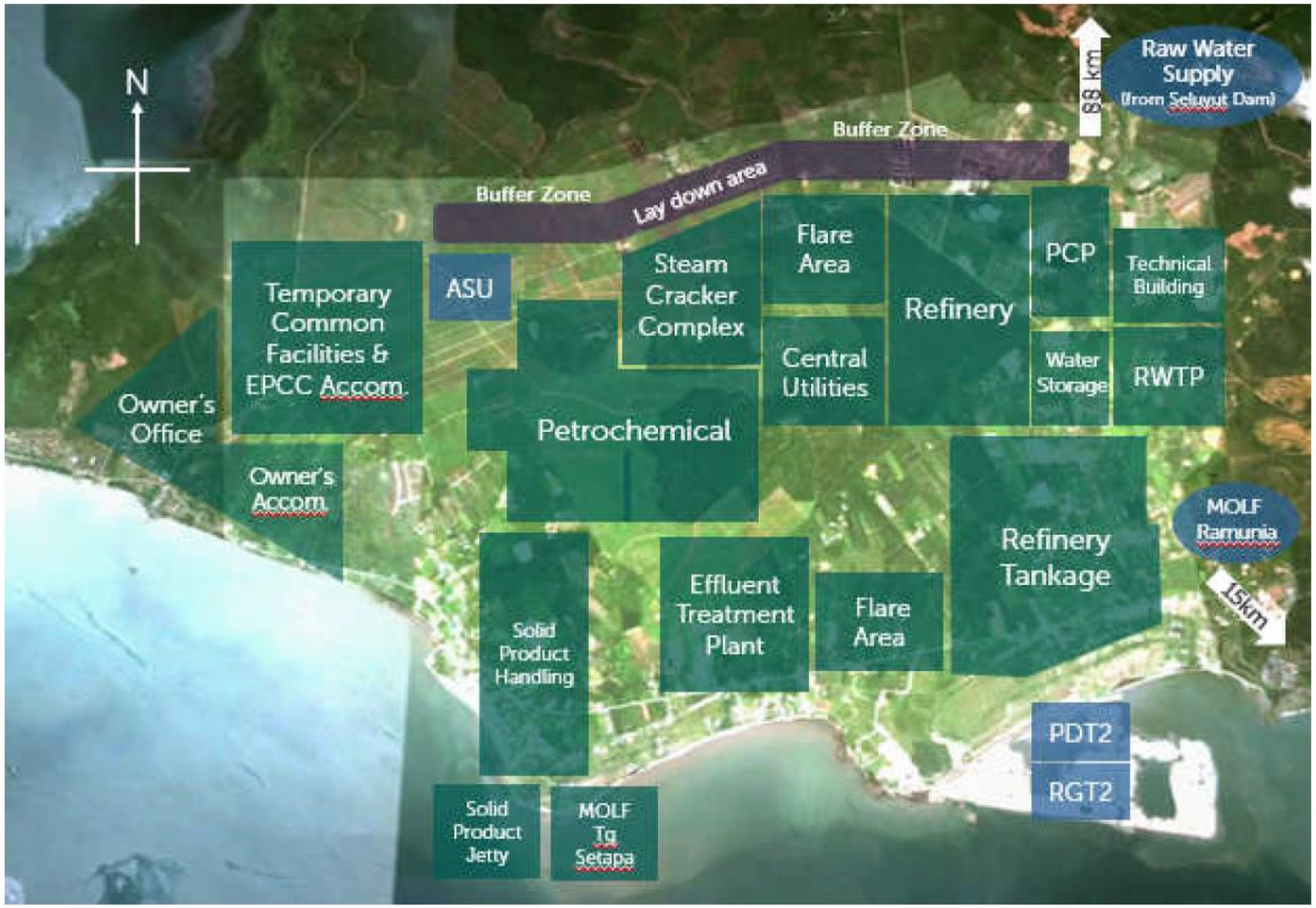
CEFS PIC Pengerang Integrated Complex

PIC Plant Overview & Simplified Process Flow

Content

RAPID facilities with its associated facilities will form Pengerang Integrated Complex (PIC) which occupies 6,000 acres in Pengerang, Johor



Plot Area
6,242 acres =

7x MALACCA REFINERY PLANT (PSR1 & PSR2)

OR

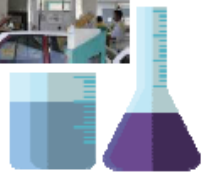
62x KLCC

Earthwork
80,000,000 m^3 =

2.5x Kuala Lumpur International Airport

RAPID project is the largest investment of PETRONAS in Downstream with highly integrated design

Refinery capacity of **300,000 bpd** & steam cracker combined production of more than **3 million tpa** of ethylene, propylene and C4 olefins as feedstock to petrochemical plants



RAPID will produce **3.6 million tpa** of petrochemical product and **220,000 bpd** of petroleum product by 2019

RAPID

Steam Cracker

Petrochemicals Production Units

LPG and Naphtha

Refinery

300,000 BPD of Crude Oil

RAPID – UIO

- Centralised utilities & facilities to support RAPID
- Generation and distribution of utilities for RAPID users

Associated Support Facilities

Pengerang Deep Water Terminal 2

Dedicated facilities for RAPID import, feedstock storage and evacuation of products.
- 58 tanks (total capacity for 1.3mil ton of petroleum, 0.2mil ton of chemicals
- 1 jetty (5 petroleum berths, 5 chemical berths and 2 LNG berths)

Raw Water Supply
Project Air Mentah RAPID (PAMER)

Supply of raw water for RAPID @230 MLD to RAPID
- Intake station
- Dam (main & saddle dam)
- Booster Pump Station
- Terminal Reservoir
- 88km of pipelines

Regasification Terminal 2

Provides primary gas supply to RAPID and PCP.
- LNG regasification unit
- 2 x 200,000 m^3 LNG storage tanks
- Send out capacity of 3.5 MTPA of natural gas
- Export facility

Pengerang Cogeneration Plant

Generates power and steam and supply for RAPID:
- Power > 1,220 MW
- Steam 1,480 tph

Air Separation Unit

Supplies O_2 and N_2 to RAPID:
- O_2 at >1500 tpd
- N_2 at >1300 tpd

RAPID is designed with Refinery processing capacity of 300 kbd & produces >3 million tpa of Petchem products

RAPID key design features:

- Fully integrated, molecules upgrade
- Heavy and high sulfur crude (3.15 wt%) processing
- Product value upgrade in petchem
- Upgrade refinery bottom to gasoline and distillates

300,000 bpd

Refinery

Steam Cracker

Ethylene & propylene

400 ktpa

Polymer

1,650 ktpa

Oxygenates

811 ktpa

C4 Derivatives

314 ktpa

Elastomer

270 ktpa

Gasoline 98 kbd
Jet A1 28 kbd
Diesel 88 kbd
Fuel Oil 5 kbd
Sulfur 458 ktpa

General Information

1. List down the nine (9) main companies/CEFS PIC Members.
   i. PETRONAS Refinery & Petrochemical Corp. Sdn Bhd
   ii. Pengerang Power Sdn Bhd
   iii. Pengerang Gas Solution Sdn Bhd
   iv. Pengerang Refining Company Sdn Bhd
   v. PRPC Utility & Facility Sdn Bhd
   vi. Pengerang Petrochemicals Company Sdn Bhd
   vii. PETRONAS Chemicals Isononanol Sdn Bhd
   viii. Pengerang Terminal (2) Sdn Bhd
   ix. Pengerang LNG(2) Sdn Bhd

2. Please explain ISBL and OSBL
   - ISBL = Inside Battery Limit (within operating plant unit boundaries e.g. CDU)
   - OSBL = Outside Battery Limit (outside operation plant boundaries).

   If the fire equipment lies inside the ISBL, it is within the jurisdiction and responsibilities of the respective plant units. If it is located on the outside, it is managed by the Common Service Facilities, PRPC (UF).

Covering Area by CEFS PIC Main Station

1. Pengerang Refining Company Sdn Bhd
   - ✓ **Refinery Cracker (RC)**
     - Area 1A – FOS, CDU & SGP
     - Area 1B – Finishing Product (DHT / NHT / CNHT / CCR / KHT)
     - Area 2A – Atmospheric Residue
     - Area 2B – Residue Fuel Catalyst Cracker
     - Area 3A – Sulphur Unit
     - Area 3B – Tank Farm

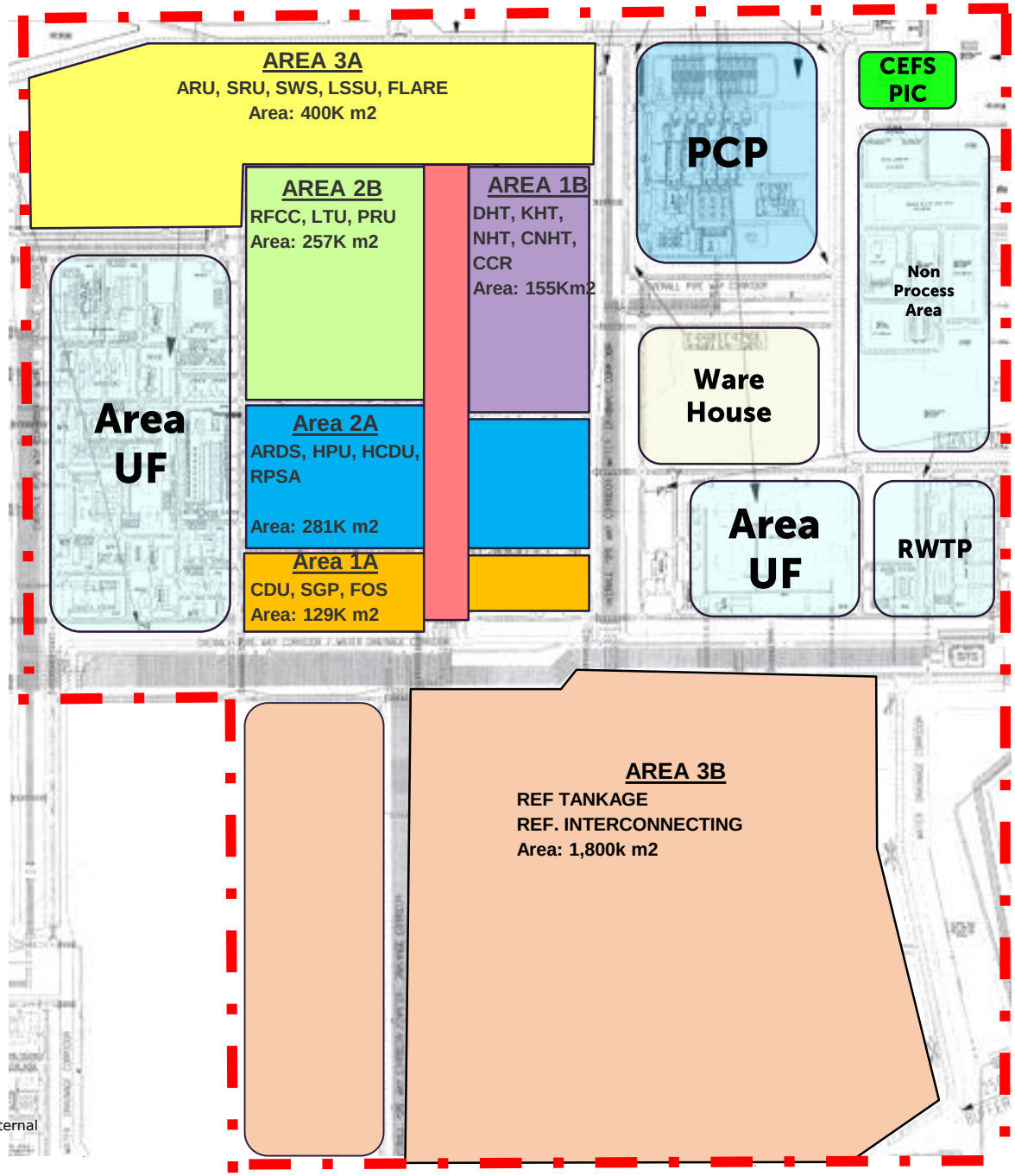
2. Pengerang Power Sdn Bhd
   - ✓ **Pengerang Cogen Plant (PCP)**
     - Steam Turbine Generator
     - Gas Turbine Generator (GTG) units
     - Heat Recovery Steam Generators (HRSG)
     - PCP Switchyard
     - Gas Conditioning Skid
     - 16 Cells Cooling Tower
     - Water Treatment Plant
     - Tank Farm

3. PRPC Utility & Facility Sdn Bhd
   - ✓ RWTP (PRPC Water)
     - Aerator
     - Clarifier
     - Filter
     - Chemical & Chlorine Building
     - Sludge Treatment Plant

4. Pengerang Terminal (2) Sdn Bhd
   - ✓ PT2SB
     - Tank Farm-Petroleum
     - Tank Farm-Petrochemical
     - Jetty

5. Pengerang LNG(2) Sdn Bhd
   - ✓ RGT
     - Tank
     - Process Area & Chemical Storage

Plot Plan Covering Area by CEFS PIC Main Station



Covering Area by CEFS PIC Satellite Station

1. **Steam Cracker Complex : Package 5**
   i. Steam Cracker Unit (SCU)
   ii. Pygas Hydrogenation Unit (PGHT)
   iii. Butadiene Extraction Unit (BDU)
   iv. Benzene Extraction Unit (BZU)
   v. MTBE / IBU

2. **Petrochemical Complex :**
   i. Linear-Low Density Polyethylene (LLDPE): Package 6A
   ii. Polypropylene (PP) : Package 7
   iii. Ethylene Oxide Ethylene Glycol(EOEG) : Package 11
   iv. High Density Poly Ethlene (HDPE) : Package 27

3. **Automated Storage Retrieval System (ASRS) : Package 12A (Product Warehouse)**

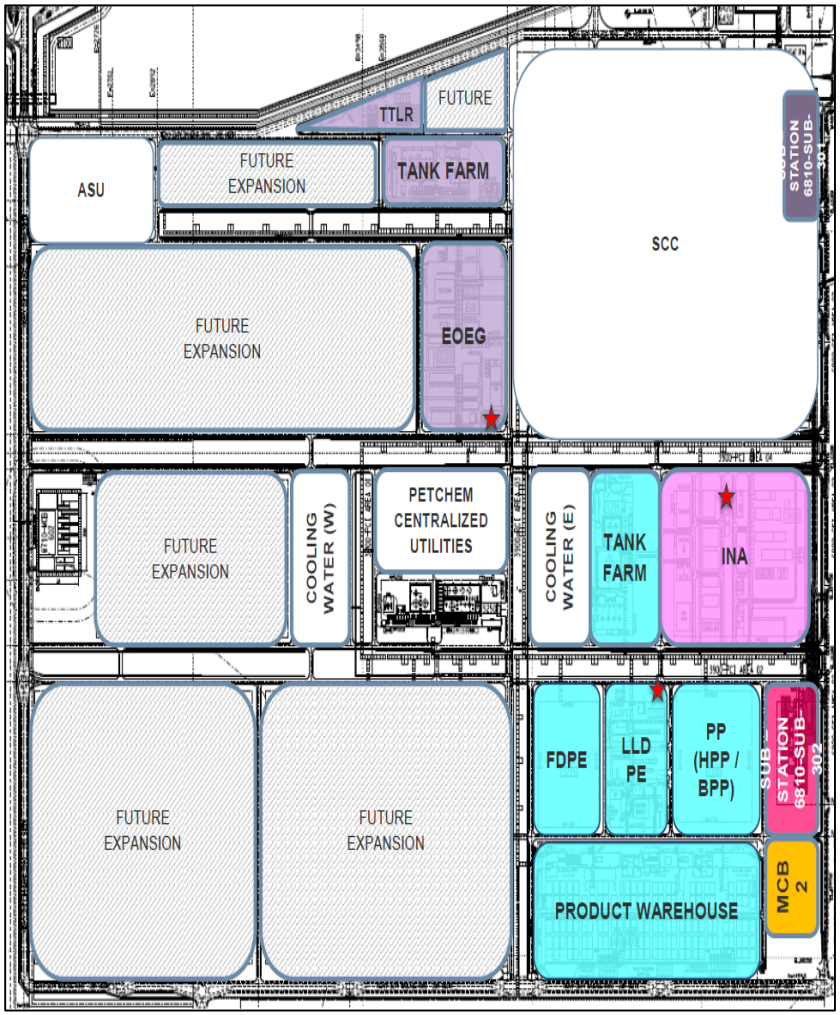
4. **C4 iNA Flour Isononanol : Package 29**

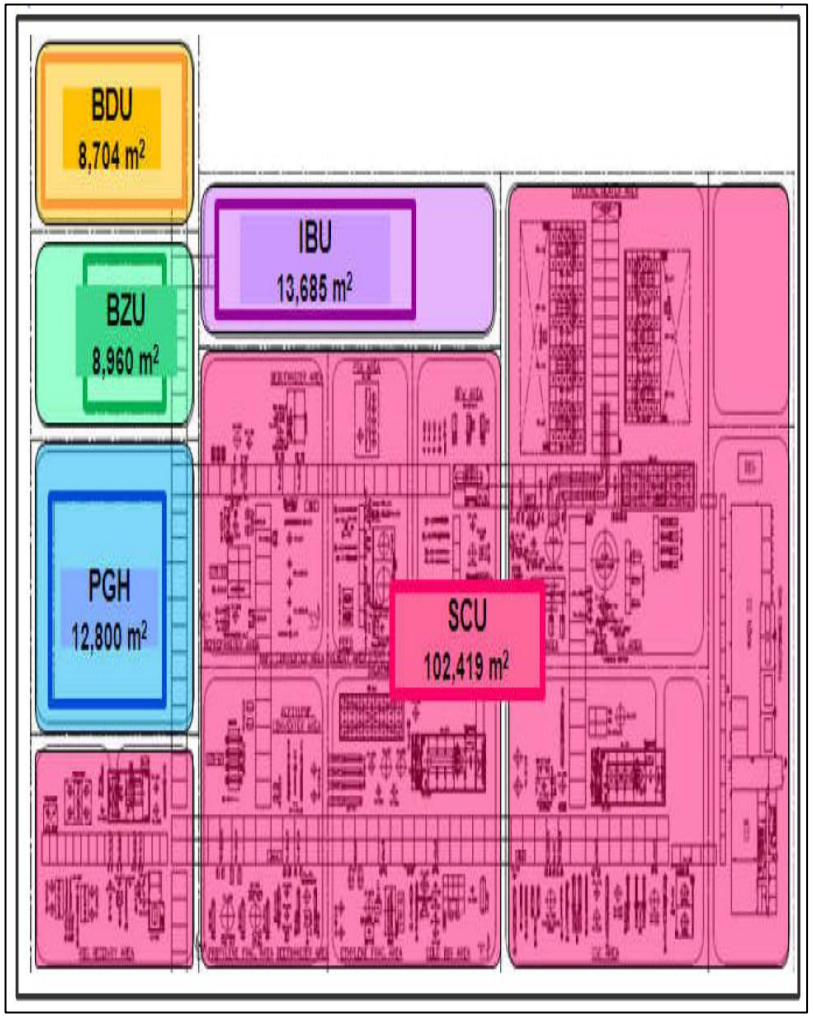
5. **Air Separation Unit (ASU)**

6. **Effluent Treatment Plant (ETP) : Lot 87**

7. **Solid Product Jetty (SPJ)**

Plot Plan Covering Area by CEFS PIC Satellite Station



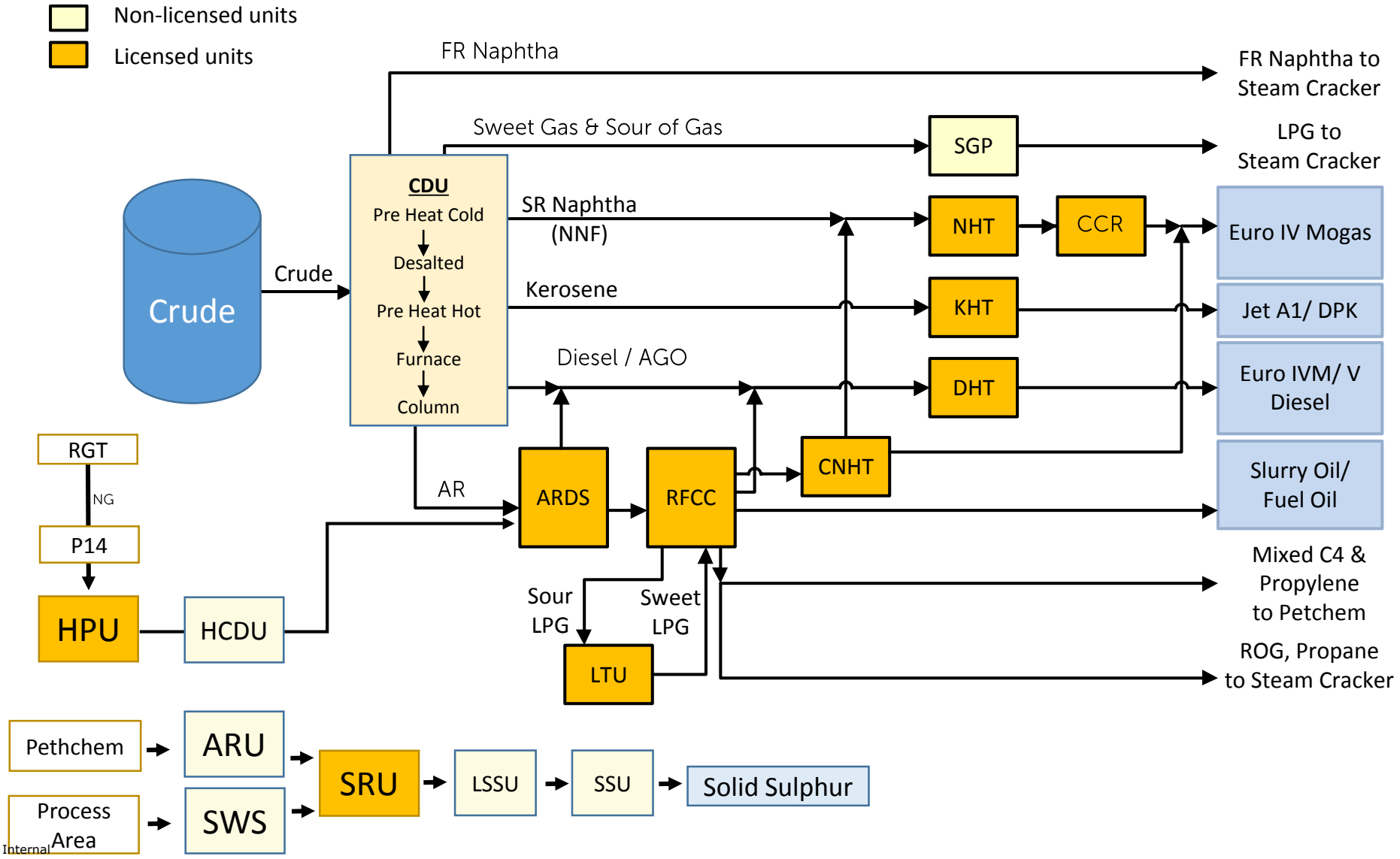


20 Location of Mustering Points

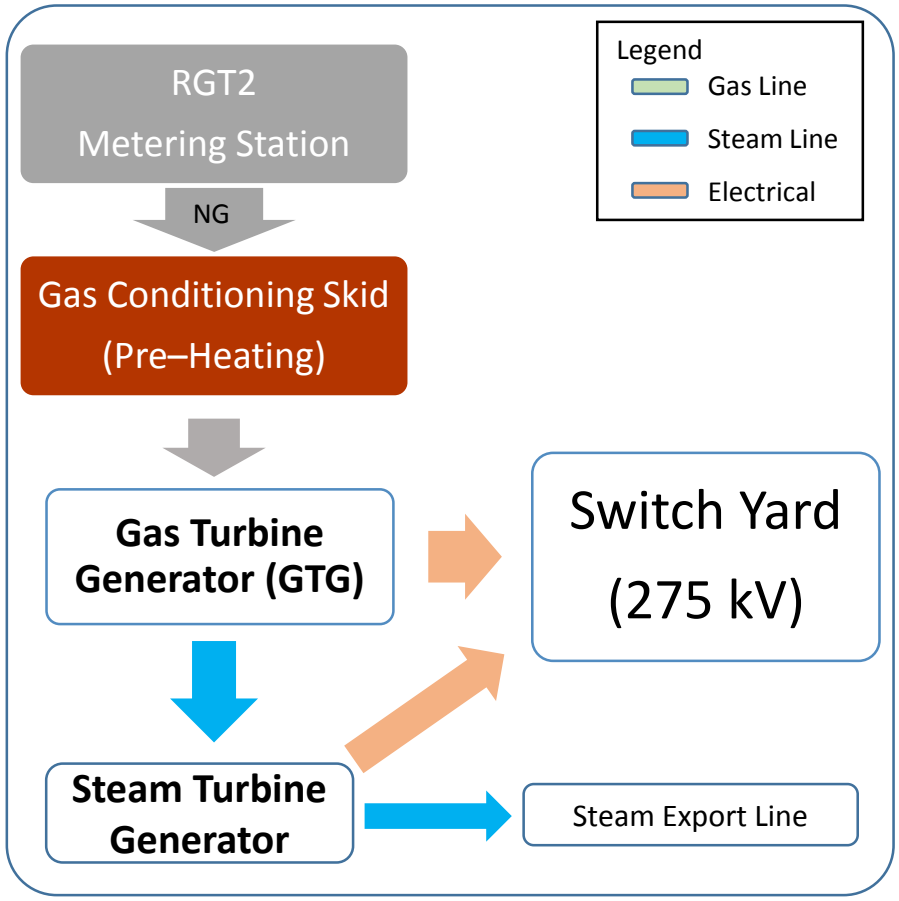
Simplified Process Flow Overview

1. Refinery Cracker (RC)
2. Pengerang Cogeneration Plant (PCP)
3. Raw Water Treatment Plant (RWTP)
4. Pengerang Terminal Two Sdn. Bhd. (PT2SB)
5. Regasification Gas Terminal Two (RGT2)
6. Steam Cracker Complex
7. Petrochemical Complex
8. Automated Storage Retrieval System (ASRS) : Package 12A (Product Warehouse)
9. C4 INA Flour Isononanol : Package 29
10. Air Separation Unit (ASU)
11. Effluent Treatment Plant (ETP) : Lot 87

1. Refinery Process Flow Overview



2. PCP Process Flow Overview



Reliable Supply

- To meet steam and power requirements of;
  - RAPID : Power – 620 MW
    Steam – 1250 tph (maximum)
  - TNB : Power – 400 MW to 600 MW

3. RWTP Process Flow Overview

INTAKE WORKS AT SG. SEDILI BESAR

SELUYUT DAM & SELUYUT BOOSTER PUMPING STATION

TERMINAL RESERVOIR AT BKT. PANJANG

Aerator
Pre-Chlorination

Silica Reaction Tank

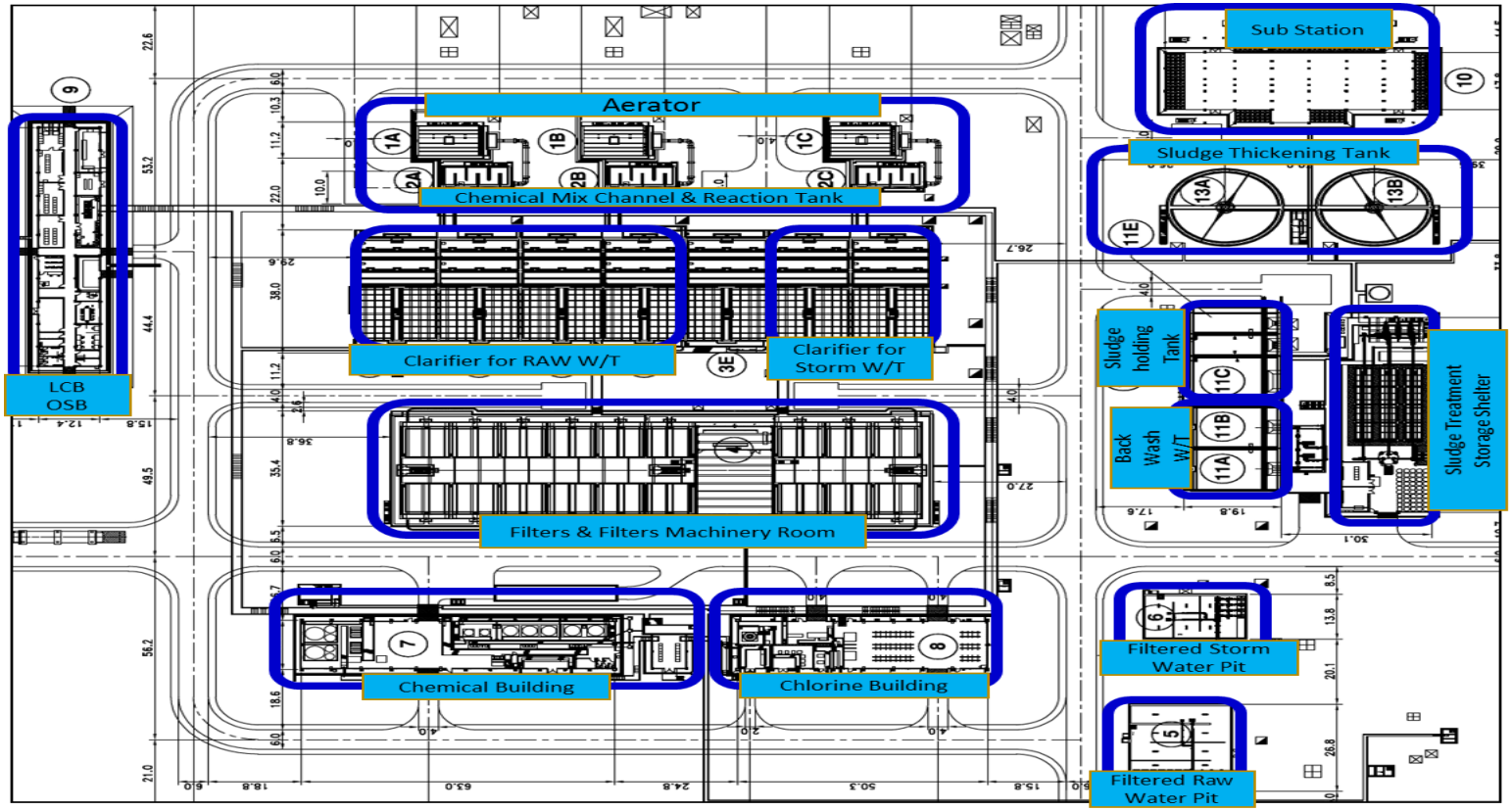
Coagulation & Flocculation

Clarifiers

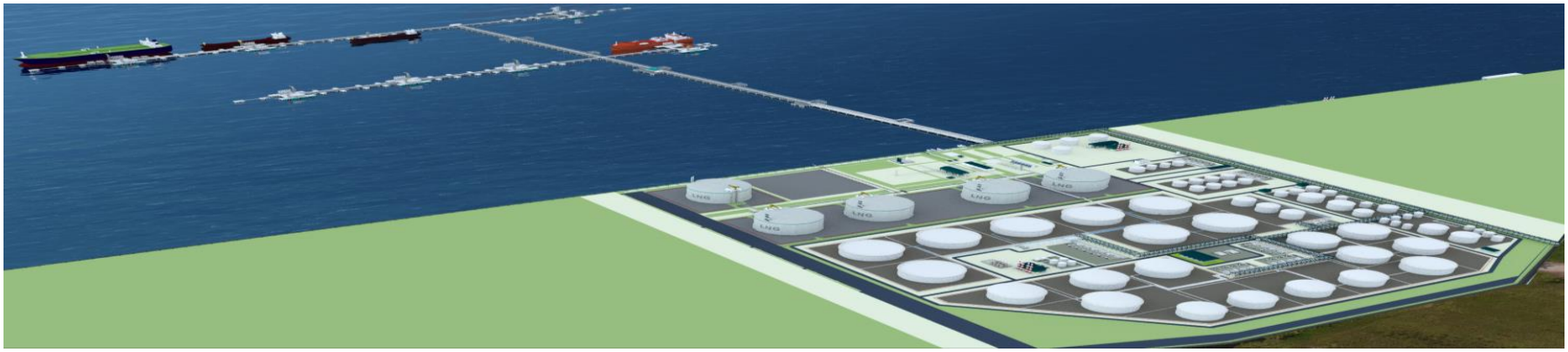
Sand Filters

Disinfection & pH Adjustment
Post -Chlorination

Pump Pit



4. PT2SB Process Flow Overview



5 Petroleum Berth

2 Gaseous Berth

3 Petchem Berth

Tank Farm (58 Storage Tanks)

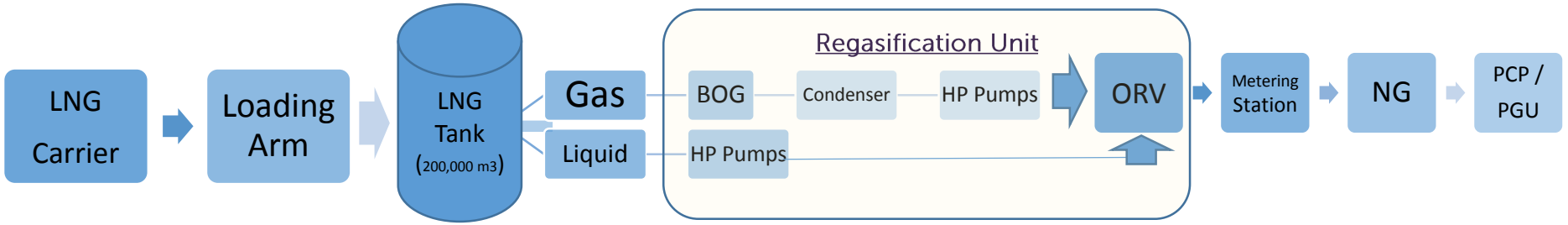
21 Storage Tanks for PIC

37 Storage Tanks for external customer

6 Storage Tanks (Petrochemical)

15 Storage Tanks (Petroleum

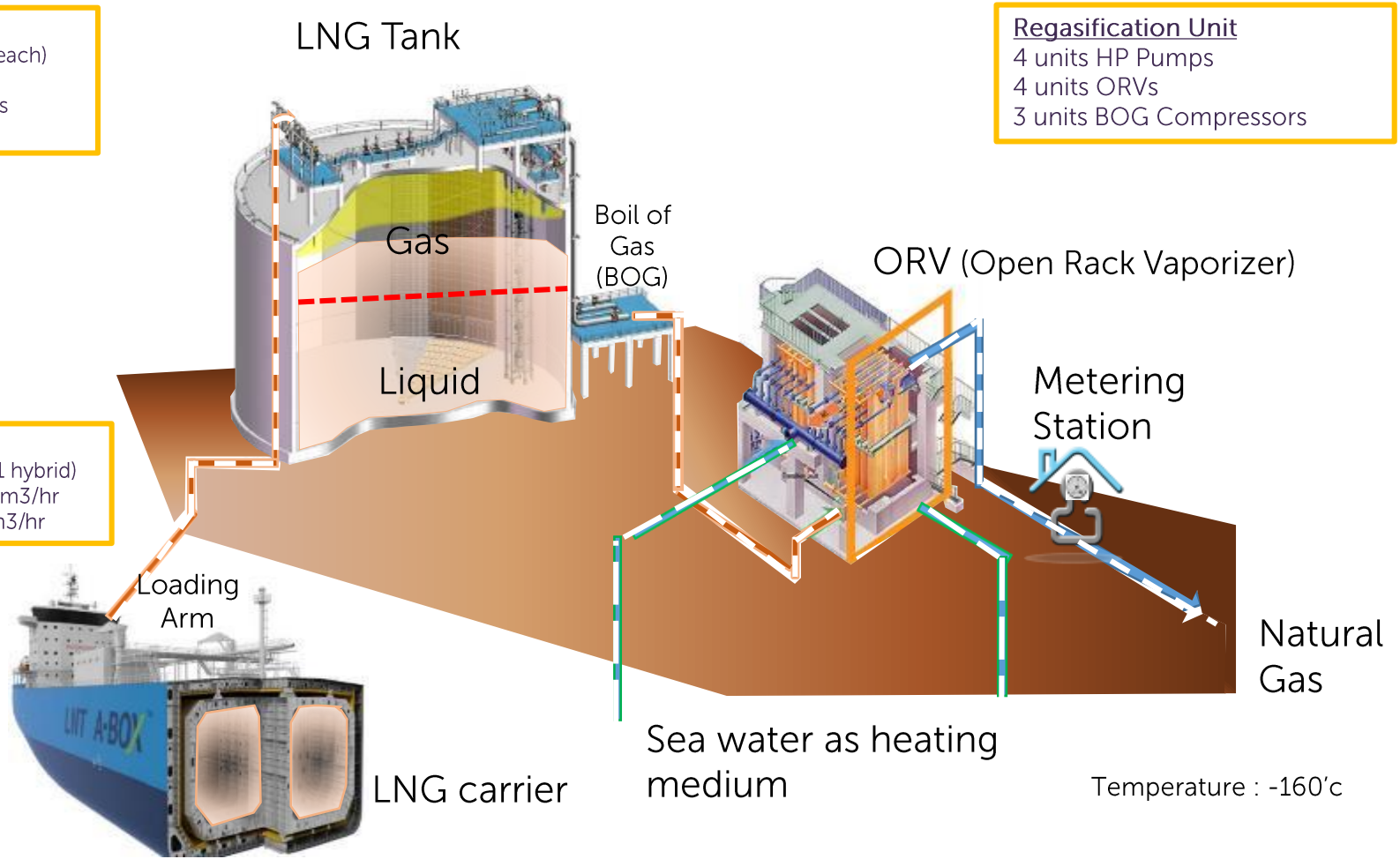
5. RGT2 Process Unit Overview



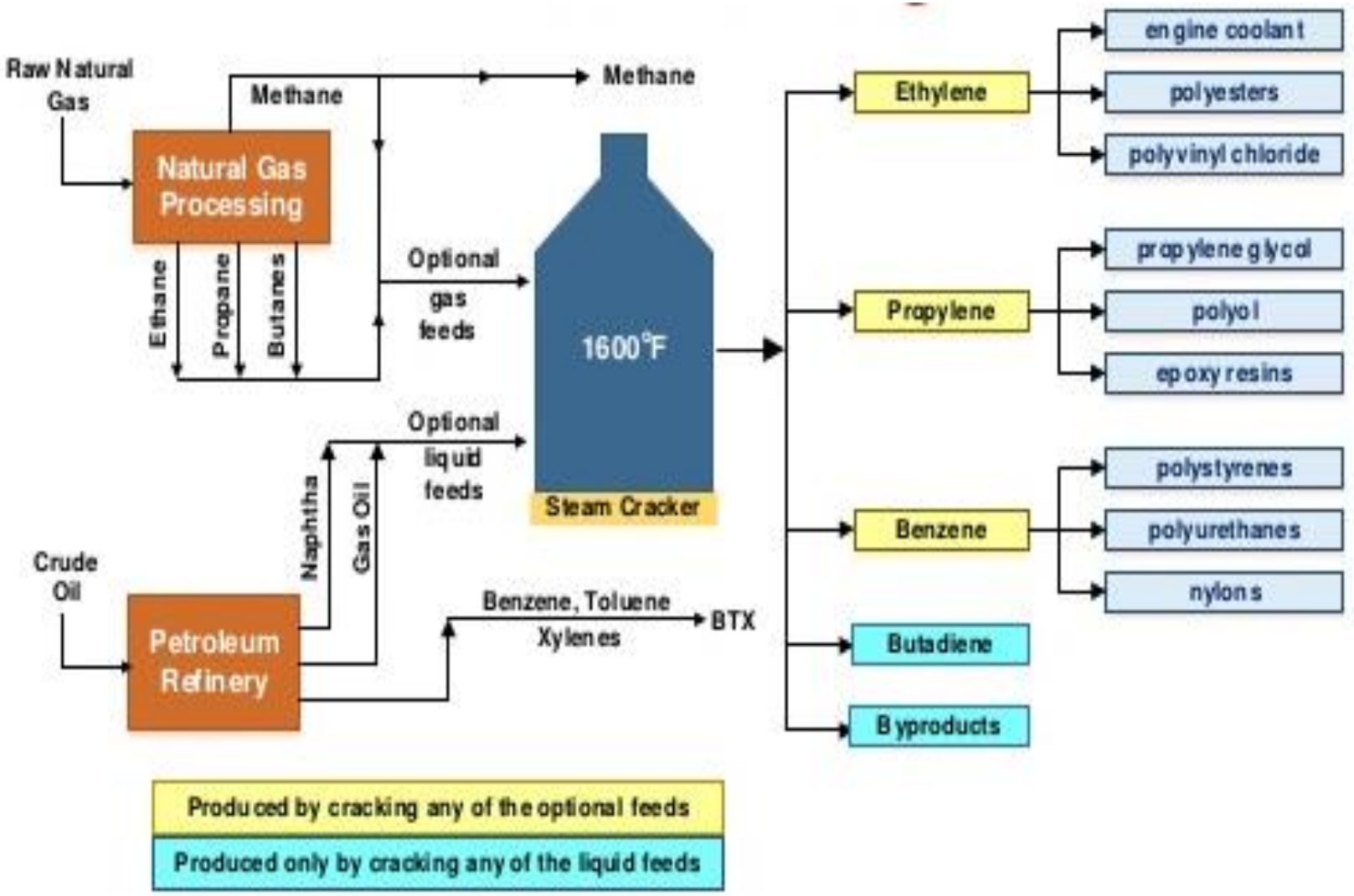
LNG Storage Tank
2 units (2 x 200,000 m3 each)
2 units In-Tank Pumps
2 units Re-loading Pumps
(each tank)

Regasification Unit
4 units HP Pumps
4 units ORVs
3 units BOG Compressors

Marine Loading Arm
4 units (2 liquid, 1 vapor, 1 hybrid)
Un-loading Rate : 14,000m3/hr
Re-loading Rate : 5,000m3/hr

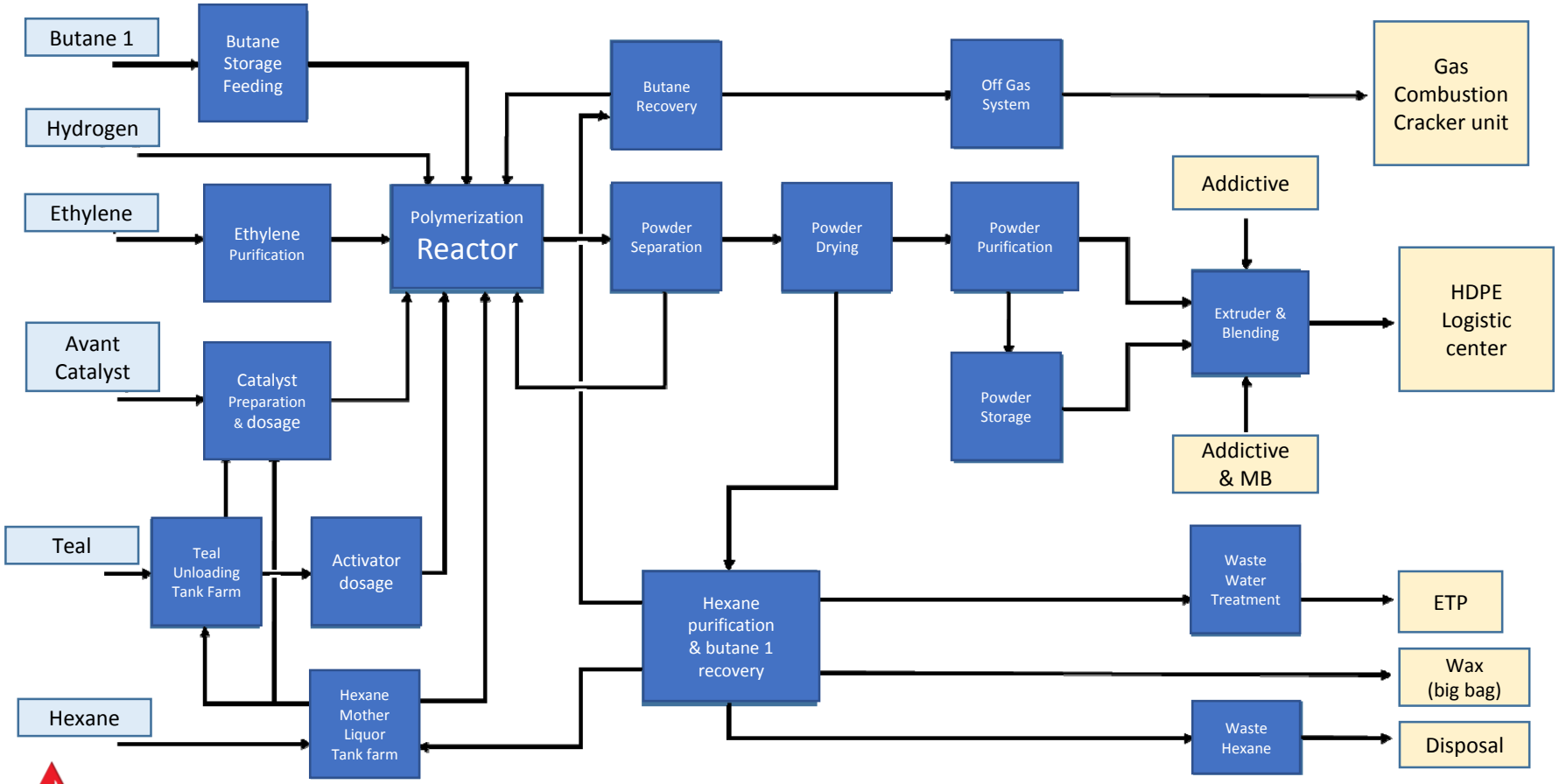


6. Steam Cracker Process Flow Overview



7. Unit: Flexi HDPE

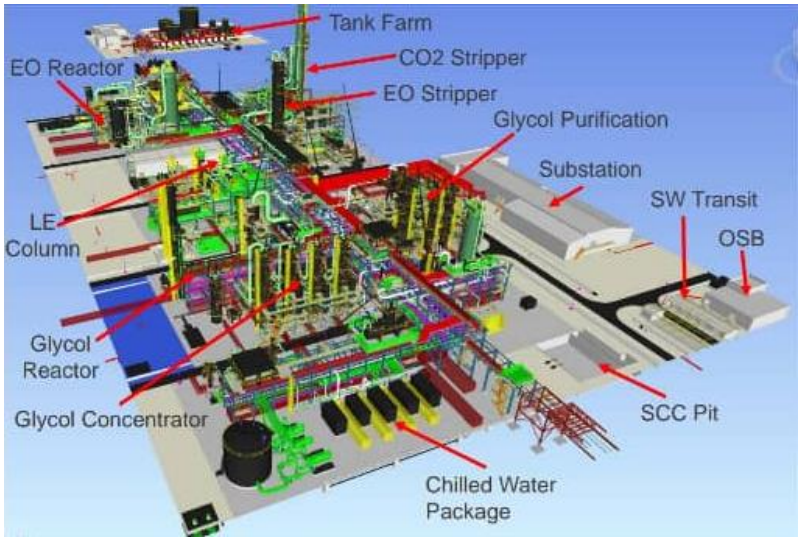
- Production capacity: 400 KTPA of HDPE
- Using Hostalen "Advanced Cascade Process" (Hostalen ACP) process technology
- Slurry cascade process with three (3) stirred polymerization reactors in series



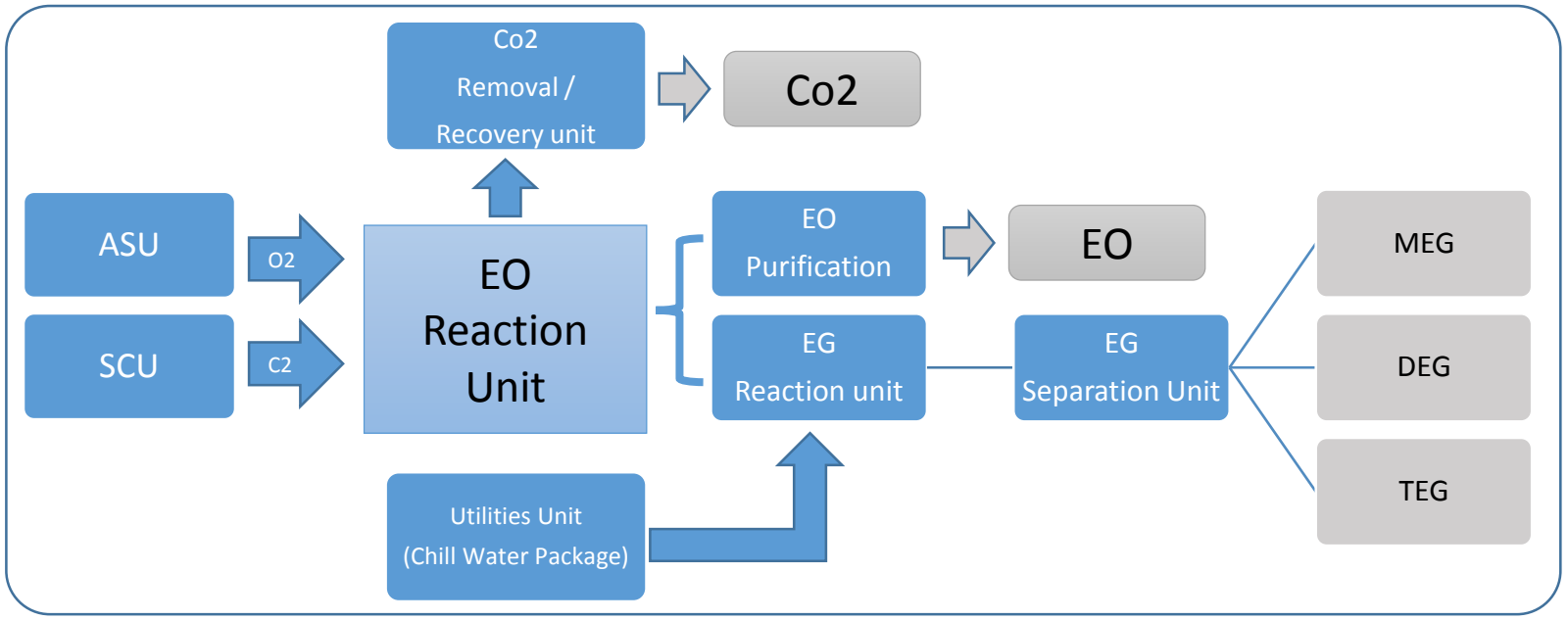
8. Ethylene Oxide Ethylene Glycol (EOEG)

Production of ethylene oxide and ethylene glycols wherein ethylene and oxygen are reacted together in the presence of a catalyst comprising of silver supported on alumina.

The ethylene oxide produced is reacted with water to produce ethylene glycols.



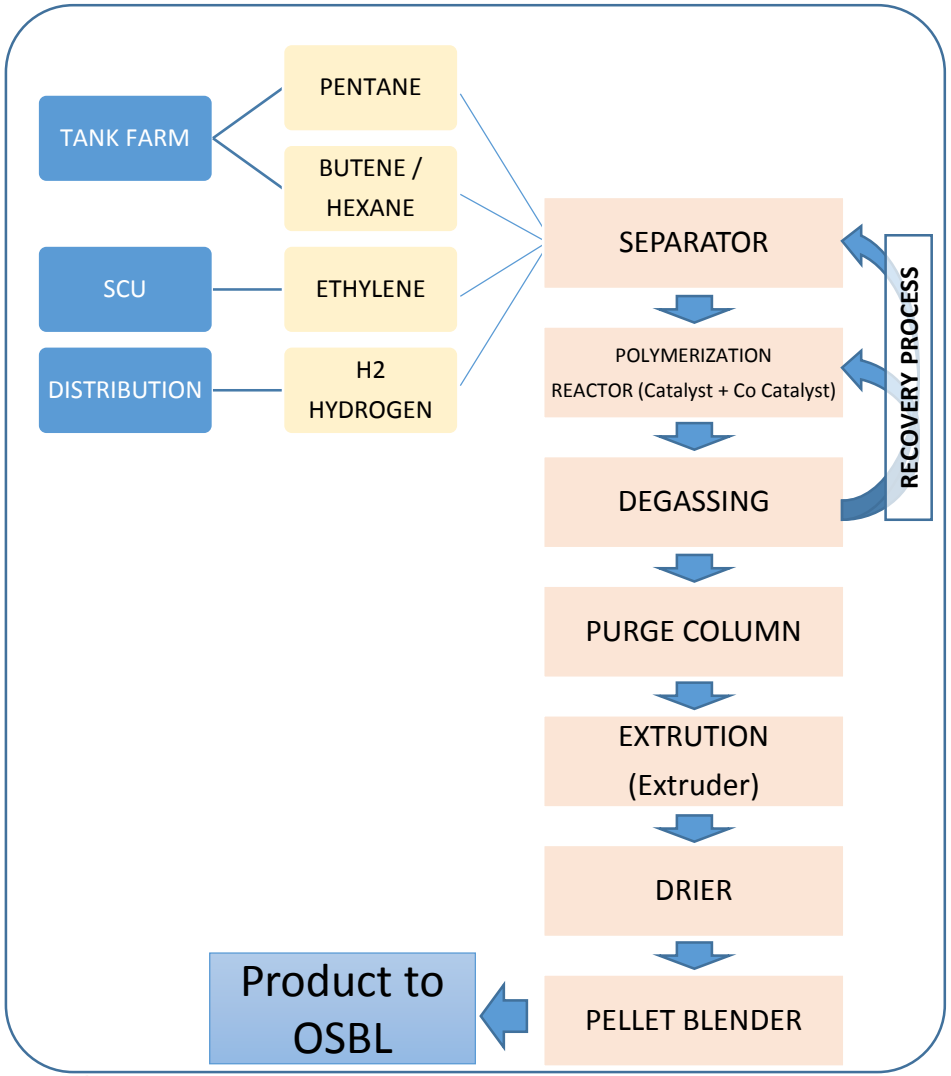
Process Flow Overview

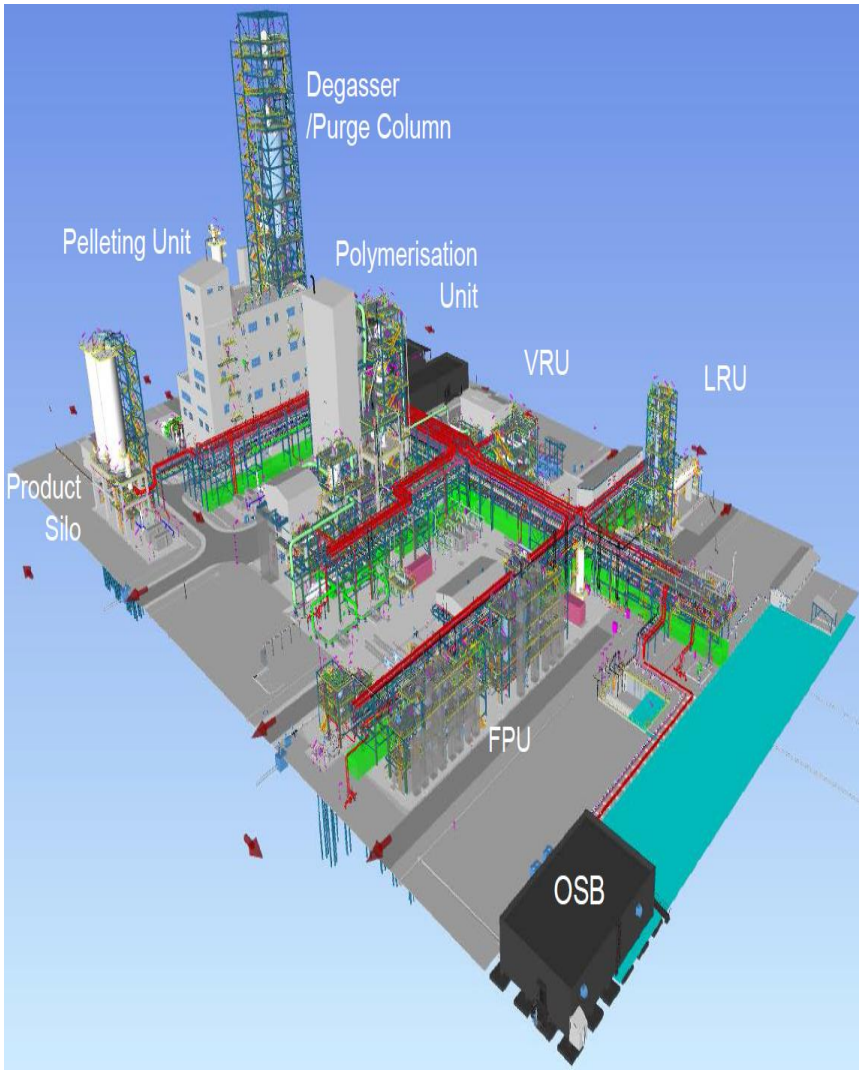


9. Linear-Low Density Polyethylene(LLDPE)

Ethylene are converted into LLDPE in the Fluidized Bed Reactor using 3 types of catalyst (HPLL, NOVACAT or SDX).

Polymerization Process Flow Overview

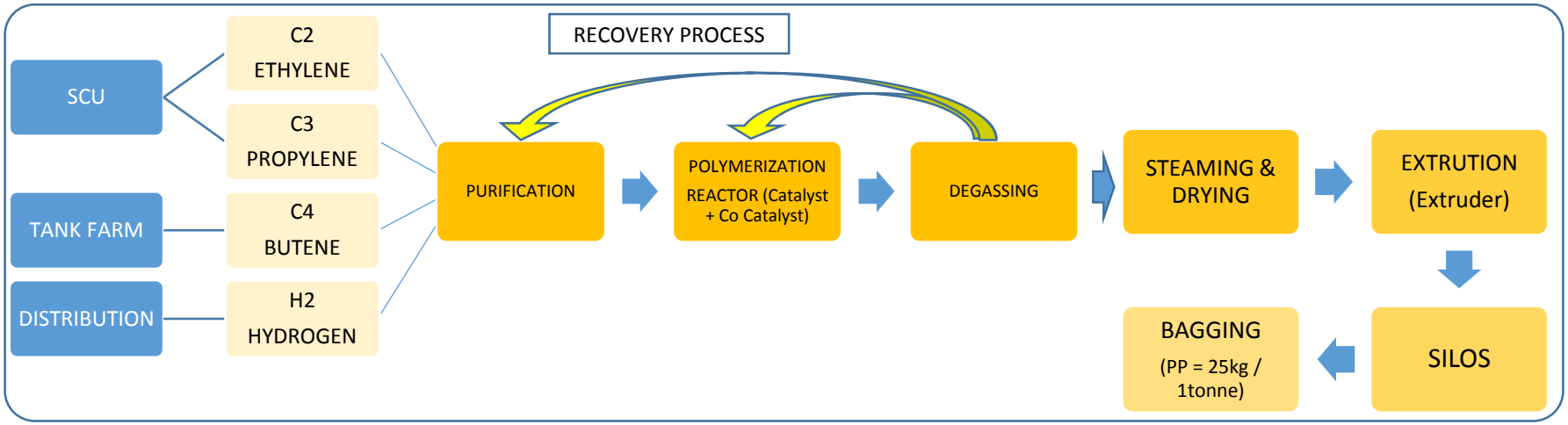


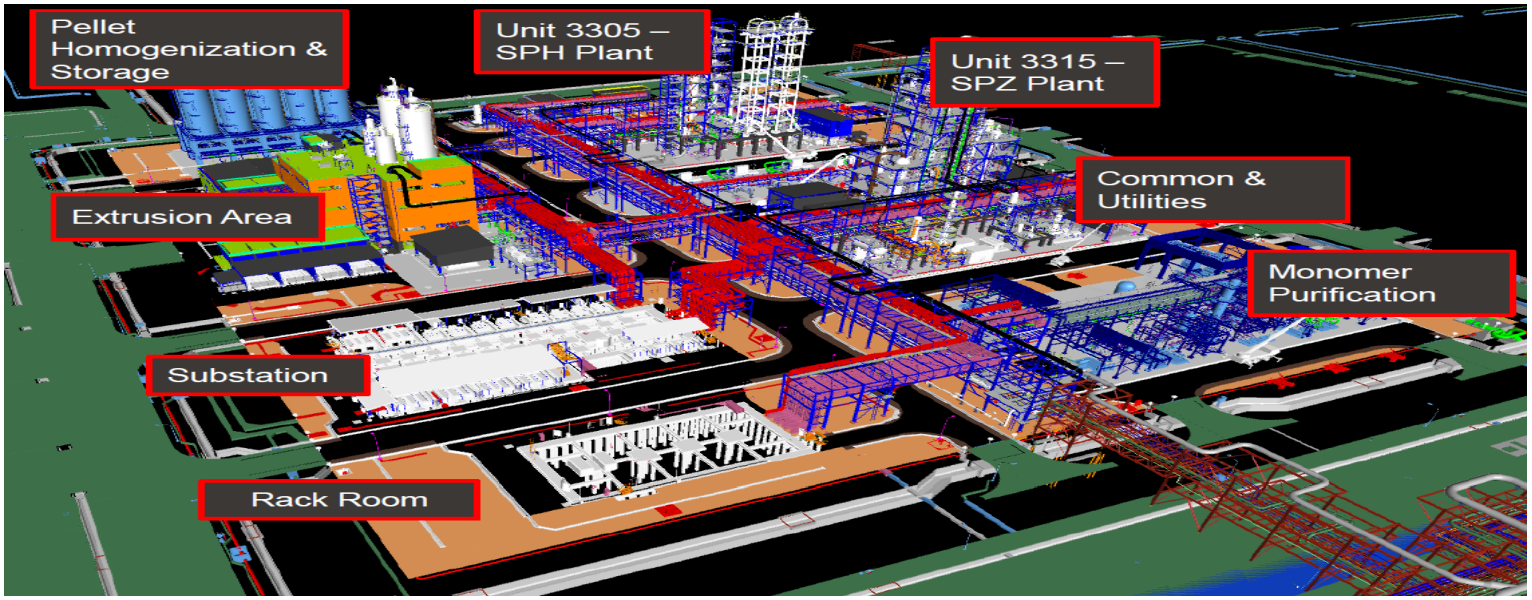


10. Polypropylene (PP)

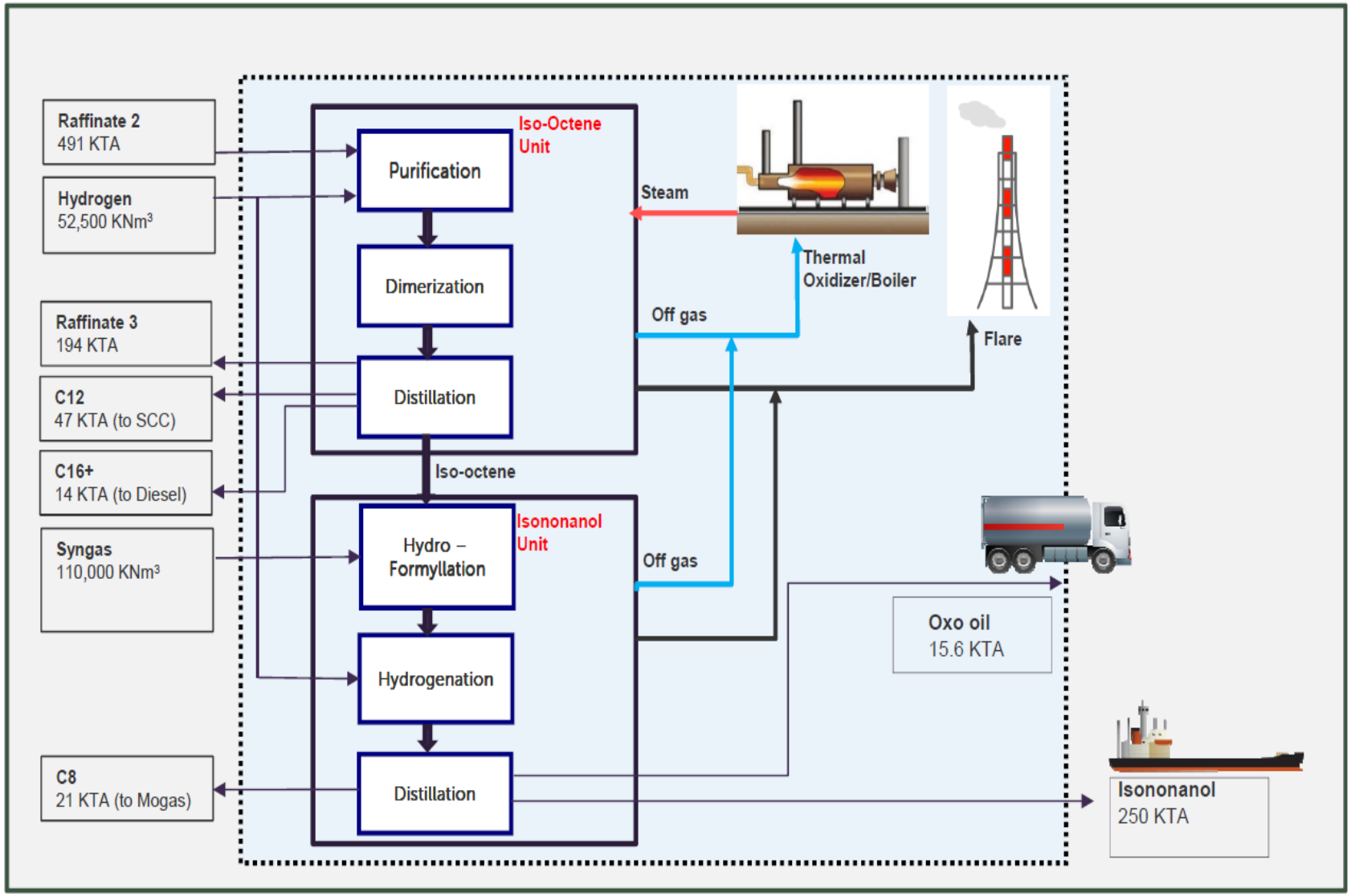
Polypropylene Spheripol Plant produce propylene homo polymers while Polypropylene Spherizone produce Polypropylene homo polymers, random copolymers, impact polymers and terpolymers.

Polymerization Process Flow Overview



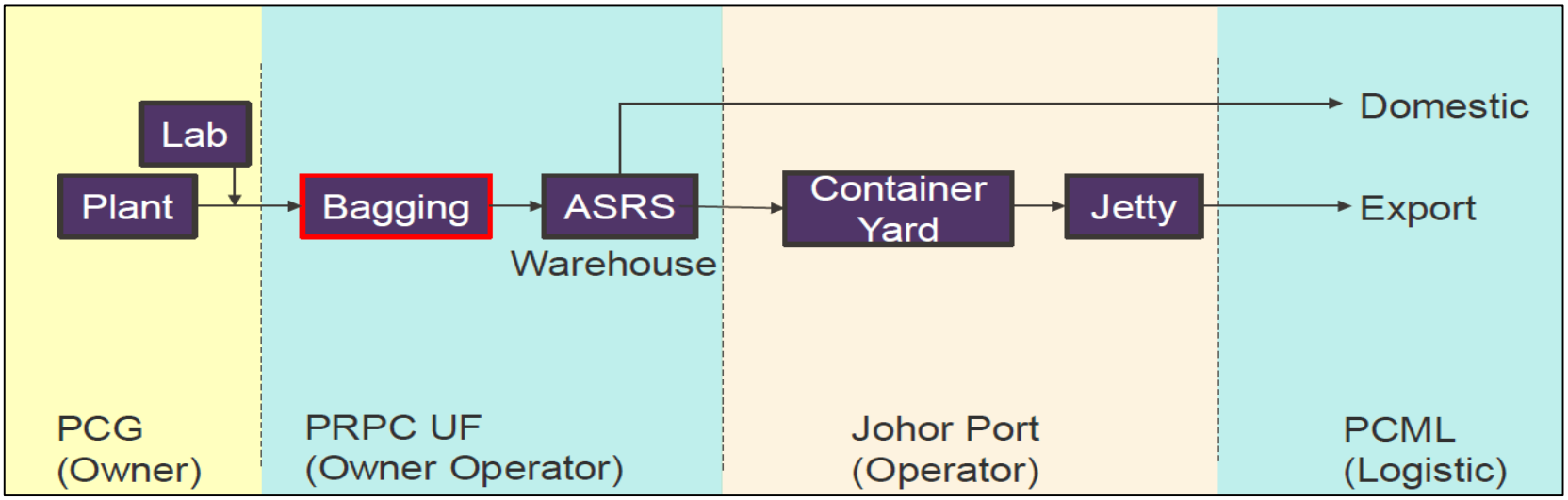


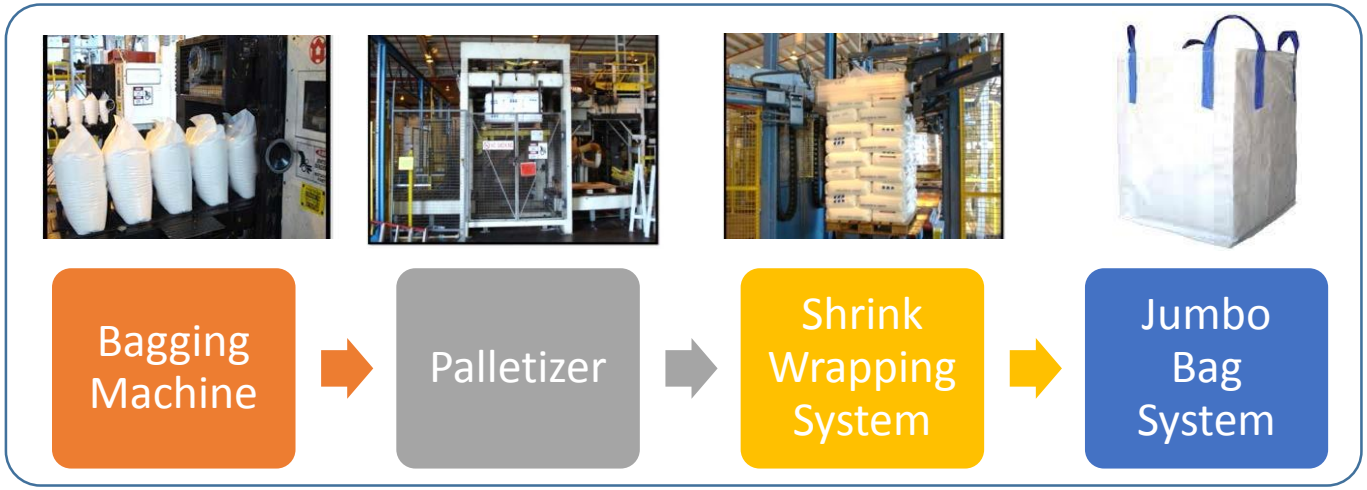
11. C4 INA Complex



12. Package 12A : Product Warehouse (Internal)

Packed bags from Polymer plant to be delivered in containers to domestic and export.





13. Air Separation Unit (ASU)

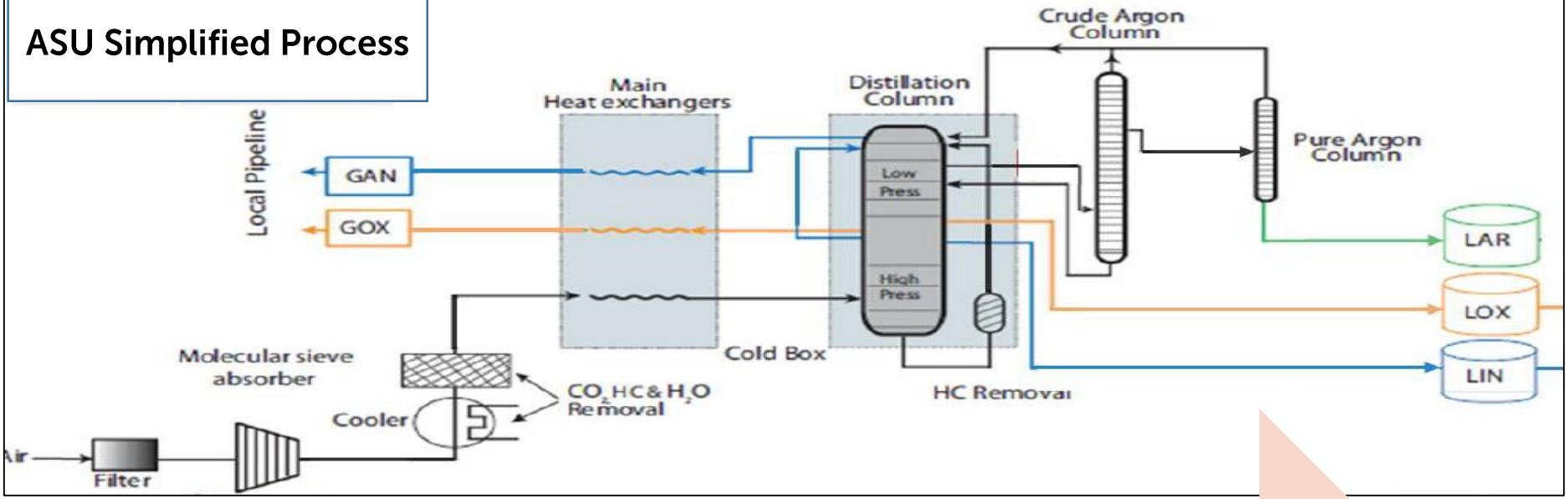
ASU plant is designed to meet plant reliability of 99.5% & product availability of 100%

- Design Capacity:
  - Oxygen = 1430 TPD
  - Nitrogen = 780 TPD
- 2 x 50% train configuration
- Individual liquid product storage facility for Oxygen and Nitrogen

Hazard / Risk

- Electrical Fire at switch room, equipment or building
- Brake fire of Liquid Nitrogen Tanker
- Diesel fire at Diesel Generator Set
- Transformer Fire (HV or LV)
- Oil spill fire during Main Air Compressor & Nitrogen Compressor system commissioning, from transfer activities or leak of oil
- Electrical fire at Main Air Compressor, Nitrogen Compressor HV motor or LRS

ASU Simplified Process



Compression & Filtering → Cooling & Purification → Refrigeration & Liquefaction → Separation of O2 & N2 → Argon Extraction / Production

GAN : Gaseous Nitrogen
GOX : Gaseous Oxygen
LIN : Liquid nitrogen
Lox : Liquid Oxygen
LAR : Liquid Argon

Thank You