شركة الخليج لصناعة البتروكيماويات

Gulf Petrochemical Industries Company

Kingdom of Bahrain



Carbon Dioxide Recovery (CDR) Project

Introduction

- Established in December 1979
- Joint-Venture between the Government of Bahrain , SABIC & PIC
- Utilizes Natural Gas as raw material
- Started production in 1985 : Ammonia , Methanol
- Started Urea Production in 1998
- Started production in 1985 : Ammonia , Methanol and Urea
- MHI CDR plant commissioned in 2009

Our Mission

To add value to our customers and shareholders by meeting their expectations whilst:

- Producing high quality products
- Focusing on customers
- Optimising business in a cost effective, safe, environmentally friendly and socially responsible way
- Embracing knowledge, creativity and best practices

Our Vision

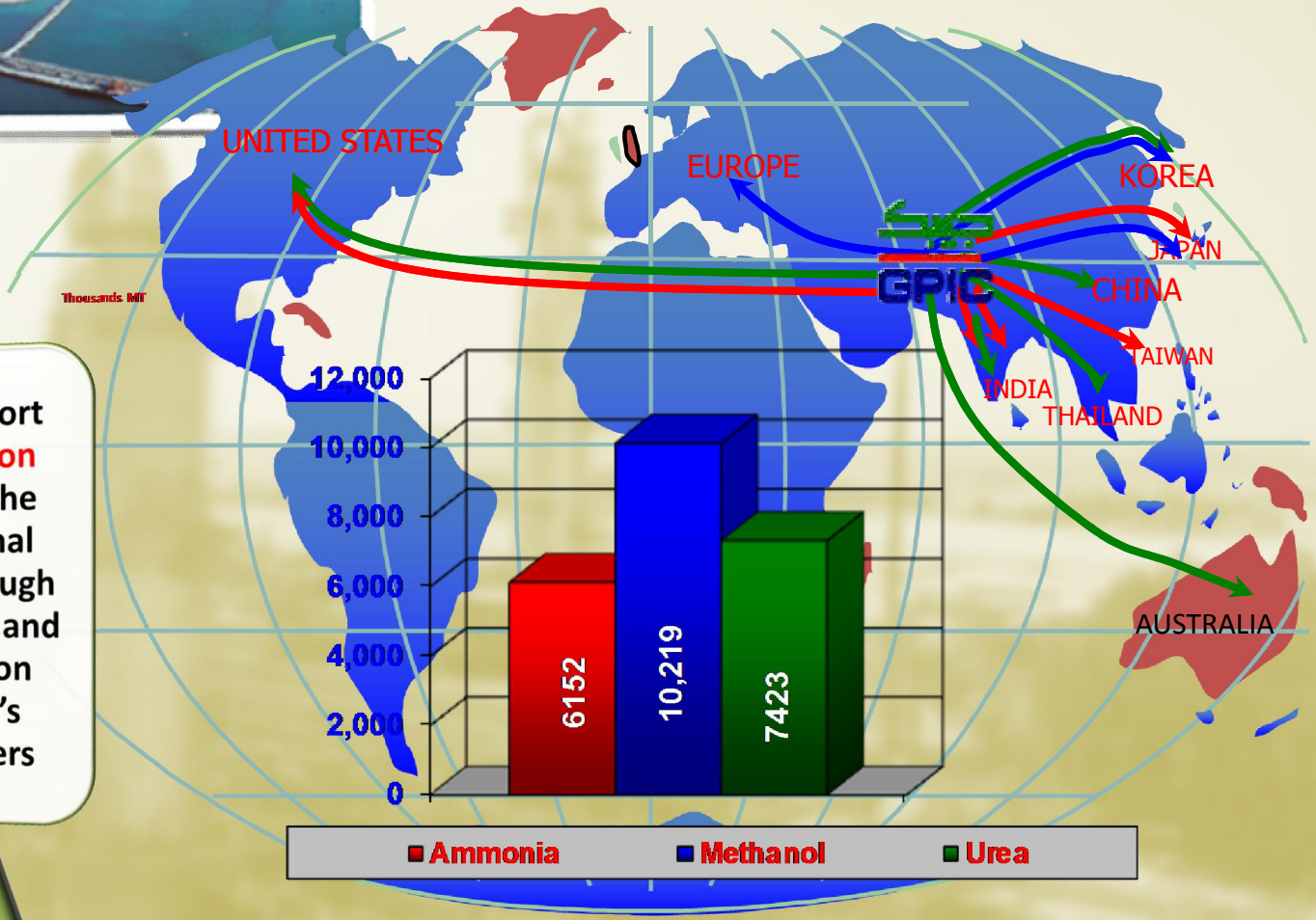
To be a global, dynamic world-class petrochemical and fertilizer company of choice recognized for excellence.

GPIC Mission & Vision

Total Production

Marketing & Export

Annual export of 1.2 Million tonnes to the International Market through cooperation and coordination with GPIC's Shareholders

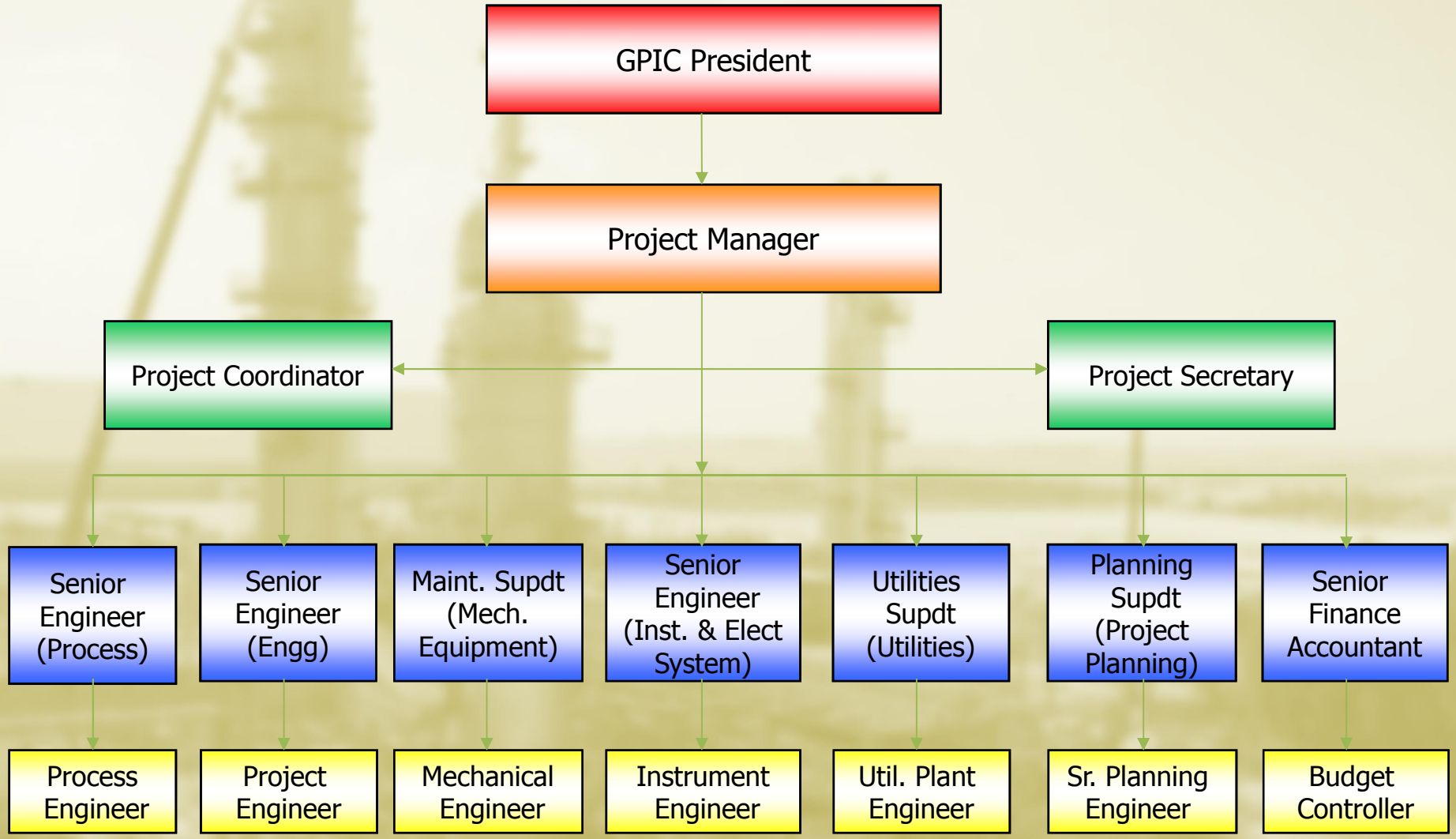


Objectives of the CDR Project

Objective of CDR Project

- **Preserve Environment**
  - Reduce the emission of green house gases
  - Recovery of 148,500 MT per annum of CO_2
- **Increase Production**
  - Urea production by ~ 26,400 MT per annum
  - Methanol production by ~ 39,600 MT per annum

Project Organization Chart



Project Materialization

CDR Project Feasibility Study

- Explore the market and price outlook for both Methanol and Urea in the medium and long term
- Explore technology options and project cost
- Assess the economics (e.g. ROI, IRR)

Strategic outlines during Project conceptualization

GPIC strategic outlines were in terms of….

- Selection criteria for the CDR plant Capacity
- Selection criteria for the Technology
- Selection criteria for the EPC Contractor

Selection criteria for the CDR plant Capacity

- Proven production capacity
- Capacity similar to regional and international practice
- Capacity compatible with GPIC raw materials (i.e. similar flue gases) and space availability for the Project

450 MTPD capacity of CDR Plant

Selection Criteria for the Technology

- Proven technology
- Reliable in terms of operation and maintenance
- Positive Environmental impact

MHI's CDR technology

Selection criteria for the EPC Contractor

- Contractor with relevant experience
- Contractor with proven records (financially and operationally)
- Competitive offer

Technimont ICB
(Italian-Indian joint venture Company)

Project Commencement

Compilation of ITB

CDR team compiled the Specs, standards and Scope of Works and all the requirements identified during the conceptualization and planning phases of the Project in the ITB.

Requirements During Project Planning Phase

- Maximum involvement of GPIC's operation, maintenance, engineering, and finance since inception of the Project.
- EPC Contractor to accommodate operation, maintenance and training requirements during the basic and detailed engineering phases.
- GPIC's approval is a "must" for Vendors and Subcontractors selection.

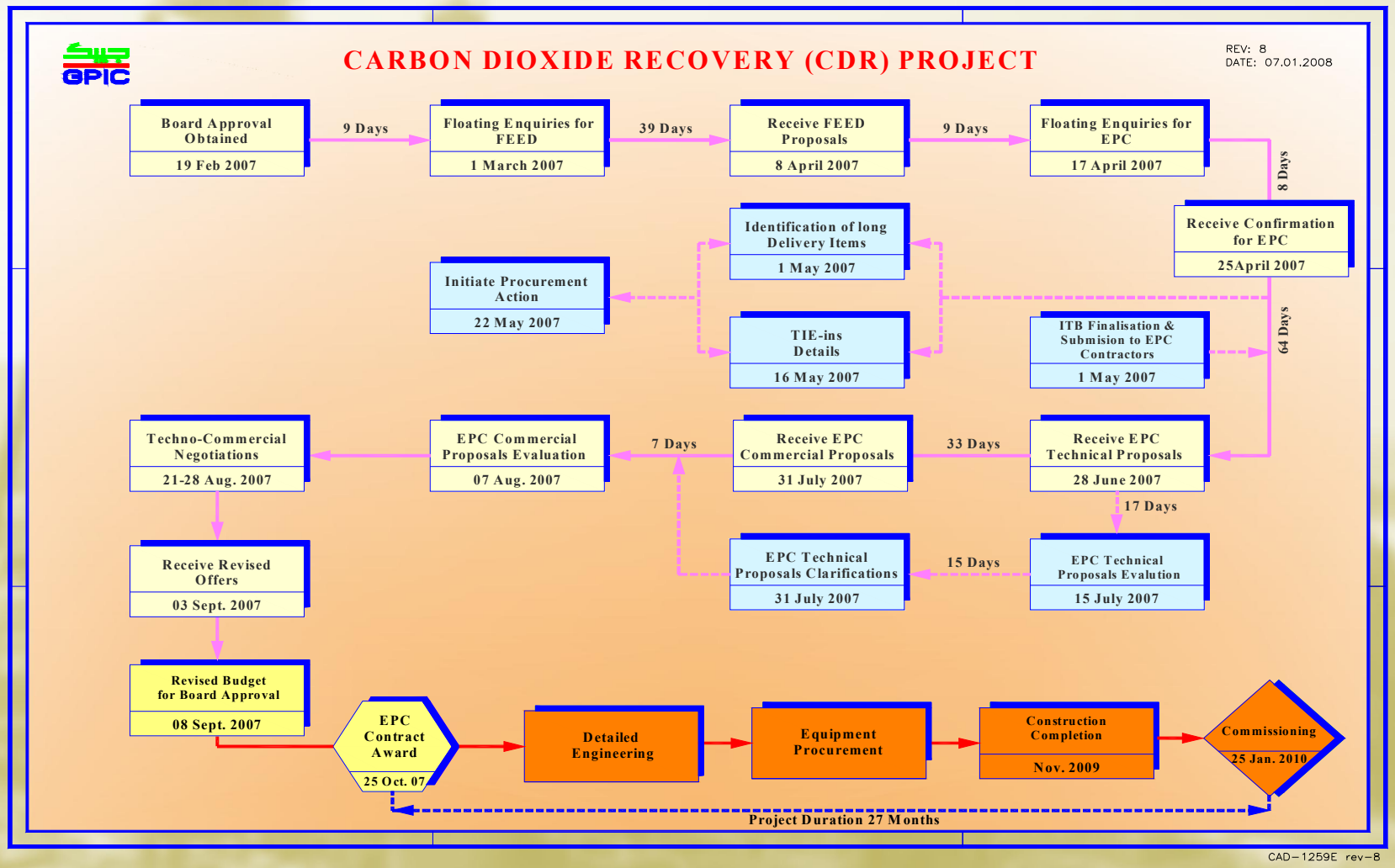
Requirements During Project Planning Phase

- Visits to be arranged to similar operating plants to learn from their experience
- Project Management shall be through GPIC project team
- Synergy and Integration study with the existing plant to be carried out
- Third party inspection of critical equipment
- Commissioning of the plant shall by the owner's personnel, under the supervision of the EPC Contractor

Requirements During Project Planning Phase

- Use of effective Planning and Scheduling tools.
- HAZOP review should be carried out during development, engineering and implementation of the Project.
- Pre Start-up Safety Review and Hazard study at the end of the construction stage prior to start up
- Carry out the Environment Impact Assessment & Business Risk Assessment for the Project.

CDR Project Road Map

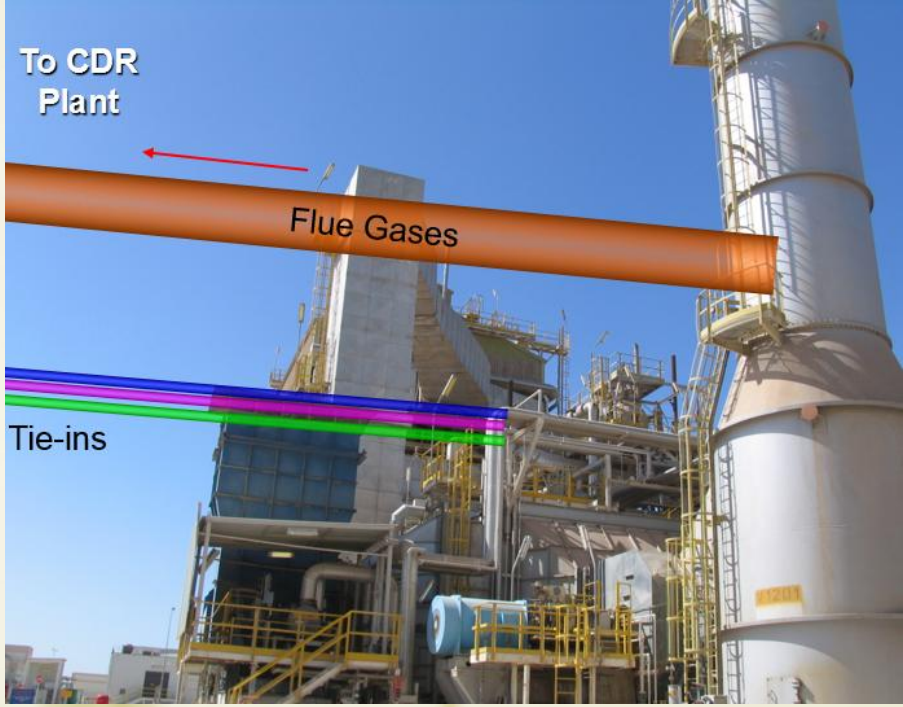


CDR Milestones

Activity	Date
CDR Agreement Signing	25th October 2007
KS1 Solution Agreement Signing	4th April 2008
Construction Works Commencement	1st June 2008
Inauguration by GPIC MD	27th August 2008
Electrical Works Completion	25th November 2009
Mechanical Completion	25th November 2009
Instrument Works Completion	3rd December 2009
Boiler Commissioning	5th December 2009
CO_2 Production	20th December 2009

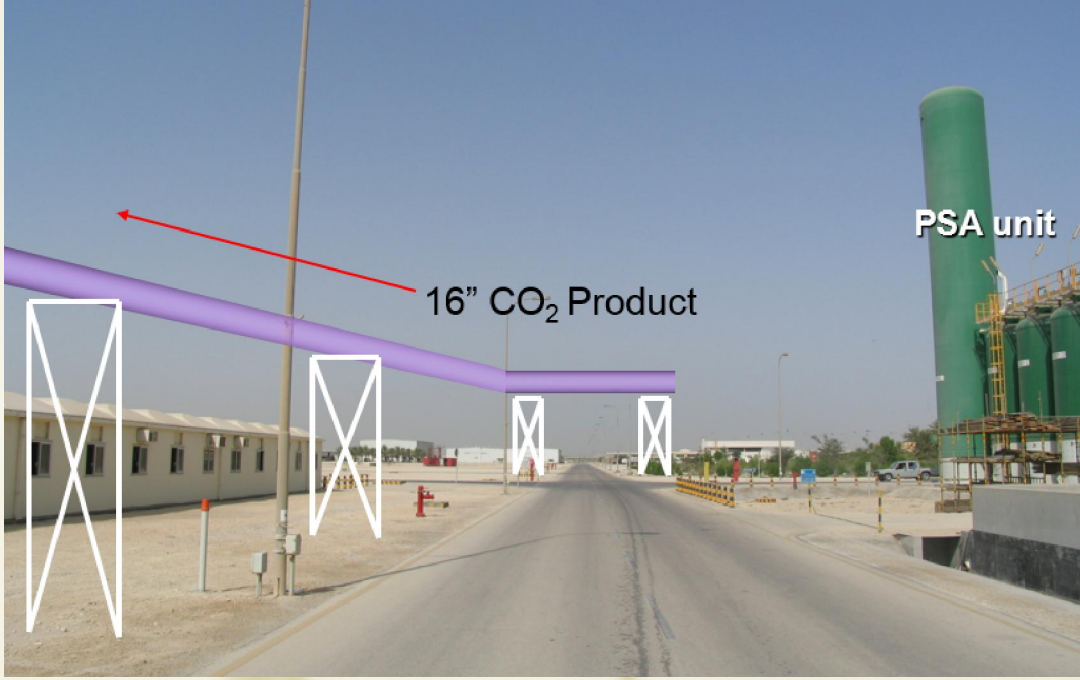
List of tie-ins

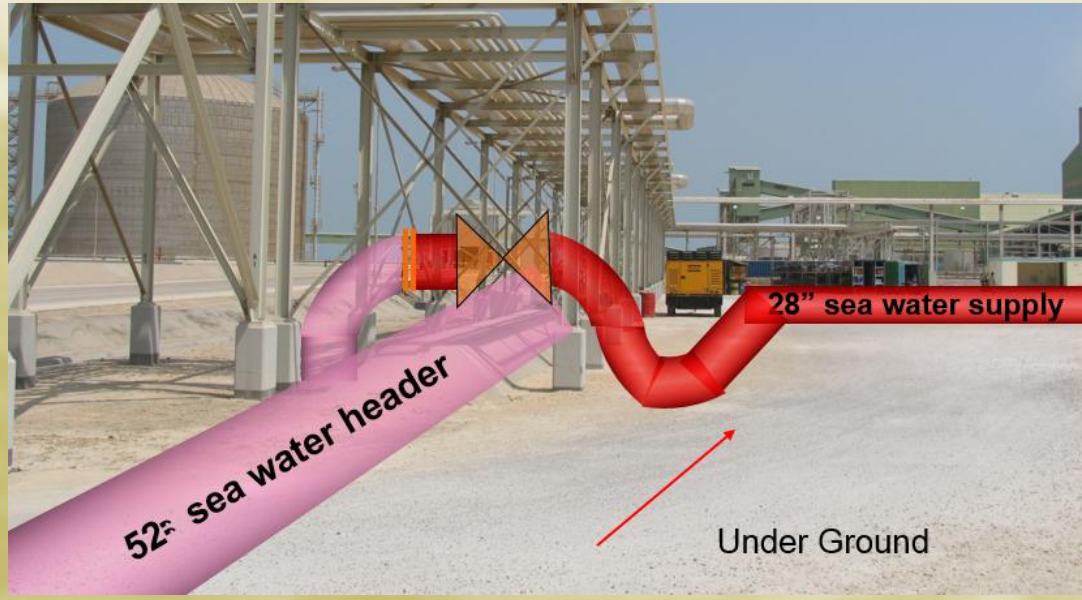
- Flue gas (at reformer stack)
- Service water
- Product CO_2 (at urea B/L)
- Natural gas
- SW supply / return
- FCW supply / return
- LH steam
- Potable water
- Nitrogen



List of tie-ins

- Plant air
- Instrument control power
- Electric power
- DM water
- Fire water
- Instrument air
- Steam condensate





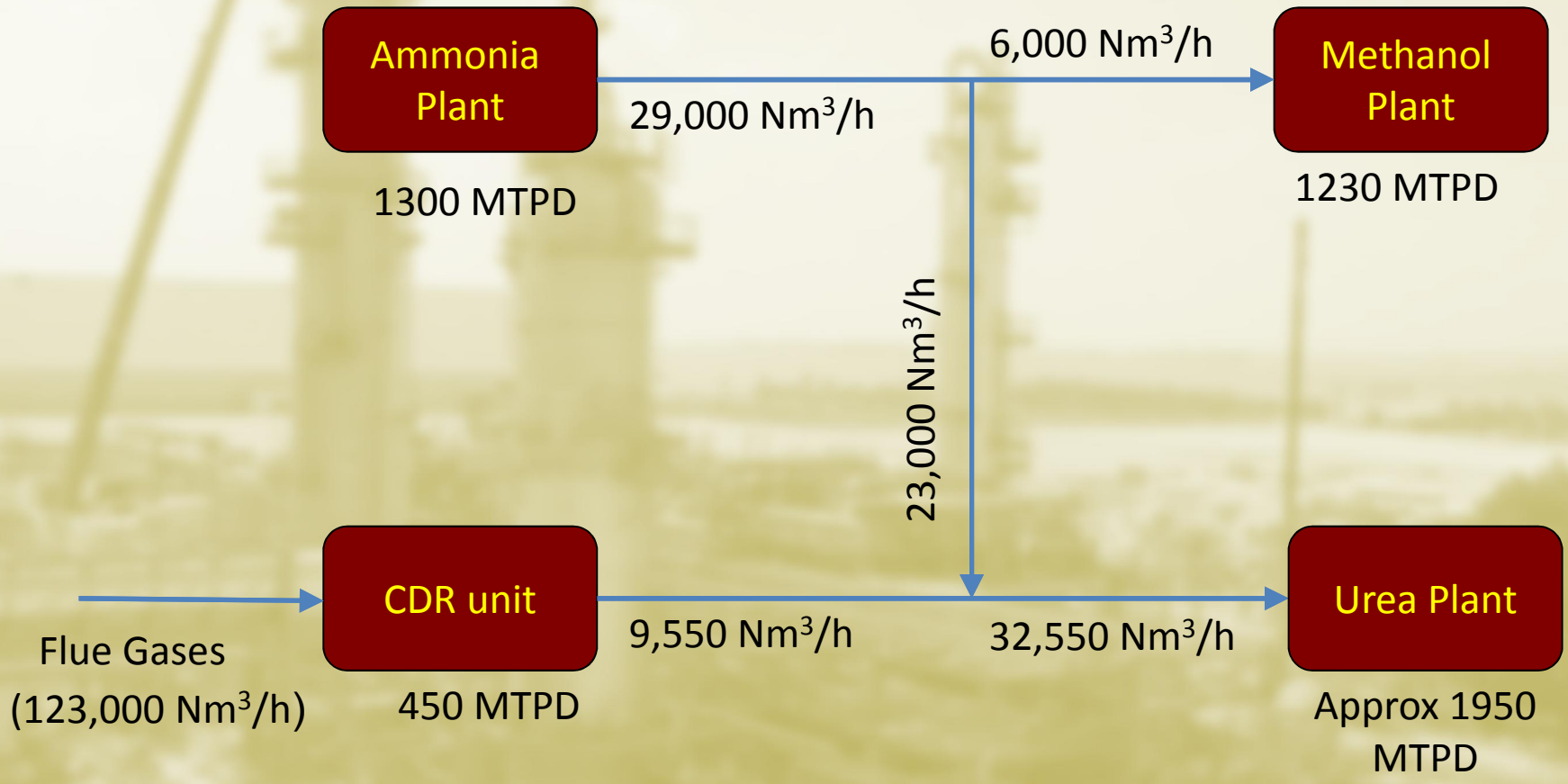
Technical Features of MHI's Technology

MHI's flue gas CO_2 capturing technology uses a solvent which is patented as KS-1, an amine based solvent.

Following are the main features :

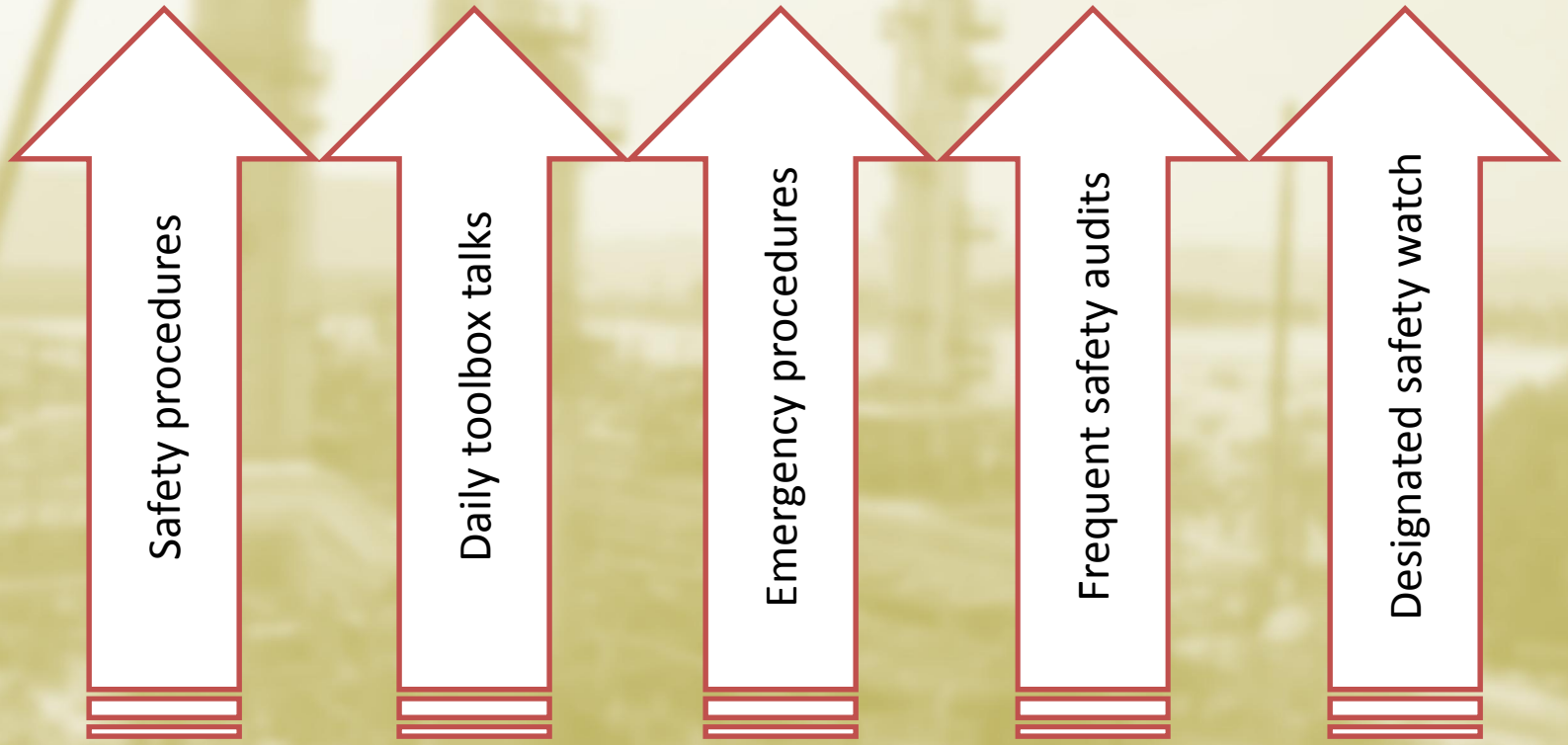
- Solvent has high loading rate
- Low residual CO_2 in the lean solvent, overall recovery process efficient
- KS-1 solvent not very corrosive
- Formation of heat stable salts – minimum
- Frequency of reclamation – very low
- Incinerator required to dispose off the degraded solvent.

CO_2 Gas Balance after CDR



CDR Safety

ONE Million man hours worked without LTA



CDR Benefits

- GPIC urea and methanol production increased by 200 MTPD.

- The specific energy consumption per ton of Methanol and Urea has reduced post CDR operation.

CDR Photos

CDR Model

CDR Photos

CDR Construction Site Aerial View

CDR Photos

CDR Photos


GPIC


Thank You