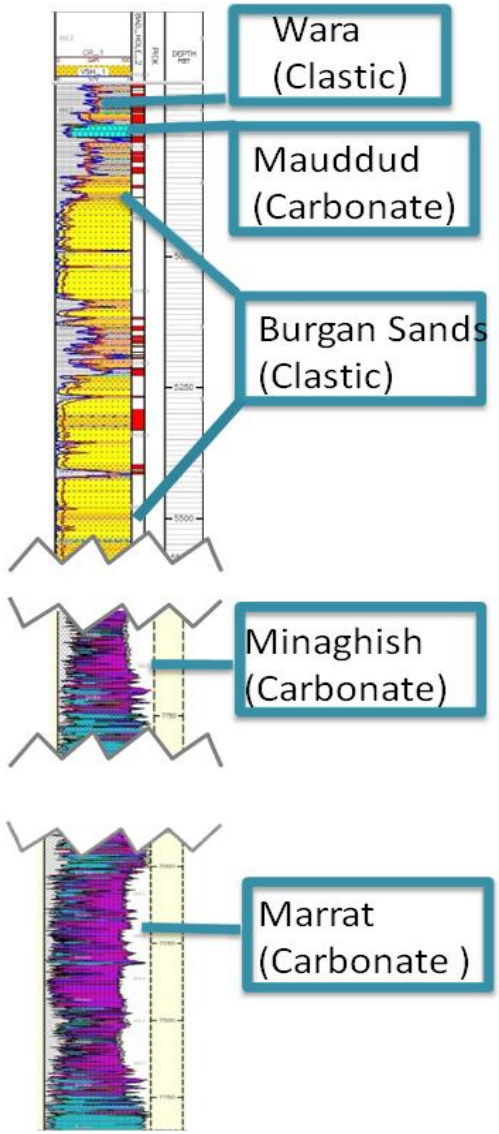
STRATEGIC GOALS

- **KOC ASSETS PLAN (2020):**
  - Crude Oil Production from all Assets: 3.0 MMBOPD.
  - Crude Oil Production from S&EK: 1.7 MMBOPD.
  - Achieve a target of Flaring: below 1% total gas produced.

- **KOC OIL PRODUCTION AREAS (ASSETS):**
  - South & East Kuwait (S&EK): Swing Production Rate.
  - North Kuwait (NK): Fixed Production Rate (Max.).
  - West Kuwait (WK): Fixed Production Rate (Max.).

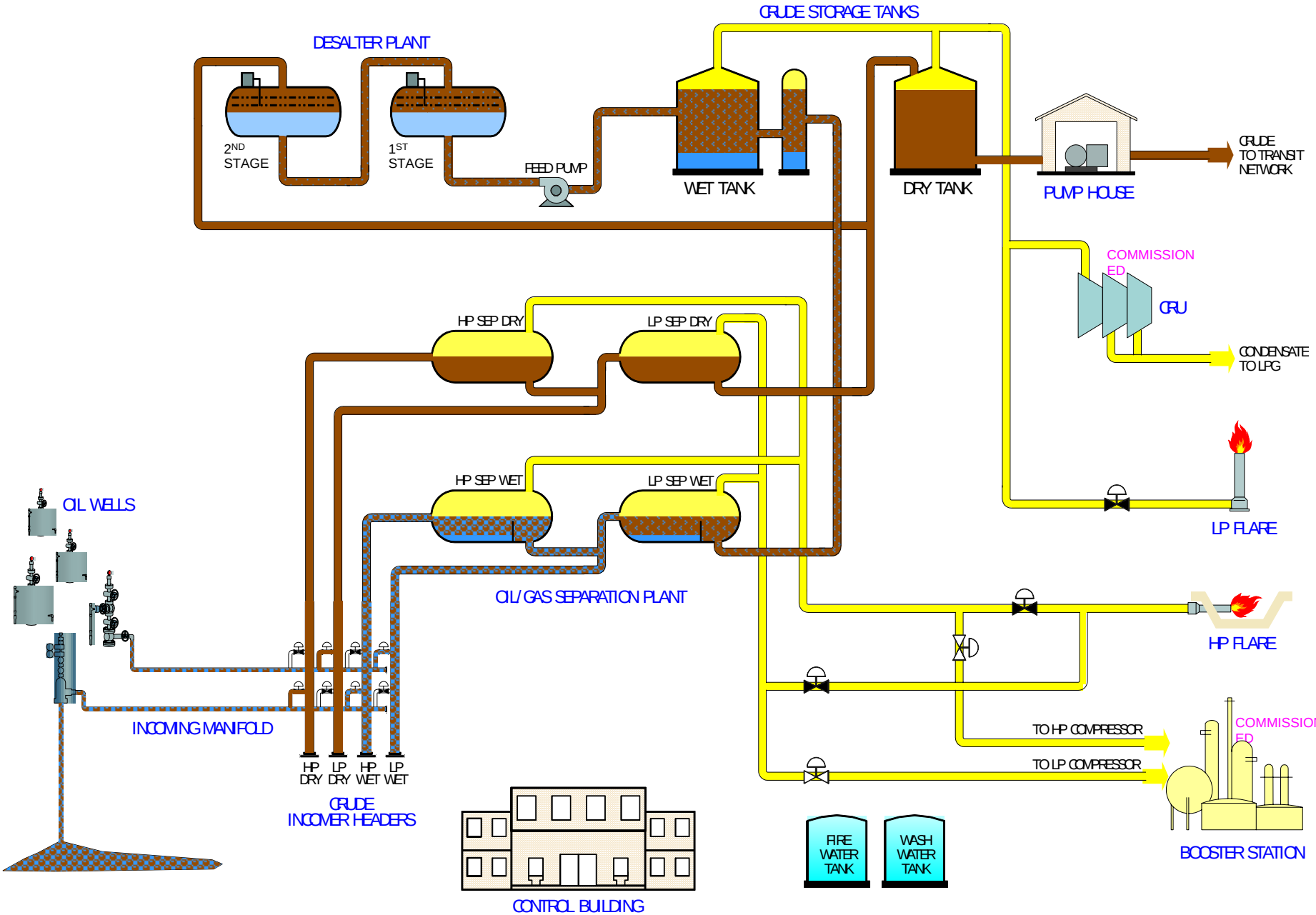
S&EK Overview - Greater Burgan Field



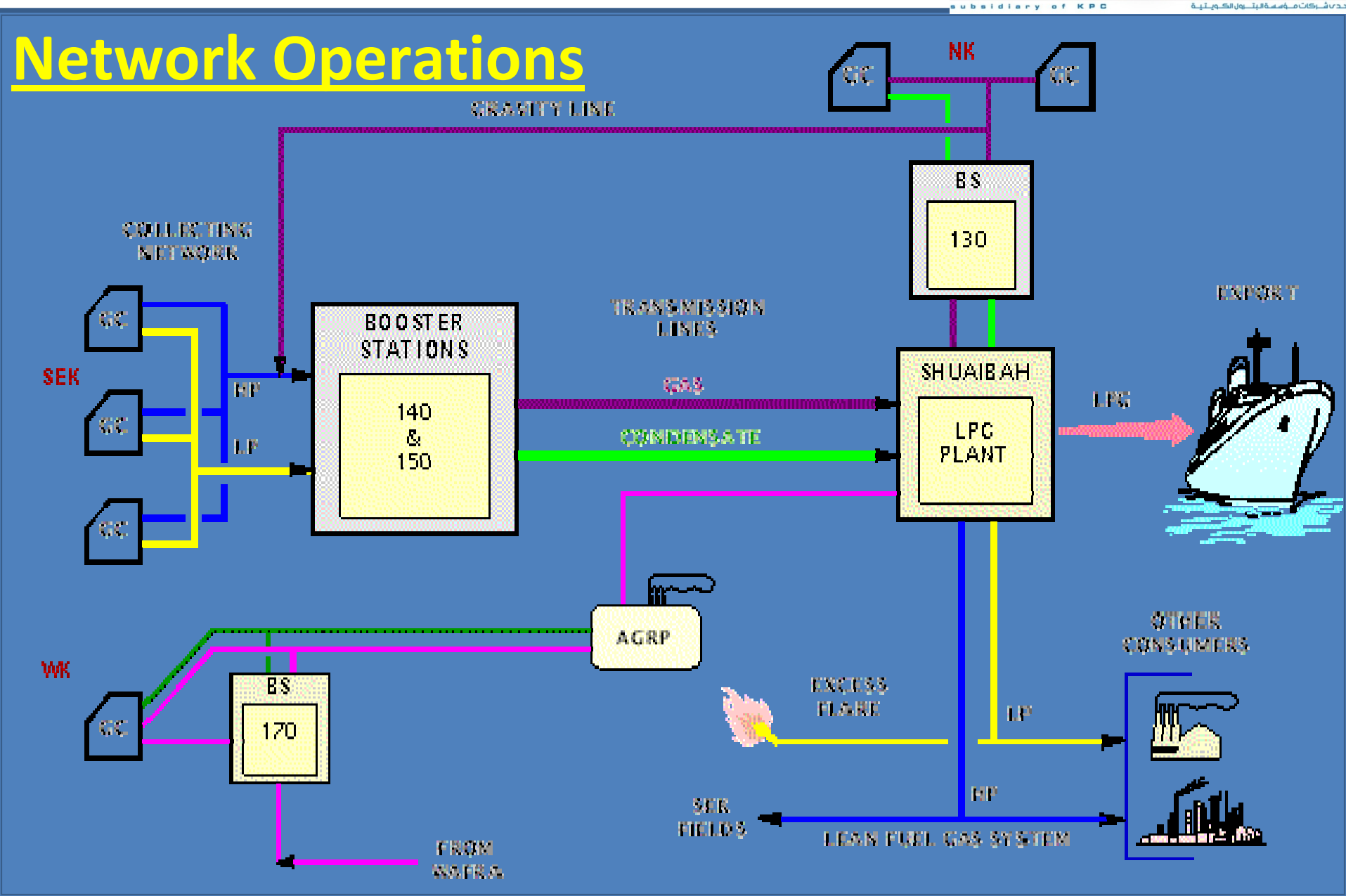


- Greater Burgan Field is the second largest oil field in the world

TYPICAL GC PROCESS FLOW DESCRIPTION



Network Operations



Statement of the problem
Production Facilities Limitation

- Production Facilities Design Capacity.
- Crude Oil Pipelines Transportation Capacity.
- Gas Compression and Flaring.
- Split between Crude Oil Well Producers:
  - HP Wet Crude
  - LP Wet Crude
  - HP Dry Crude
  - LP Dry Crude

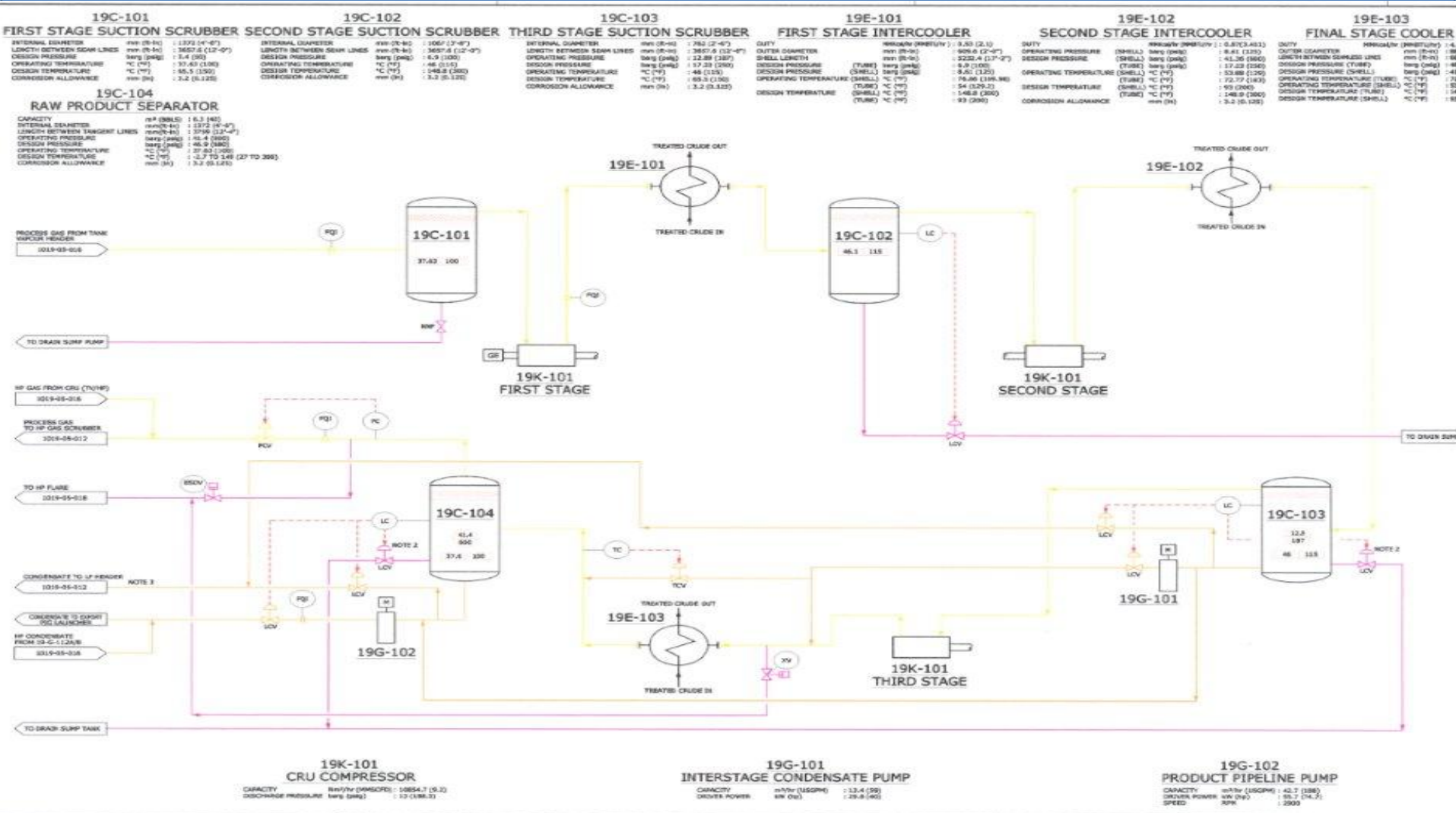
BACKGROUND (1)

- **PROBLEM:**
  - Increasing Crude Oil Production, the associated gas increases and Crude Oil Tanks Vapours increase.
  - Crude Oil Tanks Vapours generated in a number of Gathering Centers exceeded the Old Condensate Recovery Unit's design capacity.
  - Results: Gas flaring in > 2% total gas produced.

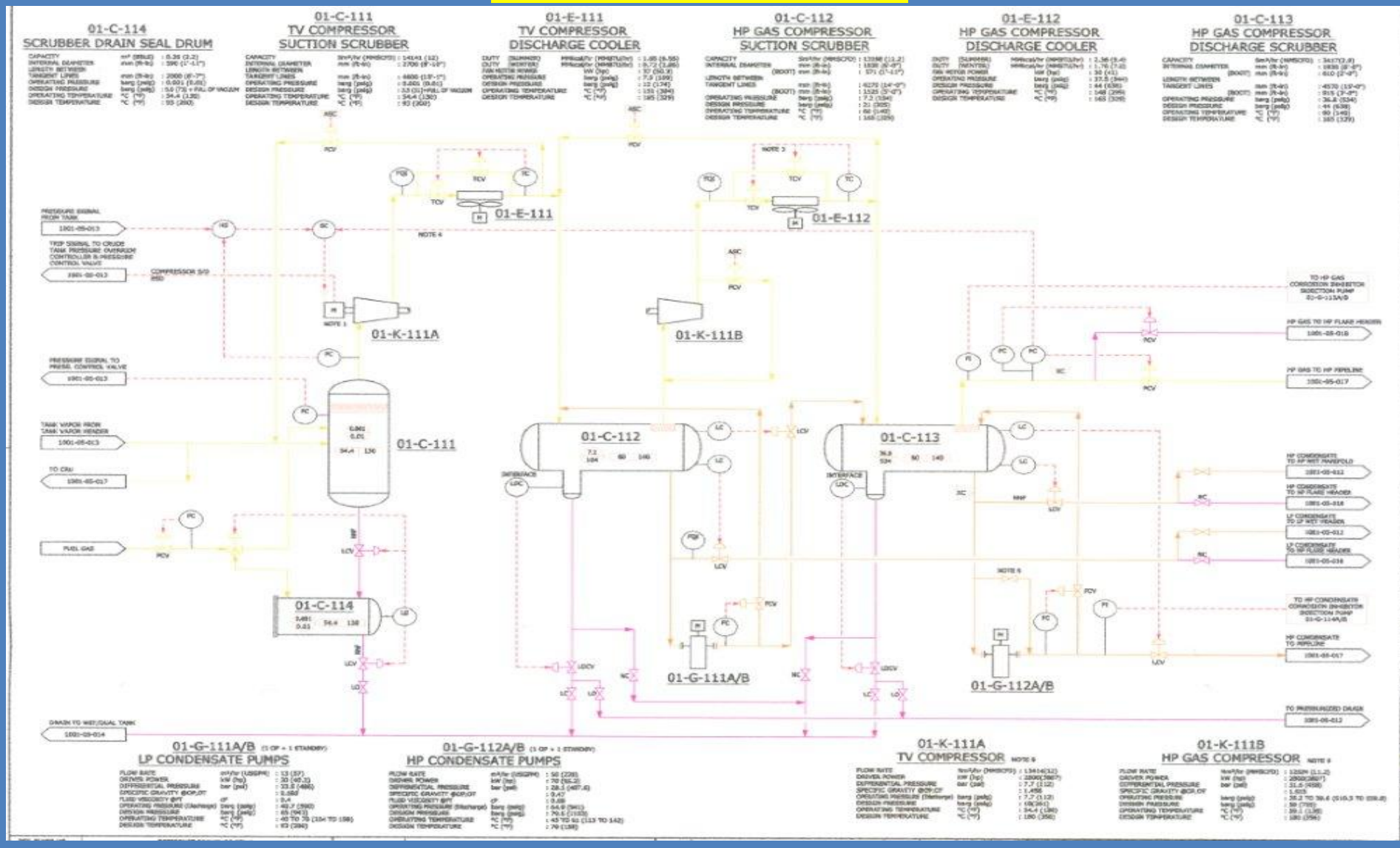
BACKGROUND (2)

- **OBJECTIVES:**
  - Minimize Gas Flaring to below 1% total gas produced.
  - Increase Crude Oil Production, improve Units Operations, Efficiency, Reliability, and Availability.
- **SOLUTION:**
  - Facility Modernization including a new Condensate Recovery Unit (CRU) with a design capacity sufficient to allow higher Crude Oil Production and minimize gas flaring.
  - Keep the Old CRU on Standby and Operate when the new CRU is down.. Increase CRU Availability & Minimizing Flaring.

PFD OLD CRU

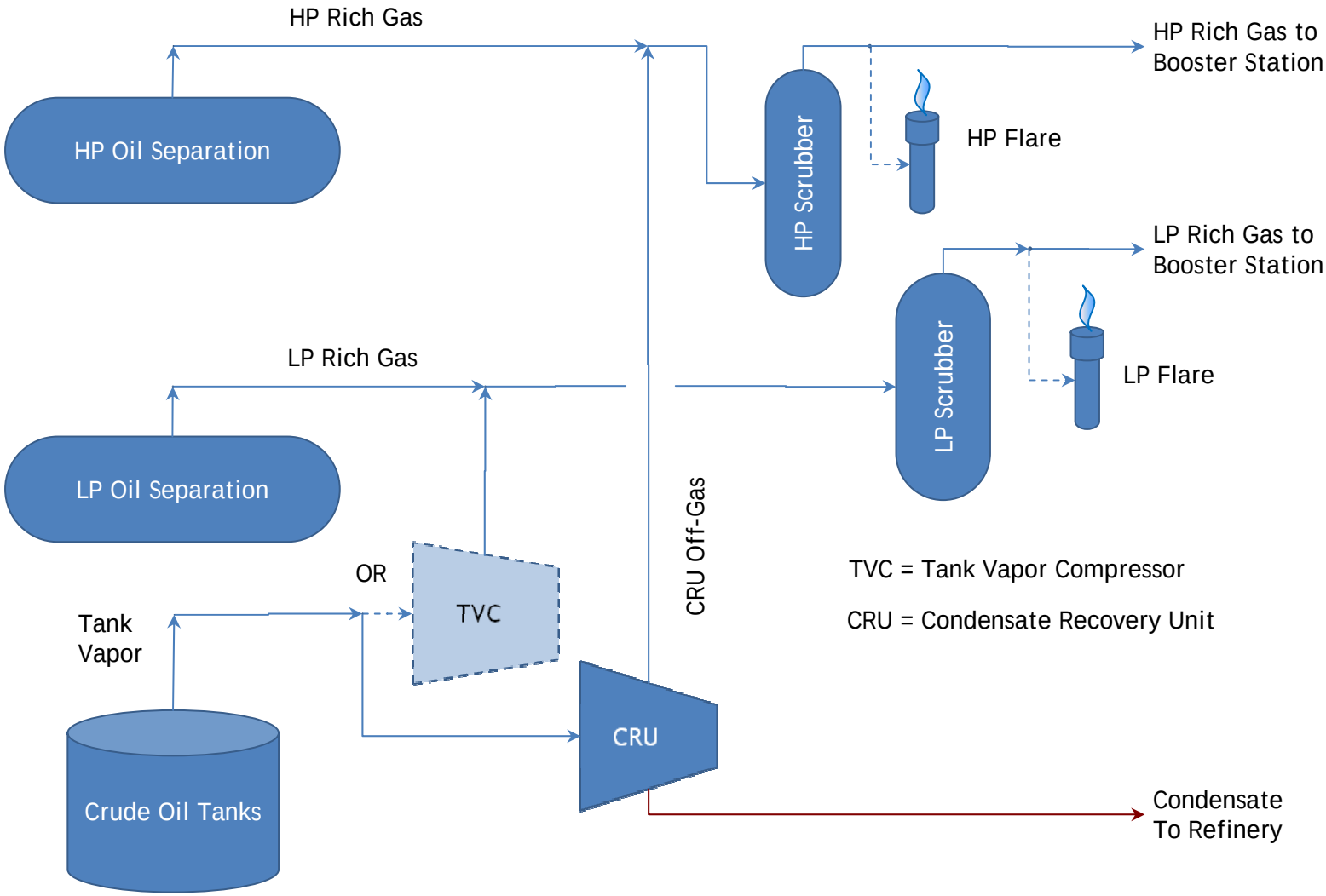

19C-101
FIRST STAGE SUCTION SCRUBBER
19C-102
SECOND STAGE SUCTION SCRUBBER
19C-103
THIRD STAGE SUCTION SCRUBBER
19E-101
FIRST STAGE INTERCOOLER
19E-102
SECOND STAGE INTERCOOLER
19E-103
FINAL STAGE COOLER
19C-104
RAW PRODUCT SEPARATOR
19K-101
FIRST STAGE
19K-101
SECOND STAGE
19K-101
THIRD STAGE
19G-101
19G-102
19K-101
CRU COMPRESSOR
19G-101
INTERSTAGE CONDENSATE PUMP
19G-102
PRODUCT PIPELINE PUMP

PFD NEW CRU


01-C-114
SCRUBBER DRAIN SEAL DRUM
01-C-111
TV COMPRESSOR
SUCTION SCRUBBER
01-E-111
TV COMPRESSOR
DISCHARGE COOLER
01-C-112
HP GAS COMPRESSOR
SUCTION SCRUBBER
01-E-112
HP GAS COMPRESSOR
DISCHARGE COOLER
01-C-113
HP GAS COMPRESSOR
DISCHARGE SCRUBBER
01-E-111
01-E-112
01-K-111A
01-K-111B
01-C-111
01-C-112
01-C-113
01-C-114
01-G-111A/B
01-G-112A/B
01-G-111A/B
LP CONDENSATE PUMPS
01-G-112A/B
HP CONDENSATE PUMPS
01-K-111A
TV COMPRESSOR
01-K-111B
HP GAS COMPRESSOR

Operations at Gathering Centers

Typical Gas Handling at Gathering Centers



DESIGN CRITERIA

- OLD CRU
  - 9.2 MMSCFD Tanks Vapour Compression.
  - Positive Displacement 3-Stage Compressor.
  - Starting-Air Engine.
- New CRU
  - 12 MMSCFD Tanks Vapour Compression.
  - Centrifugal 2-Stage Compressor.
  - Variable Speed Motor Driver.

ACHIEVEMENTS

- **Gas Flaring:**
  - Positive Contributions to the Environment (reduction in Greenhouse Gases Emission).
    - Old CRU: Gas Flaring > 2.0% of total Gas Produced.
    - New CRU: Flaring < 1.0% and reached as low as 0.2%.
- **Crude Oil Production:**
  - Old CRU: Limited to old design capacity to minimize Gas Flaring.
  - New CRU: Enhanced Production capacity up to 160,000 BOPD with a very low rate Gas Flaring.
- **Added Value to KOC:**
  - Increase Revenue (gas recovery, increase oil production).

KOC's Flaring Vision

Where we were

17.18%

2005-06

Where we are

1.75%

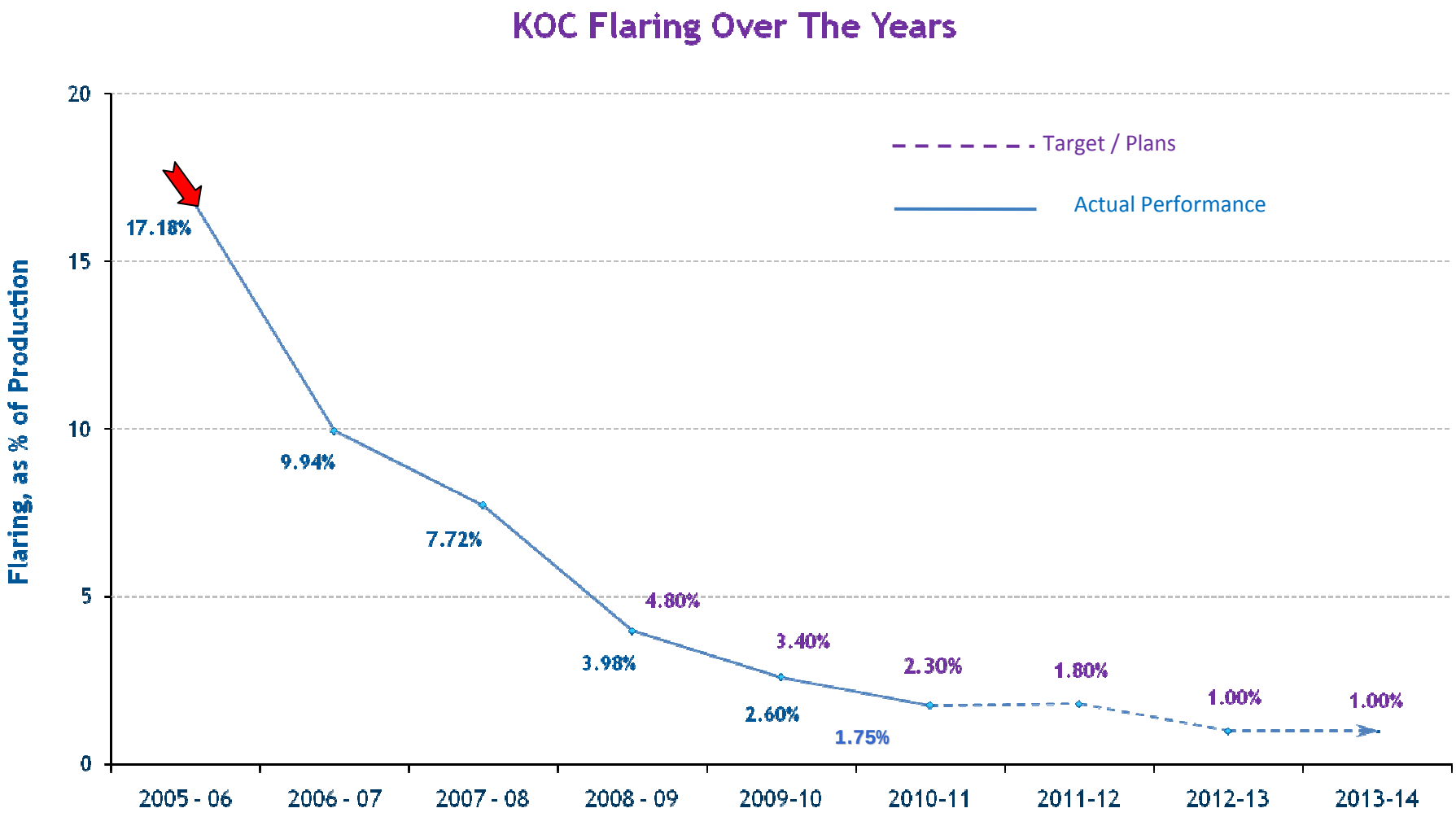
2010-11

Where we aim

< 1.0%

2012-13

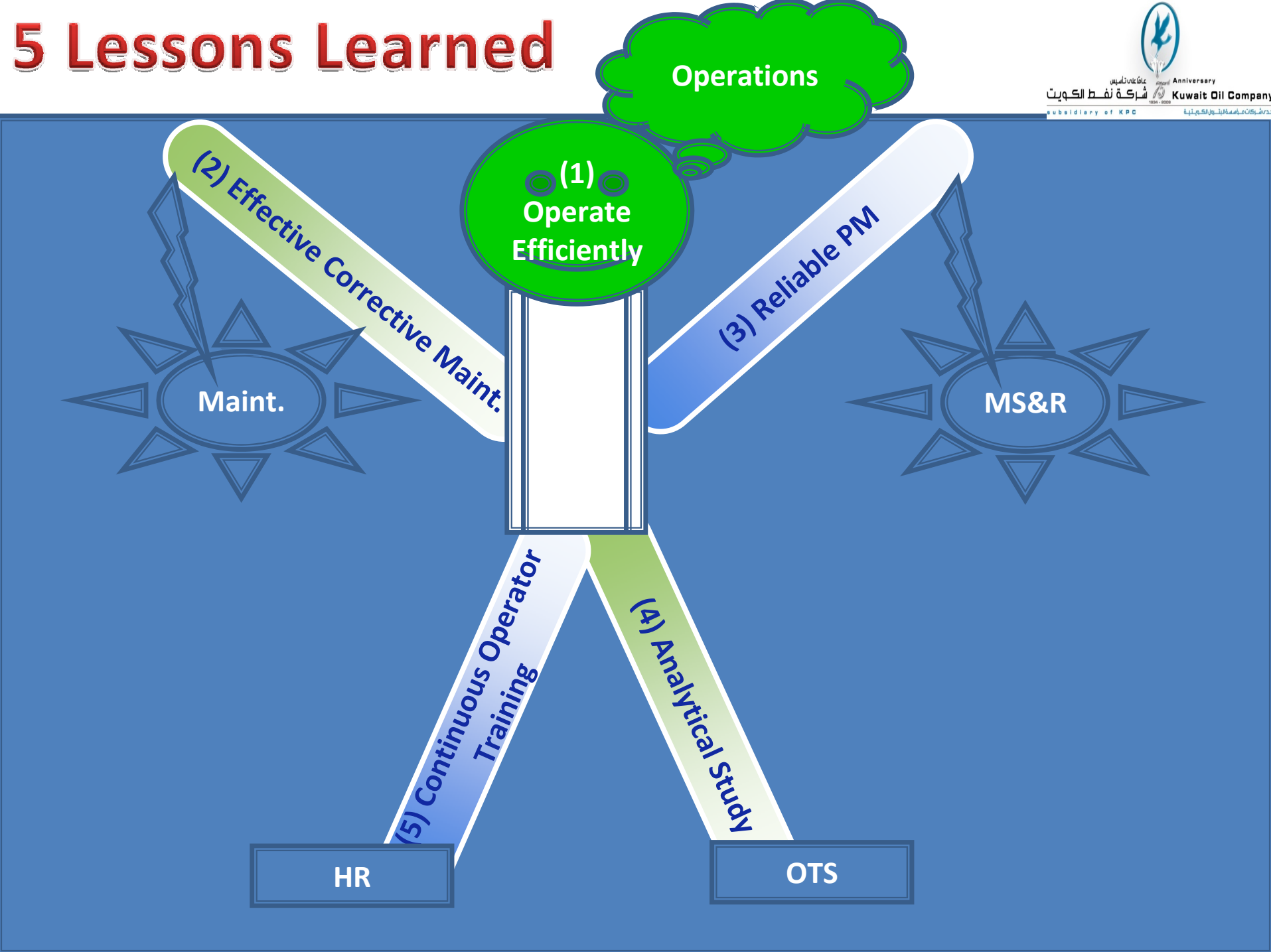
KOC Gas Flaring Over The Years



Facts & Challanges

- **Compression Availability:**
  - *Old Design: if the CRU is down…. 100% flaring of tanks vapour (loss of revenue).*
  - *New Design: If the new CRU is down…. Old CRU is available and can be On-stream within an hour… minimum Gas Flaring (minimum loss of revenue).*
  - *Enhanced Maintenance Program.*
- **Challenges:**
  - **Operate efficiently in a Safe Manner.**
  - **Achieving Target Crude Production with Minimum Gas Flaring.**

5 Lessons Learned



Additional RECOMMENDATIONS

- For Multiple Gathering Centers of different Production Capacity, select equipment design capacity to suit rather than over/under design.
- Select new equipment based on:
  - Energy Efficiency (e.g. Variable Speed Driver),
  - High Reliability (e.g. >97%).
  - High Availability (e.g. >95%).

Additional RECOMMENDATIONS

- Continue raising budgets for future projects.
- Monitor installing and commissioning the existing projects and the on going ones (down the tube).

CONCLUSIONS

- The new CRU resulted in:
  - Recovery & Compression of more Tanks Vapours.
  - Minimizing Pollution and cleaner Environment (HSE)
  - Enabling Crude Oil Production increase w/o flaring Tanks Vapours.
  - Added Value to KOC (additional revenue).
  - Less CRU Maintenance Activities (no Shell/Tube Heat Exchangers and oil leak).
  - Increase equipment availability (New CRU + Old CRU).

Final word:

Environmental aspect

Green Operations

We should treat the field as it is our home. More regulations and measures are enforced by the EPA which needed to be adhered

Simply the aim is " Our children should inherit clean Environment"

OPERATING EFFICIENCY

- ***Flaring reduced significantly***

Additional HSE Achievements

- Spirit of the desert.
- Kuwait Oasis.
- Cleaning & Restoration of a banded Gatch pit in Magwa Area.
- Management site visits to practice commitment.
- Health Surveys (Ergonomics, Indoor Air Quality ,Noise ,Drinking water& Stress Surveys).
- Mitigating the Industrial hazards(PPE& Warning sings)

Thank You

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Questions?